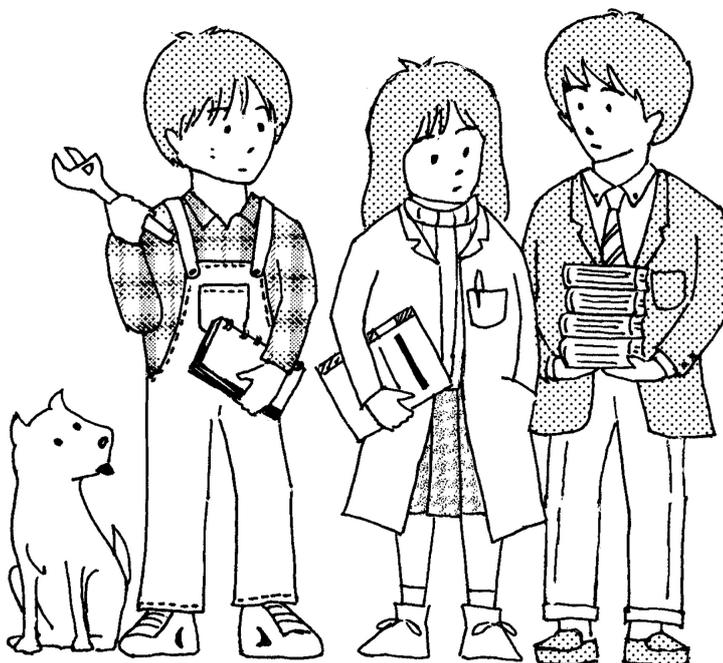


SYLLABUS

2018

[C] Advanced Engineering Course Program



Kyoto University, Graduate School of Engineering

[C] Advanced Engineering Course Program

Civil and Earth Resources Engineering

10F251 Exercise on Project Planning	1
10U051 Integrated Seminar on Infrastructure Engineering A	2
10U052 Integrated Seminar on Infrastructure Engineering B	3
10U055 Seminar on Infrastructure Engineering A	4
10U056 Seminar on Infrastructure Engineering B	5
10U059 Internship on Infrastructure Engineering	6
10F063 Practice in Infrastructure Engineering	7
10U060 ORT on Infrastructure Engineering	8
10U064 Practice in Advanced Infrastructure Engineering A	9
10U065 Practice in Advanced Infrastructure Engineering B	10
10F003 Continuum Mechanics	11
10F067 Structural Stability	12
10F068 Material and Structural System & Management	13
10F261 Earthquake Engineering/Lifeline Engineering	14
10W001 Structural Engineering for Civil Infrastructure	15
10F009 Structural Design	16
10F010 Bridge Engineering	17
10A019 Concrete Structural Engineering	18
10F227 Structural Dynamics	19
10F263 Seismic Engineering Exercise	20
10F415 Ecomaterial and Environment-friendly Structures	21
10F089 Infrastructure Safety Engineering	22
10F075 Hydraulics & Turbulence Mechanics	23
10A216 Hydrology	24
10F019 River Engineering and River Basin Management	25
10A040 Sediment Hydraulics	26
10F464 Hydrologic Design and Management	27
10F245 Open Channel Hydraulics	28
10F462 Coastal Wave Dynamics	29
10F267 Hydro-Meteorologically Based Disaster Prevention	30
10A222 Water Resources Systems	31
10F077 River basin management of flood and sediment	32
10F269 Coastal and Urban Water Disasters Engineering	33
10F466 Basin Environmental Disaster Mitigation	34
10F011 Computational Fluid Dynamics	35
10F065 Hydraulic Engineering for Infrastructure Development and Management	36
10F100 Applied Hydrology	37
10F103 Case Studies Harmonizing Disaster Management and Environment Conservation	38
10F106 Integrated Disasters and Resources Management in Watersheds	39

10F025 Geomechanics	40
10K016 Computational Geotechnics	41
10F238 Geo-Risk Management	42
10F241 Construction of Geotechnical Infrastructures	43
10F405 Fundamental Geofront Engineering	44
10A055 Environmental Geotechnics	45
10F109 Disaster Prevention through Geotechnics	46
10F203 Public Finance	47
10F207 Urban Environmental Policy	48
10F219 Quantitative Methods for Behavioral Analysis	49
10F215 Intelligent Transportation Systems	50
10A805 Remote Sensing and Geographic Information Systems	51
10A808 Civic and Landscape Design	52
10F223 Risk Management Theory	53
10X333 Disaster Risk Management	54
10X714 Disaster Information	55
10A845 Theory & Practice of Environmental Design Research	56
10A402 Resources Development Systems	57
10F053 Applied Mathematics in Civil & Earth Resources Engineering	58
10A405 Environmental Geosphere Engineering	59
10F071 Applied Elasticity for Rock Mechanics	60
10F073 Fundamental Theories in Geophysical Exploration	61
10F076 Underground space and petrophysics	62
10A420 Lecture on Exploration Geophysics	63
10F085 Measurement in the earth's crust environment	64
10F088 Earth Resources Engineering	65
10X311 Urban Infrastructure Management	66
10F113 Global Survivability Studies	67
10X715 Emergency Management Systems	68
10F201 Information Technology for Urban Society	69
10Z001 Urban Transport Policy	70
10Z002 Policy for Low-Carbon Society	71
10Z003 Urban Transport Management	72
10F380 Engineering Seminar for Disaster Resilience in ASEAN countries	73
10F382 Disaster and Health Risk Management for Liveable City	74
10X752 10X752	75
10i049 Project Management in Engineering	76
10i059 Exercise on Project Management in Engineering	77
Urban Management	
10F201 Information Technology for Urban Society	78
10F251 Exercise on Project Planning	79
10F253 Capstone Project	80
10U201 Integrated Seminar on Urban Management A	81

10U203 Integrated Seminar on Urban Management B	82
10F257 Seminar on Urban Management A	83
10F259 Seminar on Urban Management B	84
10F150 Long-Term Internship	85
10U210 Practice in Urban Management	86
10U216 ORT on Urban Management	87
10U224 Practice in Advanced Urban Management A	88
10U225 Practice in Advanced Urban Management B	89
10F003 Continuum Mechanics	90
10F067 Structural Stability	91
10F068 Material and Structural System & Management	92
10F261 Earthquake Engineering/Lifeline Engineering	93
10W001 Structural Engineering for Civil Infrastructure	94
10F009 Structural Design	95
10F010 Bridge Engineering	96
10A019 Concrete Structural Engineering	97
10F227 Structural Dynamics	98
10F263 Seismic Engineering Exercise	99
10F415 Ecomaterial and Environment-friendly Structures	100
10F089 Infrastructure Safety Engineering	101
10F075 Hydraulics & Turbulence Mechanics	102
10A216 Hydrology	103
10F019 River Engineering and River Basin Management	104
10A040 Sediment Hydraulics	105
10F464 Hydrologic Design and Management	106
10F245 Open Channel Hydraulics	107
10F462 Coastal Wave Dynamics	108
10F267 Hydro-Meteorologically Based Disaster Prevention	109
10A222 Water Resources Systems	110
10F077 River basin management of flood and sediment	111
10F269 Coastal and Urban Water Disasters Engineering	112
10F466 Basin Environmental Disaster Mitigation	113
10F011 Computational Fluid Dynamics	114
10F065 Hydraulic Engineering for Infrastructure Development and Management	115
10F100 Applied Hydrology	116
10F103 Case Studies Harmonizing Disaster Management and Environment Conservation	117
10F106 Integrated Disasters and Resources Management in Watersheds	118
10F025 Geomechanics	119
10K016 Computational Geotechnics	120
10F238 Geo-Risk Management	121
10F241 Construction of Geotechnical Infrastructures	122
10F405 Fundamental Geofront Engineering	123
10A055 Environmental Geotechnics	124
10F109 Disaster Prevention through Geotechnics	125

10F203 Public Finance	126
10F207 Urban Environmental Policy	127
10F219 Quantitative Methods for Behavioral Analysis	128
10F215 Intelligent Transportation Systems	129
10A805 Remote Sensing and Geographic Information Systems	130
10A808 Civic and Landscape Design	131
10F223 Risk Management Theory	132
10X333 Disaster Risk Management	133
10X714 Disaster Information	134
10A845 Theory & Practice of Environmental Design Research	135
10A402 Resources Development Systems	136
10F053 Applied Mathematics in Civil & Earth Resources Engineering	137
10A405 Environmental Geosphere Engineering	138
10F071 Applied Elasticity for Rock Mechanics	139
10F073 Fundamental Theories in Geophysical Exploration	140
10F076 Underground space and petrophysics	141
10A420 Lecture on Exploration Geophysics	142
10F085 Measurement in the earth's crust environment	143
10F088 Earth Resources Engineering	144
10X311 Urban Infrastructure Management	145
10F113 Global Survivability Studies	146
10X715 Emergency Management Systems	147
10Z001 Urban Transport Policy	148
10Z002 Policy for Low-Carbon Society	149
10Z003 Urban Transport Management	150
10F380 Engineering Seminar for Disaster Resilience in ASEAN countries	151
10F382 Disaster and Health Risk Management for Liveable City	152
10X752 10X752	153
10i049 Project Management in Engineering	154
10i059 Exercise on Project Management in Engineering	155

Environmental Engineering

10F439 Environmental Risk Analysis	156
10A632 Urban Metabolism Engineering	157
10F454 Systems Approach on Sound Material Cycles Society	158
10F441 Water Quality Engineering	159
10F234 Water Sanitary Engineering	160
10F461 Nuclear Environmental Engineering, Adv.	161
10F446 Atmospheric and Global Environmental Engineering, Adv.	162
10F400 Seminar on Urban and Environmental Engineering A	163
10F402 Seminar on Urban and Environmental Engineering B	164
10U401 Advanced Seminar on Urban and Environmental Engineering A	165
10U403 Advanced Seminar on Urban and Environmental Engineering B	166
10A643 Environmental Microbiology, Adv.	167

10A626 Advanced Environmental Health	168
10H424 Environmental-friendly Technology for Sound Material Cycle	169
10A622 Geohydro Environment Engineering. Adv.	170
10X321 Lecture on Environmental Management Leader	171
10F456 New Environmental Engineering I, Advanced	172
10F458 New Environmental Engineering II, Advanced	173
10F468 Environmental Organic Micropollutants Analysis Lab.	174
10F470 Advanced Environmental Engineering Lab.	175
10F472 Seminar on Practical Issues in Urban and Environmental Engineering	176
10F449 Exercises in Urban and Environmental Engineering A	177
10F450 Exercises in Urban and Environmental Engineering B	178
10F475 ORT on Urban and Environmental Engineering	179
10i051 Frontiers in Modern Science and Technology (6H course)	180
10i052 Frontiers in Modern Science and Technology (12H course)	181
10i058 Safety and Health Engineering (11 times course)	182
10i045 Exercise in Practical Scientific English	183
10i049 Project Management in Engineering	184
10i059 Exercise on Project Management in Engineering	185

Architecture and Architectural Engineering (Advanced Engineering Course Program

(3yr Course))

10Q021 Advanced Theory of Architecture and Architectural Engineering I	186
10Q022 Advanced Theory of Architecture and Architectural Engineering II	187
10Q005 Seminar on Architectural Design and Planning I	188
10Q006 Seminar on Architectural Design and Planning II	189
10Q017 Seminar on Architectural Design and Planning III	190
10Q018 Seminar on Architectural Design and Planning IV	191
10Q008 Seminar on Structural Engineering of Buildings I	192
10Q009 Seminar on Structural Engineering of Buildings II	193
10Q015 Seminar on Structural Engineering of Buildings III	194
10Q016 Seminar on Structural Engineering of Buildings IV	195
10Q011 Seminar on Environmental Engineering I	196
10Q012 Seminar on Environmental Engineering II	197
10Q013 Seminar on Environmental Engineering III	198
10Q014 Seminar on Environmental Engineering IV	199
10i051 Frontiers in Modern Science and Technology (6H course)	200
10i052 Frontiers in Modern Science and Technology (12H course)	201
10i045 Exercise in Practical Scientific English	202
10i041 Professional Scientific Presentation Exercises (English lecture)	203
10i042 Advanced Engineering and Economy (English lecture)	204
10i010 International Internship in Engineering 1	205
10i011 International Internship in Engineering 2	206
10i049 Project Management in Engineering	207
10i059 Exercise on Project Management in Engineering	208

10i055 Advanced Modern Science and Technology (4 times course) (English lecture)	209
10i056 Advanced Modern Science and Technology (8 times course) (English lecture)	210
Mechanical Engineering and Science	
10G001 Applied Numerical Methods	211
10G003 Solid Mechanics, Adv.	212
10G005 Thermal Science and Engineering	213
10G007 Introduction to Advanced Fluid Dynamics	214
10G009 Quantum Condensed Matter Physics	215
10G011 Design and Manufacturing Engineering	216
10G013 Dynamic Systems Control Theory	217
10G057 Engineering Ethics and Management of Technology	218
10G017 Fracture Mechanics	219
10B628 Physics of Neutron Scattering	220
10B407 Robotics	221
10G025 Mechanical Functional Device Engineering	222
10G036 Basic Seminar on Mechanical Engineering and Science A	223
10G037 Basic Seminar on Mechanical Engineering and Science B	224
10G031 Seminar on Mechanical Engineering and Science A	225
10G032 Seminar on Mechanical Engineering and Science B	226
10G041 Advanced Finite Element Methods	227
10B418 Strength of Advanced Materials	228
10B622 Thermophysics for Thermal Engineering	229
10G039 Transport Phenomena	230
10G021 Engineering Optics and Spectroscopy	231
10G403 Optimum System Design Engineering	232
10B631 High Energy Radiation Effects in Solid	233
10B634 Advanced Experimental Techniques and Analysis in Engineering Physics	234
10Q807 Theory for Design Systems Engineering	235
10B828 High Precision Engineering	236
10V003 Biomechanics	237
10W603 Introduction to Biomedical Engineering	238
10B440 Environmental Fluid Dynamics	239
10Q402 Turbulence Dynamics	240
10G055 Crystallography of Metals	241
10Q610 Seminar: Dynamics of Atomic Systems	242
10V007 Neutron Science Seminar I	243
10V008 Neutron Science Seminar II	244
10K013 Advanced Mechanical Engineering	245
10i056 Advanced Modern Science and Technology (8 times course) (English lecture)	246
10X411 Design of Complex Mechanical Systems	247
10X402 Theory for Designing Artifacts	248
10X716 Theory of Symbiotic Systems	249
10X717 Control Theory for Mechanical Systems	250

10X718 Theory of Human-Machine Systems	251
10X719 Dynamical Systems,Advanced	252
10X748 Heat Engine Systems	253
10X749 Combustion Science and Engineering	254
10V012 Advanced Exercise in Mechanical Engineering and ScienceA	255
10V013 Advanced Exercise in Mechanical Engineering and ScienceB	256
10V014 Advanced Exercise in Mechanical Engineering and ScienceC	257
10V015 Advanced Exercise in Mechanical Engineering and ScienceD	258
10V016 Advanced Exercise in Mechanical Engineering and ScienceE	259
10V017 Advanced Exercise in Mechanical Engineering and ScienceF	260
10G049 Internship M	261
10V019 Internship DS	262
10V020 Internship DL	263
10V025 Seminar of Complex Mechanical Engineering,A	264
10V027 Seminar of Complex Mechanical Engineering,B	265
10V029 Seminar of Complex Mechanical Engineering,C	266
10V031 Seminar of Complex Mechanical Engineering,D	267
10V033 Seminar of Complex Mechanical Engineering,E	268
10V035 Seminar of Complex Mechanical Engineering,F	269
10G051 Experiments on Mechanical Engineering and Science,Adv. I	270
10G053 Experiments on Mechanical Engineering and Science,Adv. II	271

Micro Engineering

10G001 Applied Numerical Methods	272
10G003 Solid Mechanics, Adv.	273
10G005 Thermal Science and Engineering	274
10G007 Introduction to Advanced Fluid Dynamics	275
10G009 Quantum Condensed Matter Physics	276
10G011 Design and Manufacturing Engineering	277
10G013 Dynamic Systems Control Theory	278
10G057 Engineering Ethics and Management of Technology	279
10G203 Micro Process and Material Engineering	280
10G205 Microsystem Engineering	281
10G209 Multi physics Numerical Analysis	282
10B619 Quantum Theory of Condensed Matter	283
10G211 Solid State Physics I	284
10G223 Basic Seminar on Micro Engineering A	285
10G224 Basic Seminar on Micro Engineering B	286
10G216 Seminar on Micro Engineering A	287
10G217 Seminar on Micro Engineering B	288
10B418 Strength of Advanced Materials	289
10G214 Precision Measurement and Machining	290
10V003 Biomechanics	291
10V201 Introduction to the Design and Implementation of Micro-Systems	292

10G041 Advanced Finite Element Methods	293
10W603 Introduction to Biomedical Engineering	294
10B617 Quantum Theory of Molecular Physics	295
10Q408 Quantum Theory of Chemical Physics	296
10V205 Solid State Physics 2	297
10K013 Advanced Mechanical Engineering	298
10i056 Advanced Modern Science and Technology (8 times course) (English lecture)	299
10X411 Design of Complex Mechanical Systems	300
10X402 Theory for Designing Artifacts	301
10V210 Advanced Exercise in Micro Engineering A	302
10V211 Advanced Exercise in Micro Engineering B	303
10V212 Advanced Exercise in Micro Engineering C	304
10V213 Advanced Exercise in Micro Engineering D	305
10V214 Advanced Exercise in Micro Engineering E	306
10V215 Advanced Exercise in Micro Engineering F	307
10Z101 Micro/Nano Scale Material Engineering	308
10G049 Internship M	309
10V019 Internship DS	310
10V020 Internship DL	311
10V025 Seminar of Complex Mechanical Engineering,A	312
10V027 Seminar of Complex Mechanical Engineering,B	313
10V029 Seminar of Complex Mechanical Engineering,C	314
10V031 Seminar of Complex Mechanical Engineering,D	315
10V033 Seminar of Complex Mechanical Engineering,E	316
10V035 Seminar of Complex Mechanical Engineering,F	317
10G226 Experiments on Micro Engineering, Adv. I	318
10G228 Experiments on Micro Engineering, Adv. II	319

Aeronautics and Astronautics

10G001 Applied Numerical Methods	320
10G003 Solid Mechanics, Adv.	321
10G005 Thermal Science and Engineering	322
10G007 Introduction to Advanced Fluid Dynamics	323
10G009 Quantum Condensed Matter Physics	324
10G011 Design and Manufacturing Engineering	325
10G013 Dynamic Systems Control Theory	326
10G057 Engineering Ethics and Management of Technology	327
10G401 Jet Engine Engineering	328
10G405 Propulsion Engineering, Adv.	329
10G406 Gas Dynamics, Adv.	330
10G409 Aerospace Systems and Control	331
10G411 Fluid Dynamics for Aeronautics and Astronautics	332
10C430 Advanced Flight Dynamics of Aerospace Vehicle	333
10G230 Dynamics of Solids and Structures	334

10G423 Transport Phenomena in Reactive Flows	335
10G041 Advanced Finite Element Methods	336
10V401 Seminar on Engineering Science of Ionized Gases	337
10V412 Seminar on Gas Dynamics	338
10V405 Seminar on Fluid Dynamics for Aeronautics and Astronautics	339
10R410 Seminar on Aerospace systems	340
10R419 Seminar on Systems and Control	341
10V407 Seminar on Optimum System Design Engineering	342
10V409 Thermal Engineering Seminar	343
10V413 Seminar on Mechanics of Functional Solids and Structures	344
10X411 Design of Complex Mechanical Systems	345
10K013 Advanced Mechanical Engineering	346
10X719 Dynamical Systems,Advanced	347
10X720 Mathematical Analysis,Advanced	348
10X721 Topics in Nonlinear Dynamics A	349
10X722 Topics in Nonlinear Dynamics B	350
10M226 Meteorology I	351
10M227 Meteorology II	352
10V019 Internship DS	353
10V020 Internship DL	354
10V025 Seminar of Complex Mechanical Engineering,A	355
10V027 Seminar of Complex Mechanical Engineering,B	356
10V029 Seminar of Complex Mechanical Engineering,C	357
10V031 Seminar of Complex Mechanical Engineering,D	358
10V033 Seminar of Complex Mechanical Engineering,E	359
10V035 Seminar of Complex Mechanical Engineering,F	360
10G418 Experiments and Exercises in Aeronautics and Astronautics I	361
10G420 Experiments and Exercises in Aeronautics and Astronautics II	362

Nuclear Engineering

10C070 Introduction to Quantum Science	363
10C072 Introduction to Advanced Nuclear Engineering	364
10C004 Quantum Field Theory	365
10C074 Quantum Science	366
10C013 Nuclear Materials	367
10C014 Nuclear Fuel Cycle 1	368
10C017 Radiation Physics and Engineering	369
10C018 Neutron Science	370
10C031 Quantum Manipulation Technology	371
10C076 Fundamentals of Magnetohydrodynamics	372
10C034 Nuclear Energy Conversion and Reactor Engineering	373
10C037 Multiphase Flow Engineering and Its Application	374
10C038 Physics of Fusion Plasma	375
10C078 Hybrid Advanced Accelerator Engineering	376

10C080 Nuclear Reactor Safety Engineering	377
10C082 Applied Neutron Engineering	378
10C047 Radiation Medical Physics	379
10C084 Nuclear Engineering, Adv.	380
10C068 Nuclear Engineering Application Experiments	381
10R001 Quantum Beam Science, Adv.	382
10R004 Quantum Physics, Adv.	383
10R013 Nonlinear Physics in Fusion Plasmas	384
10C086 Introduction to Nuclear Engineering 1	385
10C087 Introduction to Nuclear Engineering 2	386
10W620 Radiation Measurement for Medicine	387
10i054 Introduction to Advanced Material Science and Technology (15 times course) (English lecture)	388
10i055 Advanced Modern Science and Technology (4 times course) (English lecture)	389
10i056 Advanced Modern Science and Technology (8 times course) (English lecture)	390
10i046 Exercise in Practical Scientific English	391
10i057 Safety and Health Engineering (4 times course)	392
10i011 International Internship in Engineering 2	393
10C050 Internship M	394
10C063 Experiments and Exercises on Nuclear Engineering, Adv. I	395
10C064 Experiments and Exercises on Nuclear Engineering, Adv. II	396
10C089 Seminar on Nuclear Engineering A	397
10C090 Seminar on Nuclear Engineering B	398
10R017 Engineering Internship D	399
10R019 Seminar on Nuclear Engineering, Adv. A	400
10R021 Seminar on Nuclear Engineering, Adv. B	401
10R023 Seminar on Nuclear Engineering, Adv. C	402
10R025 Seminar on Nuclear Engineering, Adv. D	403
10R027 Seminar on Nuclear Engineering, Adv. E	404
10R029 Seminar on Nuclear Engineering, Adv. F	405
Materials Science and Engineering	
10C209 Non-ferrous extractive metallurgy, Adv.	406
10C210 Material and Chemical Information Analysis	407
10C214 Microstructure, solidification and crystal growth	408
10C267 Ceramic Materials Science	409
10C263 Physical Properties of Crystals Adv.	410
10C271 Magnetism and magnetic materials	411
10C286 Atomic-molecular scale engineering	412
10C288 Microstructure theory and structure evaluation	413
10C289 Advanced Structural Metallic Materials	414
10C290 Electrochemistry for Materials Processing,	415
10i054 Introduction to Advanced Material Science and Technology (15 times course) (English lecture)	416

10C273 Social Core Advanced Materials I	417
10C275 Social Core Advanced Materials I I	418
10C277 Internship M for Materials Science & Engineering	419
10C251 Seminar on Materials Science and Engineering A	420
10C253 Seminar on Materials Science and Engineering B	421
10C240 Laboratory & Seminar in Materials Science and Engineering, Adv.	422
10C241 Laboratory & Seminar in Materials Science and Engineering, Adv.II	423
10R241 Seminar on Materials Science and Engineering, Adv. B	424
10R242 Seminar on Materials Science and Engineering, Adv. B	425
10R243 Seminar on Materials Science and Engineering, Adv. C	426
10R244 Seminar on Materials Science and Engineering, Adv. D	427
10R245 Seminar on Materials Science and Engineering, Adv. E	428
10R247 Seminar on Materials Science and Engineering, Adv. A ~ F	429
10i052 Frontiers in Modern Science and Technology (12H course)	430
10C292 International Standards	431
10i010 International Internship in Engineering 1	432
10i011 International Internship in Engineering 2	433
10i049 Project Management in Engineering	434
10i059 Exercise on Project Management in Engineering	435

Electrical Engineering

10C643 Advanced Experiments and Exercises in Electrical Engineering ,	436
10C646 Advanced Experiments and Exercises in Electrical Engineering II	437
10R610 Advanced Electrical Engineering Seminar	438
10C628 State Space Theory of Dynamical Systems	439
10C604 Applied Systems Theory	440
10C601 Applied Mathematics for Electrical Engineering	441
10C647 Electrical and Electromagnetic Circuits	442
10C610 Electromagnetic Theory, Adv.	443
10C613 Superconductivity Engineering	444
10C614 Biological Function Engineering	445
10C621 Applied Hybrid System Engineering	446
10C625 Theory of Electric Circuits, Adv.	447
10C631 Design of Control Systems	448
10C611 Computer Simulations of Electrodynamics	449
10C612 Space Radio Engineering	450
10C617 Applied Microwave Engineering	451
10C714 Spacio-Temporal Media Analysis	452
10C716 Visualized Simulation Technology	453
10K010 Recent Advances in Electrical and Electronic Engineering	454
10X723 Digital Communication Engineering	455
10X724 Information Network	456
10X001 Prospects of Interdisciplinary Photonics and Electronics	457
10C718 Advanced Seminar in Electrical Engineering I	458

10C720 Advanced Seminar in Electrical Engineering II	459
10C627 Research Internship(M)	460
10R630 Research Internship (D)	461
10R632 Advanced Exercises on Electrical Engineering I, II	462
10R633 Advanced Exercises on Electrical Engineering I, II	463
10i051 Frontiers in Modern Science and Technology (6H course)	464
10i052 Frontiers in Modern Science and Technology (12H course)	465
10i054 Introduction to Advanced Material Science and Technology (15 times course) (English lecture)	466
10i045 Exercise in Practical Scientific English	467
10i055 Advanced Modern Science and Technology (4 times course) (English lecture)	468
10i056 Advanced Modern Science and Technology (8 times course) (English lecture)	469

Electronic Science and Engineering

10C710 Advanced Experiments and Exercises in Electronic Science and Engineering	470
10C713 Advanced Experiments and Exercises in Electronic Science and Engineering II	471
10R701 Advanced Seminar on Electronic Science and Engineering	472
10C825 Quantum Mechanics for Electronics Engineering	473
10C800 Semiconductor Nanospintronics	474
10C801 Charged Particle Beam Apparatus	475
10C803 Quantum Information Science	476
10C810 Semiconductor Engineering Adv.	477
10C813 Electronic Materials Adv.	478
10C816 Molecular Electronics	479
10C819 Surface Electronic Properties	480
10C822 Optical Properties and Engineering	481
10C828 Quantum Optoelectronics Devices	482
10C829 Quantum Optics	483
10C830 Quantum Measurement	484
10C851 Electrical Conduction in Condensed Matter	485
10C834 High Performance Thin Film Engineering	486
10K010 Recent Advances in Electrical and Electronic Engineering	487
10X725 Integrated Circuits Engineering, Advanced.	488
10X001 Prospects of Interdisciplinary Photonics and Electronics	489
10C846 Advanced Seminar in Electronic Science and Engineering I	490
10C848 Advanced Seminar in Electronic Science and Engineering II	491
10C821 Research Internship(M)	492
10R823 Research Internship(D)	493
10R825 Advanced Exercises on Electronic Science and Engineering I, II	494
10R827 Advanced Exercises on Electronic Science and Engineering I, II	495
10i051 Frontiers in Modern Science and Technology (6H course)	496
10i052 Frontiers in Modern Science and Technology (12H course)	497
10i054 Introduction to Advanced Material Science and Technology (15 times course) (English lecture)	498

10i045 Exercise in Practical Scientific English	499
10i055 Advanced Modern Science and Technology (4 times course) (English lecture)	500
10i056 Advanced Modern Science and Technology (8 times course) (English lecture)	501
Material Chemistry	
10H001 Chemistry of Inorganic Materials	502
10H004 Chemistry of Organic Materials	503
10H007 Chemistry of Polymer Materials	504
10H010 Chemistry of Functional Materials	505
10H013 Chemistry and Structure of Inorganic Compounds	506
10H016 Synthetic Chemistry of Inorganic Solids	507
10H019 Synthesis of Organic Materials	508
10H022 Chemistry of Organic Natural Products	509
10H025 Analysis and Characterization of Materials	510
10H029 Polymer Physics and Function	511
10H031 Chemistry of Biomaterials	512
10H034 Analysis and Characterization of Materials	513
10D037 Laboratory and Exercise in Material Chemistry	514
10i053 Introduction to Advanced Material Science and Technology (11 times course) (English lecture)	515
10i054 Introduction to Advanced Material Science and Technology (15 times course) (English lecture)	516
10i055 Advanced Modern Science and Technology (4 times course) (English lecture)	517
10i056 Advanced Modern Science and Technology (8 times course) (English lecture)	518
10i045 Exercise in Practical Scientific English	519
10i051 Frontiers in Modern Science and Technology (6H course)	520
10i052 Frontiers in Modern Science and Technology (12H course)	521
10i057 Safety and Health Engineering (4 times course)	522
10i058 Safety and Health Engineering (11 times course)	523
10D043 Instrumental Analysis, Adv.	524
10D046 Instrumental Analysis, Adv.	525
10H041 Organotransition Metal Chemistry 1	526
10H042 Organotransition Metal Chemistry 2	527
10P055 Material Chemistry Adv. I	528
10P056 Material Chemistry Adv. II	529
10P057 Material Chemistry Adv.	530
10P058 Material Chemistry Adv.	531
10S001 Design of Functional Materials	532
10S002 Design of Functional Materials,Advanced	533
10S003 Inorganic Structural Chemistry,Advanced	534
10S006 Industrial Solid-State Chemistry,Advanced	535
10S010 Organic Reaction Chemistry,Advanced	536
10S013 Organic Chemistry of Natural Products, Advanced	537
10S016 Analytical Chemistry of Materials, Advanced	538

10S019 Physical Properties of Polymer Materials,Advanced	539
10S022 Synthesis of Polymer Materials,Advanced	540
10i041 Professional Scientific Presentation Exercises (English lecture)	541
10i042 Advanced Engineering and Economy (English lecture)	542
10i049 Project Management in Engineering	543
10i059 Exercise on Project Management in Engineering	544
10Z101 Micro/Nano Scale Material Engineering	545
10P011 General Material Chemistry	546
10P111 Chemical Industry, Advanced	547

Energy and Hydrocarbon Chemistry

10H201 Energy Conversion Reactions	548
10H202 Green and Sustainable Chemistry	549
10H205 Inorganic Solid-State Chemistry	550
10H200 Electrochemistry Advanced	551
10H215 Chemistry of Functional Interfaces	552
10H213 Catalysis in Organic Reactions	553
10H207 Excited-State Hydrocarbon Chemistry	554
10H209 Advanced Biomedical Engineering	555
10H217 Chemical Conversion of Carbon Resources	556
10H210 Chemistry of Organometallic Complexes	557
10H218 Design of Solid Catalysts	558
10H222 Material Transformation Chemistry	559
10H219 Structural Organic Chemistry	560
10H238 Radiochemistry, Adv.	561
10H226 Chemistry of Well-Defined Catalysts	562
10H208 Seminar on Energy & Hydrocarbon Chemistry (A)	563
10H818 Advanced Organic Chemistry	564
10H041 Organotransition Metal Chemistry 1	565
10H042 Organotransition Metal Chemistry 2	566
10D228 Energy and Hydrocarbon Chemistry, Adv. I	567
10D229 Energy and Hydrocarbon Chemistry, Adv. II	568
10D230 Energy and Hydrocarbon Chemistry, Adv. III	569
10D231 Energy and Hydrocarbon Chemistry, Adv. IV	570
10D232 Energy and Hydrocarbon Chemistry, Adv. V	571
10D233 Energy and Hydrocarbon Chemistry, Adv. IV	572
10D235 Energy and Hydrocarbon Chemistry, Adv. VII	573
10D236 Energy and Hydrocarbon Chemistry, Adv. VIII	574
10i053 Introduction to Advanced Material Science and Technology (11 times course) (English lecture)	575
10i054 Introduction to Advanced Material Science and Technology (15 times course) (English lecture)	576
10i055 Advanced Modern Science and Technology (4 times course) (English lecture)	577
10i056 Advanced Modern Science and Technology (8 times course) (English lecture)	578

10D043 Instrumental Analysis, Adv.	579
10D046 Instrumental Analysis, Adv.	580
10i051 Frontiers in Modern Science and Technology (6H course)	581
10i052 Frontiers in Modern Science and Technology (12H course)	582
10i045 Exercise in Practical Scientific English	583
10D234 Experiments & Exercises in Energy and Hydrocarbon Chemistry, Adv.	584
10S204 Energy and Hydrocarbon Chemistry Special Seminar 1	585
10S205 Energy and Hydrocarbon Chemistry Special Seminar 2	586
10S206 Energy and Hydrocarbon Chemistry Special Seminar 3	587

Molecular Engineering

10H401 Statistical Thermodynamics	588
10H405 Quantum Chemistry	589
10H406 Quantum Chemistry	590
10H408 Molecular Spectroscopy	591
10H448 Biomolecular Function Chemistry	592
10H413 Molecular Materials	593
10H416 Catalysis Science at Molecular Level	594
10P416 Catalysis Science at Molecular Level 2	595
10H417 Molecular Photochemistry	596
10P417 Molecular Photochemistry 2	597
10H423 Condensed Matter Physical Chemistry	598
10H422 Molecular Materials Science	599
10H427 Quantum Materials Science	600
10H428 Molecular Rheology	601
10H430 Molecular Porous Physical Chemistry	602
10D432 Laboratory and Exercises in Molecular Engineering I	603
10D433 Laboratory and Exercises in Molecular Engineering I I	604
10D439 Molecular Engineering, Adv. IA	605
10D445 Molecular Engineering, Adv. IB	606
10D440 Molecular Engineering, Adv. IIA	607
10D447 Molecular Engineering, Adv. IIB	608
10H436 Molecular Engineering, Adv.	609
10D438 Molecular Engineering, Adv. V	610
10P439 Molecular Engineering, Adv.	611
10P440 Molecular Engineering, Adv.	612
10P448 Japan Gateway Project Seminar	613
10P450 Japan Gateway Project Seminar	614
10P452 Japan Gateway Project Seminar	615
10P454 Japan Gateway Project Seminar	616
10P456 Japan Gateway Project Seminar	617
10P457 Japan Gateway Project Seminar	618
10P459 Japan Gateway Project Seminar	619
10P461 Japan Gateway Project Seminar	620

10P463 Japan Gateway Project Seminar	621
10P465 Japan Gateway Project Seminar	622
10P467 Japan Gateway Project Seminar ?	623
10P469 Japan Gateway Project Seminar ?	624
10P471 10P471	625
10i053 Introduction to Advanced Material Science and Technology (11 times course) (English lecture)	626
10i054 Introduction to Advanced Material Science and Technology (15 times course) (English lecture)	627
10i055 Advanced Modern Science and Technology (4 times course) (English lecture)	628
10i056 Advanced Modern Science and Technology (8 times course) (English lecture)	629
10i045 Exercise in Practical Scientific English	630
10D043 Instrumental Analysis, Adv.	631
10D046 Instrumental Analysis, Adv.	632
10i051 Frontiers in Modern Science and Technology (6H course)	633
10i052 Frontiers in Modern Science and Technology (12H course)	634
10S401 Advanced Molecular Engineering	635
10S404 Advanced Seminar on Molecular Engineering 1	636
10S405 Advanced Seminar on Molecular Engineering 2	637

Polymer Chemistry

10H649 Polymer Synthesis	638
10D652 Polymer Physical Properties	639
10S604 Advanced Seminar on Polymer Chemistry 1	640
10S605 Advanced Seminar on Polymer Chemistry 2	641
10H662 10H662	642
10H645 Polymer Functional Chemistry	643
10H607 Design of Polymerization Reactions	644
10H610 Reactive Polymers	645
10H611 Biomacromolecular Science	646
10H613 Polymer Structure and Function	647
10H643 Polymer Solution Science	648
10H622 Physical Chemistry of Polymers	649
10H625 Polymer Spectroscopy	650
10H616 Polymer Supramolecular Structure	651
10H628 Design of Polymer Materials	652
10H647 Polymer Controlled Synthesis	653
10H636 Polymer Design for Biomedical and Pharmaceutical Applications	654
10H663 10H663	655
10H664 10H664	656
10H650 Polymer Functional Chemistry	657
10H651 Design of Polymerization Reactions	658
10H652 Reactive Polymers	659
10H653 Biomacromolecular Science	660

10H654 Polymer Structure and Function	661
10H655 Polymer Solution Science	662
10H656 Physical Chemistry of Polymers	663
10H657 Polymer Spectroscopy	664
10H658 Polymer Supramolecular Structure	665
10H659 Design of Polymer Materials	666
10H660 Polymer Controlled Synthesis	667
10H661 Polymer Design for Biomedical and Pharmaceutical Applications	668
10H665 10H665	669
10D640 Polymer Chemistry Laboratory & Exercise	670
10i053 Introduction to Advanced Material Science and Technology (11 times course) (English lecture)	671
10i054 Introduction to Advanced Material Science and Technology (15 times course) (English lecture)	672
10i055 Advanced Modern Science and Technology (4 times course) (English lecture)	673
10i056 Advanced Modern Science and Technology (8 times course) (English lecture)	674
10H041 Organotransition Metal Chemistry 1	675
10H042 Organotransition Metal Chemistry 2	676
10H818 Advanced Organic Chemistry	677
10D043 Instrumental Analysis, Adv.	678
10D046 Instrumental Analysis, Adv.	679
10i051 Frontiers in Modern Science and Technology (6H course)	680
10i052 Frontiers in Modern Science and Technology (12H course)	681
10i045 Exercise in Practical Scientific English	682
10i041 Professional Scientific Presentation Exercises (English lecture)	683
10i010 International Internship in Engineering 1	684
10i011 International Internship in Engineering 2	685
10i049 Project Management in Engineering	686
10i059 Exercise on Project Management in Engineering	687

Synthetic Chemistry and Biological Chemistry

10H802 Organic System Design	688
10H804 Synthetic Organic Chemistry	689
10H805 Functional Coordination Chemistry	690
10H808 Physical Organic Chemistry	691
10H834 Fine Synthetic Chemistry	692
10H813 Bioorganic Chemistry	693
10H812 Molecular Biology	694
10H815 Biorecognics	695
10H816 Microbiology and Biotechnology	696
10H818 Advanced Organic Chemistry	697
10H836 Advanced Biological Chemistry	698
10P836 Advanced Biological Chemistry 2 Continued	699
10H041 Organotransition Metal Chemistry 1	700

10H042 Organotransition Metal Chemistry 2	701
10D839 Synthetic Chemistry and Biological Chemistry, Adv,A	702
10D840 Synthetic Chemistry and Biological Chemistry, Adv,B	703
10D841 Synthetic Chemistry and Biological Chemistry, Adv,C	704
10D842 Synthetic Chemistry and Biological Chemistry, Adv,D	705
10D843 Synthetic Chemistry and Biological Chemistry, Adv,E	706
10D844 Synthetic Chemistry and Biological Chemistry, Adv,F	707
10D828 Special Experiments and Exercises in Synthetic Chemistry and Biological Chemistry	708
10i053 Introduction to Advanced Material Science and Technology (11 times course) (English lecture)	709
10i054 Introduction to Advanced Material Science and Technology (15 times course) (English lecture)	710
10i055 Advanced Modern Science and Technology (4 times course) (English lecture)	711
10i056 Advanced Modern Science and Technology (8 times course) (English lecture)	712
10D043 Instrumental Analysis, Adv.	713
10D046 Instrumental Analysis, Adv.	714
10i051 Frontiers in Modern Science and Technology (6H course)	715
10i052 Frontiers in Modern Science and Technology (12H course)	716
10i045 Exercise in Practical Scientific English	717
10i041 Professional Scientific Presentation Exercises (English lecture)	718
10i042 Advanced Engineering and Economy (English lecture)	719
10i010 International Internship in Engineering 1	720
10i011 International Internship in Engineering 2	721
10i049 Project Management in Engineering	722
10i059 Exercise on Project Management in Engineering	723
10S807 Special Seminar 1in Synthetic Chemistry and Biological Chemistry	724
10S808 Special Seminar 2in Synthetic Chemistry and Biological Chemistry	725
10S809 Special Seminar 3 in Synthetic Chemistry and Biological Chemistry	726

Chemical Engineering

10H002 Special Topics in Transport Phenomena	727
10H003 Advanced Topics in Transport Phenomena (English lecture)	728
10H005 Separation Process Engineering, Adv.	729
10H008 Chemical Reaction Engineering, Adv.	730
10H009 Chemical Reaction Engineering, Adv. (English lecture)	731
10H011 Advanced Process Systems Engineering	732
10H053 Process Data Analysis	733
10H017 Fine Particle Technology, Adv.	734
10H020 Surface Control Engineering	735
10H021 Engineering for Chemical Materials Processing	736
10H023 Environmental System Engineerig	737
10E038 Process Design	738
10H030 Special Topics in Chemical Engineering I	739
10H032 Special Topics in Chemical Engineering II	740

10H033 Special Topics in Chemical Engineering III	741
10H035 Special Topics in Chemical Engineering IV	742
10H040 Research Internship in Chemical Engineering	743
10P043 Chemical Engineering Seminar	744
10P044 Chemical Engineering Seminar	745
10P045 Chemical Engineering Seminar	746
10P046 Chemical Engineering Seminar	747
10E045 Reseach in Chemical Engineering	748
10E047 Reseach in Chemical Engineering	749
10E049 Reseach in Chemical Engineering	750
10E051 Reseach in Chemical Engineering	751
10i053 Introduction to Advanced Material Science and Technology (11 times course) (English lecture)	752
10i054 Introduction to Advanced Material Science and Technology (15 times course) (English lecture)	753
10i055 Advanced Modern Science and Technology (4 times course) (English lecture)	754
10i056 Advanced Modern Science and Technology (8 times course) (English lecture)	755
10D043 Instrumental Analysis, Adv.	756
10D046 Instrumental Analysis, Adv.	757
10i051 Frontiers in Modern Scinece and Technology (6H course)	758
10i052 Frontiers in Modern Scinece and Technology (12H course)	759
10i049 Project Management in Engineering	760
10i059 Exercise on Project Management in Engineering	761
10i057 Safety and Health Engineering (4 times course)	762
10i058 Safety and Health Engineering (11 times course)	763
10P470 10P470	764
10P471 10P471	765
10T004 Special Seminar of Chemical Engineering 1	766
10T005 Special Seminar in Chemical Engineering 2	767
10T006 Special Seminar of Chemical Engineering 3	768
10T007 Special Seminar in Chemical Engineering 4	769
10T008 Special Seminar in Chemical Engineering 5	770
10T009 Special Seminar in Chemical Engineering 6	771
10T010 Special Seminar in Chemical Engineering 7	772

Exercise on Project Planning

自主企画プロジェクト

【Code】 10F251 【Course Year】 Master 1st 【Term】 1st+2nd term

【Class day & Period】 1st term: Thu 3rd, 2nd term: Wed 5th 【Location】 1st term : C1-173 2nd term : C1-192

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Exercise 【Language】 Japanese and English

【Instructor】 Related instructors,

【Course Description】 The purpose of this seminar is to bring out the self-initiative, the planning ability, the creativity of students. From project and to practice, the students set up the goals of projects, go ahead with the projects by themselves, and finally make the presentations of project results. Specifically, about the internship activities in enterprises, the training activities in enterprises or universities at home and abroad, the planning and operation of collaborative projects with citizen, the student makes the perfect plannings including the purposes, the ways, the results and so on. For a final, the students do practice, they write the reports and make the presentations about the project results.

【Grading】 Planning, implementation of project and reports are comprehensively evaluated.

【Course Goals】 Goals are cultivating ability for self-initiative, planning and creativity.

【Course Topics】

Theme	Class number of times	Description
Course introduction	1	
Proposal of project	6	
Management of project	12	
Progress report	1	
Final report	8	
Presentation	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Details are provided in the first lecture.

Integrated Seminar on Infrastructure Engineering A

社会基盤工学総合セミナー A

【Code】10U051 【Course Year】Doctor 1st 【Term】1st term 【Class day & Period】Fri 5th 【Location】C1-173

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】English 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	10	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Integrated Seminar on Infrastructure Engineering B

社会基盤工学総合セミナー B

【Code】10U052 【Course Year】Doctor 1st 【Term】2nd term 【Class day & Period】Tue 5th

【Location】C1-173 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】English

【Instructor】Related instructors,

【Course Description】 On the investigation of themes by the students, they make the presentation and discussion in English. The themes are about the technology innovation of infrastructure on the international viewpoint, the ideal style of infrastructure management, the standardization of project technology for internationalization, and about the technology movement or the role of Japan in the world on the construction of infrastructure and the usage of resource energy such as the development and utilization of international crust or resource energy.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	10	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Details will be provided in the guidance and first lecture.

Seminar on Infrastructure Engineering A

社会基盤工学セミナー A

【Code】 10U055 【Course Year】 Master Course 【Term】 1st+2nd term

【Class day & Period】 1st term: Wed&Fri 5th, 2nd term: Mon&Tue 5th 【Location】 【Credits】 4 【Restriction】

【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】 This lecture focuses on the movement and content of the most advanced research at home and abroad on Infrastructure Engineering. The students are individually instructed about the planning of study schedule , the way of collecting datas, the way of doing the research and summarizing the results of research.

【Grading】 Points are allocated for research activities such as a presentation at laboratory seminars, domestic conferences, international conferences, research paper presentation etc. Students are required to obtain the points in total which are more than predefined points.

Students are required to get no less than 10 points in total for two years from M1 to M2, no less than 3 points in each year.

1 point: Presentation at laboratory seminar (only if supervisor agrees), oral presentation in the annual meeting in the Society of Civil Engineers.

1 ~ 5 point: Attending the lecture held by Academic Society (Certification is required), number of points is determined by your supervisor in accordance to the level of difficulty for approval.

3 point : Presentation in English in international conference. If the papers are peer-reviewed, the points are determined as journal papers (see below).

5 ~ 10 point: First author or coauthor of published and/or accepted journal papers (e.g., for Journal of Society of Civil Engineers, ASCE Journal, etc.) (Number of points is determined by your supervisor depending on level of journal and/or your contribution.)

Others: Exercise on project or training course (Number of points is determined by your supervisor). However, the activities related to the other courses are not admitted, which are Exercise on Project Planning, Capstone Project, Internship on Infrastructure Engineering, Long-Term Internship, Practice in Infrastructure Engineering or Practice in Urban Management.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	6	
	8	
	6	
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Infrastructure Engineering B

社会基盤工学セミナー B

【Code】 10U056 【Course Year】 Master Course 【Term】 1st+2nd term

【Class day & Period】 1st term: Thu 5th & Fri 4th, 2nd term: Thu 4th & Fri 5th 【Location】 【Credits】 4

【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 Related instructors,

【Course Description】 The students make the collection of data, study and summarize the research results about the specific themes on Infrastructure Engineering. In addition, the students are individually instructed about the way of presentation of research results through the presentations at the conferences at home and abroad, the ones at laboratory and participation in training course.

【Grading】 Points are allocated for research activities such as a presentation at laboratory seminars, domestic conferences, international conferences, research paper presentation etc. Students are required to obtain the points in total which are more than predefined points.

Students are required to get no less than 10 points in total for two years from M1 to M2, no less than 3 points in each year.

1 point: Presentation at laboratory seminar (only if supervisor agrees), oral presentation in the annual meeting in the Society of Civil Engineers.

1 ~ 5 point: Attending the lecture held by Academic Society (Certification is required), number of points is determined by your supervisor in accordance to the level of difficulty for approval.

3 point : Presentation in English in international conference. If the papers are peer-reviewed, the points are determined as journal papers (see below).

5 ~ 10 point: First author or coauthor of published and/or accepted journal papers (e.g., for Journal of Society of Civil Engineers, ASCE Journal, etc.) (Number of points is determined by your supervisor depending on level of journal and/or your contribution.)

Others: Exercise on project or training course (Number of points is determined by your supervisor). However, the activities related to the other courses are not admitted, which are Exercise on Project Planning, Capstone Project, Internship on Infrastructure Engineering, Long-Term Internship, Practice in Infrastructure Engineering or Practice in Urban Management.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
all	2	Each supervisor navigates students thorough their presentations and discussion.
	6	
	8	
	6	
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Internship on Infrastructure Engineering

社会基盤工学インターンシップ

【Code】 10U059 【Course Year】 Master and Doctor Course 【Term】 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】 Through the long-term internship outside the university, the students can get the practical techniques, the way of finding and solving the problems, the way of integrating the techniques, the way of summarizing the results and making the presentation in each field of Urban Management.

【Grading】 Writing plans, completing internship, final report and presentation are comprehensively evaluated.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
-------	--------------------------	-------------

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Practice in Infrastructure Engineering

社会基盤工学実習

【Code】 10F063 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 Tue 1st

【Location】 C1-173 【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese

【Instructor】 Related instructors,

【Course Description】 To develop fundamental and practical understandings on Civil and Earth Resources Engineering and cultivate problem-solving abilities, students are encouraged to attend a practical education and engineering program offered by educational institutes such as universities, international and domestic associations. Students attend a program under the instructions of academic supervisors. Programs are limited to the ones certified by the department.

【Grading】 Attendance and reports are comprehensively evaluated.

【Course Goals】 To develop fundamental and practical understandings on Civil and Earth Resources Engineering and cultivate problem-solving abilities by attending a practical education and engineering program offered by educational institutes such as universities, international and domestic associations.

【Course Topics】

Theme	Class number of times	Description
all	1	study practical knowledge.
	5	
	6	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

ORT on Infrastructure Engineering

社会基盤工学ORT

【Code】10U060 【Course Year】Doctor Course 【Term】1st+2nd term

【Class day & Period】1st term: Thu 3rd&4th, 2nd term: Thu 4&5th 【Location】C1-173 【Credits】4 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】Related instructors,

【Course Description】By practicing about the research themes on Infrastructure Engineering and making the presentations of the research results at the conferences, the students can develop the advanced specialities and the ability of finding out the new fields of research. Also, the students get the practical ability which is necessary for researchers and engineers. The students can participate in the conferences at home and abroad, in the presentations of research at laboratory, in some kinds of seminars, symposiums, lecture classes, internship to the enterprises or research organizations at home and abroad. The director of the department and the supervisor totally evaluate the reports made about these activities by the students.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	6	
	8	
	6	
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Details will be provided in the guidance.

Practice in Advanced Infrastructure Engineering A

社会基盤工学総合実習 A

【Code】 10U064 【Course Year】 Doctor 1st 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 1 【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	3	
	5	
	2	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Practice in Advanced Infrastructure Engineering B

社会基盤工学総合実習 B

【Code】 10U065 【Course Year】 Doctor 1st 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 1 【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	5	
	2	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Continuum Mechanics

連続体力学

【Code】10F003 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 2nd 【Location】C1-192
 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Kunitomo Sugiura, Tomomi Yagi,

【Course Description】Continuum mechanics is a unified basis for solid mechanics and fluid mechanics. The aims of this course are to introduce the continuum mechanics from their basics to the some forms of constitutive law and also to provide students with mathematical way of understanding the continuum mechanics. This course contains the fundamentals of vector and tensor calculus, the basic equations of continuum mechanics, the tensor expressions of elastic problems and further applications.

【Grading】Assessment will be based on exam, report and participation.

【Course Goals】Fundamental theorems on structural mechanics and design will be learned, and ability to judge the proprieties of each computational structural analysis will be acquired.

【Course Topics】

Theme	Class number of times	Description
Introductions	1	- Outline of Structural Analysis - Mathematical Preliminaries(Vectors and Tensors)
Matrices and tensors	1	- Summation Convention - Eigenvalues and Eigenvectors
differential and integral calculus of tensors	1	- Quotient Laws - Divergence Theorem
Kinematics	1	- Material Description - Spatial Description - Material derivative
Deformation and strain	2	- Strain tensors - Compatibility conditions
Stress and equilibrium equation	1	- Stress Tensors - Equilibrium Equations
Conservation law and governing equation	1	- Conservation of Mass - Conservation of Linear Momentum - Conservation of Energy
Constitutive equation of idealized material	1	- Perfect Fluid - Linear Elastic Material(Isotropic)
Elastic-plastic behavior and constitutive equation of construction materials	1	- Yield Criteria - Flow Rule - Hardening Rule
Boundary value problem	1	- Governing Equations and Unknowns - Navier-Stokes Equation - Navier Equation
Variational principle	1	- Principle of Virtual Work - Principle of Complementary Virtual Work
Various kinds of numerical analyses	2	- Weighted Residual Method - Finite Element Method
Confirmation of the attainment level of learning	1	Feedback based on the Final Examination

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】Basic knowledge for structural mechanics, soil mechanics and fluid mechanics are required.

【Independent Study Outside of Class】As appropriate, the assignments are given based on the content of Lecture.

【Web Sites】

【Additional Information】

Structural Stability

構造安定論

【Code】 10F067 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 2nd
 【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English
 【Instructor】 Kunitomo SUGIURA

【Course Description】 Fundamental concept of static and dynamic stability of large-scale structures such as bridges is to be introduced in addition to the way to keep/improve their safety and to evaluate their performance. Basic concept of structural stability and its application and technical subjects to improve safety will be lectured systematically. Furthermore, the practical solutions to the subjects are to be introduced to assure the safety of structures.

【Grading】 Grading will be evaluated by written examination, reports and attendance.

【Course Goals】 The class aims to cultivate the understanding of static and dynamic stability problems for structural system and make understand the methodology to clarify the limit state. To get knowledge on countermeasures to assure the stability which is applicable to practical design and manufacturing will be also required.

【Course Topics】

Theme	Class number of times	Description
Elastic Stability under Static Loading	7	Stability of Structures and Failures Basis of Structural Stability Elastic Buckling of Columns Elastic Buckling of Beams & Frames Elastic Buckling of Plates Elasto-plastic Buckling Buckling Analysis
Basic theory of dynamic stability and its application	7	The stability around the equilibrium points based on the state equation of motion in which the nonlinearity of external, damping and restrung forces are taken into account. Wind-induced vibration of a square prism (Galopping) and 1dof system with nonlinear spring will be introduced as practical examples. Chaotic motion of a pendulum subjected to periodic external force is also explained as an introduction of chaos theory.
Achievement Check	1	Summary and Achievement Check.

【Textbook】 Not specified.

【Textbook(supplemental)】 Introduced in class if necessary.

【Prerequisite(s)】 It is desired for participants to master structural mechanics, continuum mechanics, mathematical analysis as well as vibration theory.

【Independent Study Outside of Class】

【Web Sites】 none

【Additional Information】 none

Material and Structural System & Management

材料・構造マネジメント論

【Code】 10F068 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Wed 2nd

【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture

【Language】 English 【Instructor】 Hirotaka Kawano, Atsushi Hattori, Takashi Yamamoto,

【Course Description】 With regard to the maintenance of concrete structures, the deterioration prediction procedures in material and structural properties are discussed based on durability and deterioration processes of concrete structures. Repair materials and methods are also introduced. Note: strengthening materials and methods are discussed in Concrete Structural Engineering, provided in the second semester. In the later half of this lecture, structures are focused as groups rather than an individual structure to understand the difference between asset management and maintenance. By taking into consideration the economic aspect and human resources aspect as well as the physical aspect, the flow of the asset management for structures' groups with view points of the life cycle cost and the budget is provided.

【Grading】 Reports ,presentations and other activities are inclusively considered.

【Course Goals】 To understand the maintenance for a single structure and the asset management for structures' group.

【Course Topics】

Theme	Class number of times	Description
1. Outline of maintenance for concrete structures	1	
2. Deterioration mechanisms of concrete structures and deterioration prediction	4	
3. Repair materials and methods for concrete structures	1	
4. Maintenance and asset management	2	
5. Maintenance for structures' group	2	
6. Management for structures' group	2	
7. Presentations and discussions	3	

【Textbook】 Not specified. Some materials may be provided.

【Textbook(supplemental)】 Not specified.

【Prerequisite(s)】 Basic knowledge on Construction Materials and Concrete Engineering.

【Independent Study Outside of Class】 Check the handouts. Additional studies will also be instructed.

【Web Sites】

【Additional Information】 Positive presence in the lecture is expected by joining discussions for example.

Earthquake Engineering/Lifeline Engineering

地震・ライフライン工学

【Code】10F261 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 4th
 【Location】C1-191 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English
 【Instructor】J. Kiyono, A. Igarashi

【Course Description】This course deals with the mechanism and propagation characteristics of the seismic ground motion that often greatly affects the urban society, in particular the wave generation in the earthquake fault and the ground vibration analysis, and the elastic and elastoplastic response of the structures to the seismic ground motions. The topics include the dynamic response characteristics of RC/steel structures, current seismic response control technology, basic theory and technical development of lifeline earthquake engineering, thoretical aspect of lifeline management and safety assessment learned from past damage experience.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	1	
	1	
	1	
Principles of seismic design of structures	2	Fundamental thories on dynamic response of nonlinear elastoplastic structural systems and representative seismic design principles
Seismic performance of concrete and steel structures	1	Essentials and current issues related to seismic performance and design of RC and steel structures
Seismic response control and seismic retrofit of structures	1	Idea and current issues on seismic isolation, seismic response control techniques for enhancement of seismic performance of structures, and seismic retrofit and rehabilitation of existing structures
	1	
	2	
	1	
	1	
Achievement evaluation	1	Students' achievements in understanding of the course material are evaluated.

【Textbook】Not specified

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Structural Engineering for Civil Infrastructure

社会基盤構造工学

【Code】 10W001 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 2nd

【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture

【Language】 English 【Instructor】 Related Faculty members,

【Course Description】 Structural engineering problems related to planning, design, construction and maintenance of the infrastructures are discussed. Topics concerning structural engineering and management are widely taken up including latest advanced knowledge and technology, future view and/or international topics. Special lectures by extramural lecturers are carried out if necessary.

【Grading】 Coursework will be graded based on the reports.

【Course Goals】 To grasp problems related to structural engineering and their specific solutions.
To understand applicability of advanced technologies and development prospects.

【Course Topics】

Theme	Class number of times	Description
Structural Materials, Structural Mechanics	4	Steel materials, Concrete materials, mechanical behavior of structures, Problems related to design, construction and maintenance
Applied Mechanics	1	Numerical analysis for structure performance evaluation
Earthquake and Wind Resistance of Structures	7	Infrastructure and natural disaster, Trends of disaster prevention technology, Problems related to Earthquake and wind resistant design
Maintenance of structure	3	International technology, Scenario design, International technological education and collaboration

【Textbook】 The textbook is not required. Materials will be supplied by instructors.

【Textbook(supplemental)】 Supplemental text books will be introduced by instructors.

【Prerequisite(s)】 Structural Mechanics, Wind Resistant Design, Construction Materials, Dynamics of Structures, etc.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Structural Design

構造デザイン

【Code】 10F009 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 2nd
 【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English
 【Instructor】 Yoshikazu Takahashi, Masahide Matsumura

【Course Description】 This course provides the knowledge of the structural planning and design for civil infrastructures. Fundamentals of the reliability of structures based on the probability and statistics are given. Emphasis is placed on the reliability index and the calibration of partial safety factors in the LRFD design format. Furthermore, the relationship between structure and form is discussed with various examples.

【Grading】 Assessed by term-end examination, reports and quizzes

【Course Goals】 To understand the structural planning and design for civil infrastructures.

To understand the reliability-based design of structures.

To deepen the understanding of the relationship between structure and form.

【Course Topics】

Theme	Class number of times	Description
Structural Planning	2	Structural Planning of civil infrastructures is introduced. The concept, significance of planning, characteristics of civil infrastructures are discussed. Practical planning process of a bridge is explained.
Structure and Form	3	The bridge types such as girder, truss, arch and suspension bridge that have been regarded individually are explained as an integrated concept from the viewpoint of acting forces to understand the structural systems which have continuous or symmetrical relationships. Furthermore, various examples are discussed based on the understanding of the structural systems.
Structural Design and Performance-based Design	3	Design theory of civil infrastructures is introduced. The allowable stress design method and the limit state design method are explained. The basic of earthquake resistant design is discussed based on the dynamic response of structures. Performance-based design is also introduced.
Random Variables and Functions of Random Variables	1	Fundamentals of random variables, functions of random variables, probability of failure and reliability index in their simplest forms are lectured.
Structural Safety Analysis	3	Limit states, probability of failure, FOSM reliability index, Hasofer-Lind reliability index, Monte Carlo method are lectured.
Design Codes	2	Code format as Load and Resistance Factors Design (LRFD) method, calibration of partial safety factors based on the reliability method are given.
Assessment of the Level of Attainment	1	Assess the level of attainment.

【Textbook】 Reliability of Structures, A. S. Nowak & K. R. Collins, McGraw-Hill, 2000

【Textbook(supplemental)】 U.Baus, M.Schleich, Footbridges, Birkhauser, 2008 (Japanese ver.: Footbridges(translated by Kubota, et al.), 鹿島出版会, 2011)

久保田善明, 『橋のディテール図鑑』, 鹿島出版会, 2010

Other books will be given in the lectures as necessary.

【Prerequisite(s)】 Fundamental knowledge on Probability and Statistics, and Structural Mechanics

【Independent Study Outside of Class】 N/A

【Web Sites】

【Additional Information】 Structural planning and design will be given by Y. Takahashi, and Structural reliability analysis by M. Matsumura.

Bridge Engineering

橋梁工学

【Code】 10F010 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 3rd 【Location】 C1-172 【Credits】 2
 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English 【Instructor】 Kunitomo Sugiura, Tomomi Yagi, Masahide Matsumura
 【Course Description】 The subject matter of bridge engineering can be divided into two main parts, which are steel structure and wind loading/wind resistant structure. The aim of this course is to provide details of mechanical behaviors, maintenance and design of bridge structures. The former part of this course contains the static instability of steel structures and the problems of corrosion, fatigue, brittleness, weldability on steel bridges. In the latter part, the basics of wind engineering, bridge aerodynamics and wind-resistant design including current problems to be solved are provided.
 【Grading】 Assessment will be based on exam, reports and participation.

【Course Goals】

Also, the basic knowledge for wind engineering and aerodynamic instabilities, which are necessary for the wind resistant design of bridges, will be acquired.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	- Fundamental knowledge on steel structures - Types of steel structures - Future trend of steel structures
Material behavior, Initial imperfections and Damages	1	- Construction of steel structures - Residual stresses and initial deformations - Damages
Stress-strain relationship, Joints	1	- Yield surfaces - Bauschinger effect - Hardening effect - Welded joint - Bolted joint
Fatigue fracture, fatigue life and fatigue design	1	- S-N design curve - Fatigue crack growth, stress intensity factor - Miner's rule on damage accumulation - Repair of fatigue damage
Structural stability and design for buckling	1	- Structural instability and accident - Theory of Stability - Compressive members, etc.
Corrosion and anti-corrosion of steel structures	1	- Mechanism of corrosion - Micro- and Macro- cells - Anti-corrosion - Life-cycle costs
Wind resistant design of structures	3	- Natural winds due to Typhoon, Tornado and so on - Evaluation and estimation of strong winds - Wind resistant design methods - Various kinds of design codes
Aerodynamic instabilities of structures	3	- Introduction of aerodynamic instabilities (ex. vortex-induced vibration, galloping, flutter, buffeting, cable vibrations) - Mechanisms of aerodynamic instabilities - Evaluation methods and Countermeasures
Wind-induced disaster	1	- Accidents on structures due to strong winds - Disaster prevention
Topics	1	Introduction of current topics on bridge engineering by a visiting lecturer
Confirmation of the attainment level of learning	1	Confirm the attainment level of learning

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 Basic knowledge for construction materials, structural mechanics and fluid mechanics are required.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Concrete Structural Engineering

コンクリート構造工学

【Code】10A019 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Tue 2nd

【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Yoshikazu Takahashi, Takashi Yamamoto, Satoshi Takaya, Katsuhiko Mizuno (Sumitomo Mitsui Construction Co., LTD.)

【Course Description】Concrete is one of the most useful construction materials employed for an infrastructure. The structural properties of a reinforced concrete including a prestressed concrete are introduced among the various structural components of concrete. The engineering techniques in design, execution, diagnosis, repair, strengthening and management of reinforced and/or prestressed concrete structures are discussed from the point of view of the performance based system.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	6	
	6	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Structural Dynamics

構造ダイナミクス

【Code】 10F227 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 2nd
 【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese
 【Instructor】 A. Igarashi, A. Furukawa

【Course Description】 This course deals with dynamics of structural systems and related topics, to provide the theoretical basis to deal with the problems of vibration, safety under dynamic loads and health monitoring associated with infrastructures. The students will study the dynamic response, properties of natural modes and methods of eigenvalue analysis for multi-DOF systems. The topics on the numerical time integration schemes, probabilistic evaluation of structural response to random excitation, and dynamic response control techniques for structures are also studied.

【Grading】 Based on the results of a final examination, plus homework assignments

【Course Goals】 (1) To acquire the knowledge on theories and principles of analysis of MDOF systems (2) Systematic understanding of frequency-domain structural response analysis (3) Concept of analysis of numerical time integration schemes (4) Understanding of fundamentals of the random vibration theory

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The fundamental concepts of structural dynamics and the scope of the problem to be treated are described, and the outline of the theoretical framework of methodologies for analysis is overviewed.
Dynamics of Multi-Degree-Of-Freedom Systems	2	Basic concepts, including the formulation of vibration model of multi-degree of freedom systems, eigenvalue analysis, normal modes and modal analysis of linear systems and modeling of system damping, are described.
Frequency-Domain Analysis of System Response	1	Methodology of response analysis of linear systems based on the concept of the frequency response function, and the relationship between the frequency-domain analysis and time-domain response via Fourier integral, mathematical operation and numerical procedure are described.
Numerical Time Integration	2	Overview of the step-by-step time integration method used for numerical response analysis in the time domain is followed by the implication and mathematical analysis of the characteristics of the integration method, including stability and accuracy.
Random Vibration	6	The methodology for stochastic modeling of inputs when the dynamic load on the structure can not be deterministically specified is shown, and the concept, theory and method for probabilistic evaluation of the dynamic response of the structures are described.
Structural Response Control	2	The concept of dynamic response control of structures, in particular the active control and semi-active control, is described, and the standard theories for analysis and design are introduced.
Achievement Evaluation	1	Students' achievements in understanding of the course material are evaluated.

【Textbook】 Not used; Class hand-outs are distributed when necessary.

【Textbook(supplemental)】

【Prerequisite(s)】 Mechanical vibration (undergraduate level), Complex calculus (integration of analytic functions, Fourier transform, etc.), Probability theory, Linear algebra

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There will be homework assignments at the end of most of the lectures.

Seismic Engineering Exercise

サイスミックシミュレーション

【Code】 10F263 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 4th

【Location】 C1-192 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture and Exercise

【Language】 Japanese 【Instructor】 Sawada, Takahashi, Goto

【Course Description】 This course provides the knowledge of simulation methods for earthquake engineering.

Small groups of students are exercised in the prediction of ground motion generated by a specified seismic fault and the response analysis of structure selected by themselves considering soil-structure interaction.

【Grading】 Based on the performance during the course (including homework) and the results of presentation and reports.

【Course Goals】 At the end of this course, students will be required to have a good understanding of: - Prediction of ground motion generated by a specified seismic fault - Dynamic response analysis of structures and foundation (linear/nonlinear)

【Course Topics】

Theme	Class number of times	Description
Frequency domain analysis	1	Basics of Fourier transformation is introduced.
Modeling of structure - soil system and time domain analysis	1	Equation of motion of SR model is introduced and the integration method of the equation in time domain is explained.
Exercise of linear seismic response analysis	2	Small groups of students are exercised in elastic modeling of structures and linear response analysis in time domain and frequency domain.
Prediction of ground motion by empirical Green's function method	3	Empirical Green's function method is introduced to predict large earthquakes based on observed small earthquakes.
Seismic analysis method of soil	2	Seismic analysis method of layered half-space based on equivalent linearization method is introduced.
Nonlinear seismic analysis method of structures	2	Nonlinear modeling of structures and the integration and iterative methods of the nonlinear equation of motion in time domain are introduced.
Exercise of nonlinear seismic response analysis	3	Small groups of students are exercised in the prediction of ground motion generated by a specified seismic fault and the nonlinear response analysis of structures and foundation.
Achievement Check	1	All students give presentations and discussions.

【Textbook】 Not used; Class hand-outs are distributed when necessary.

【Textbook(supplemental)】

【Prerequisite(s)】 Earthquake Engineering/Lifeline Engineering (10F261), Structural Dynamics (10F227)

【Independent Study Outside of Class】 Students require to review and analyze in preparation for final presentations.

【Web Sites】

【Additional Information】

Ecomaterial and Environment-friendly Structures

環境材料設計学

【Code】 10F415 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Wed 1st

【Location】 C1-117 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Hirotaka KAWANO, Atsushi HATTORI, Toshiyuki ISHIKAWA,

【Course Description】 Lecture on outline of impact of construction materials to environment and influence on materials and structures from environment. Discuss how to use materials sustainably. Keywords are concrete, steel, composite materials, CO₂, durability, recycle and reuse, life-cycle assessment.

【Grading】 Attendance(%), Report(%), Presentation(%)

【Course Goals】 To understand the limit of resources and effect of material use to environment. and to understand the basic theory to make environmental-friendly infrastructures from the view point of materials use.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	Object of the Course, Grading and Goals
product of materials and impact to environment	1	Product of cement, steel, concrete CO ₂ product and its influence
recycle and reuse of materials	3	Recycle and reuse of steel, metals, concrete, asphalt, plastics Technology development of construction materials
deterioration of concrete structures	1	Mechanism of deterioration of concrete structures: carbonation, salt attack, alkali-aggregate reaction Maintenance and retrofit methods
deterioration of steel structures	1	Mechanism of deterioration of steel structures: corrosion, fatigue Maintenance and retrofit methods
deterioration of composite structures	1	Mechanism of deterioration of composite structures: Maintenance and retrofit methods
life-cycle assessment of structures	1	Life-cycle assessment of structures considering initial cost as well as maintenance cost
topics and discussion	2	Recent topics on construction materials and discussion
presentation by students and discussion / feedback	4	Presentation by students on the individual topics Discussion on the topics. Feedback at the last class

【Textbook】 No set text

【Textbook(supplemental)】 Instructed in class

【Prerequisite(s)】 Basic knowledge of construction materials, concrete engineering

【Independent Study Outside of Class】 Check the handouts. Additional studies will also be instructed.

【Web Sites】

【Additional Information】 Questions and discussions are welcome

Infrastructure Safety Engineering

社会基盤安全工学

【Code】10F089 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 3rd
 【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
 【Instructor】Tomoyasu Sugiyama, Tsutomu Iyobe

【Course Description】The issues concerning the safety and reliability of infrastructures such as tunnels and bridges and also the issues on natural disaster are reviewed in the lecture.

【Grading】This lecture involves reports (70%) and attendance(30%)

【Course Goals】To understand the basic technologies to enhance the safety of structures and also the fundamentals on disaster prevention.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction on the safety of infrastructures
Maintenance of railway structures	1	Planning, investigation, evaluation and repair in maintenance for mainly railway structures is generally explained
Weather information for disaster prevention	2	Overview of weather information for disaster prevention and its monitoring system, the evaluation method for climatological statistics and extreme value statistics.
Disaster prevention in railway structures	1	To sustain the users' safety in railway system, it is necessary to maintain the structures properly but also to consider the prevention against disaster. Thus herein disasters in railway structures and its counteractions are explained
Regulation and counteraction against rainfall	1	The need for regulation in railway operation at rainfall is explained
Risk assessment for rainfall disaster	1	Risk assessment for rainfall disaster is described and also some practical cases are introduced
Technical tour	3	Prevention technologies against natural disaster
Earthquake and its early detection	1	Warning system for earthquake and the algorithm of earthquake early detection, which is one of the regulations for Super expressway in earthquake, is explained
Basics of snow hydrology	2	Physical phenomenon of snow hydrology and its relationship with natural and social environment
Countermeasures of snow disasters for railway	1	Disorder caused by snow and ice and the countermeasures in railways
Report	1	Report

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】Basic knowledge on statistics is required. Students should have taken the course of geo-mechanics, structural mechanics and concrete engineering.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】confirm the attendance at every lecture

Hydraulics & Turbulence Mechanics

水理乱流力学

【Code】10F075 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 3rd

【Location】C1-191 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Toda,Sanjou,Okamoto,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Guidance	1	Guidance and entrance level lecture about fluid dynamics and turbulence
Theories of turbulence	3	Lectures about momentum equation, boundary layer, energy transport, vortex dynamics and spectrum analysis
Turbulence in natural rivers	4	Lectures about diffusion and dispersion phenomena observed in natural rivers.
Vegetation and turbulence	3	Lecture about turbulence transport in vegetation canopy together with introduction of recent researches
Practical topics in natural rivers	2	Lectures about compound channel and sediment transport
Practical topics in hydraulic engineering	2	Lectures about drifting object in flood and fish way

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】Hydraulics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Hydrology

水文学

【Code】10A216 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Tue 2nd
 【Location】C1-117 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English
 【Instructor】Yasuto TACHIKAWA, Yutaka ICHIKAWA and Kazuaki YOROZU

【Course Description】Physical mechanisms of the hydrologic cycle are described from the engineering viewpoint. The rainfall-runoff modeling and its prediction method are emphasized. Physical hydrological processes explored are surface flow, saturated-unsaturated subsurface flow, streamflow routing, and evapotranspiration. Physical mechanism of each hydrological process and its numerical modeling method are explained. The basic equations and numerical simulation methods are provided. Then, detail of distributed hydrological modeling is explained through exercise.

【Grading】Examination and report

【Course Goals】The goals of the class are to understand the physical mechanism of hydrological processes, their basic equations, and numerical simulation methods.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The hydrologic cycle and the hydrological processes are explained.
Surfaceflow	2	The physical process of the surface flow and its numerical modeling method are described. The basic equations of the surface flow and the numerical simulation methods are explained.
Streamflow routing	2	The physical process of the streamflow routing and its numerical modeling method are described. The basic equations of the streamflow routing and the numerical simulation methods are explained.
Channel network and watershed modeling	1	Numerical representations of channel networks and catchments are explained.
Distributed hydrological model	5	A physically-based distributed hydrological model is described, which is constructed with numerical representations of channel networks and catchments.
Climate change and hydrologic cycle	1	Data analysis of the latest GCM simulation is presented and the impact of climate change on the hydrologic cycle is discussed.
Evapotranspiration	2	The physical process of the evapotranspiration and its numerical modeling method are described. The basic equations of the evapotranspiration and the numerical simulation methods are explained.
Feedback of study achievement	1	Feedback of study achievement is conducted.

【Textbook】Handouts are distributed at each class.

【Textbook(supplemental)】

【Prerequisite(s)】Basic knowledge of hydraulics and hydrology

【Independent Study Outside of Class】Read the textbook and/or related documents in advance and work on assignments to improve understanding of the lecture contents.

【Web Sites】<http://hywr.kuciv.kyoto-u.ac.jp/lecture/lecture.html>

【Additional Information】This course is open in English every other year. The course will be open in AY2018.

River Engineering and River Basin Management

河川マネジメント工学

【Code】10F019 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 1st 【Location】C1-173
 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Hosoda,T., Kishida, K., Onda, S.

【Course Description】It is important to consider about rivers comprehensively from the various points of view based on natural & social sciences and engineering & technology. The fundamental knowledge to consider rivers and to make the plans for river basins is explained with the following contents: various view points to consider rivers, long term environmental changes of rivers and its main factors, river flows and river channel processes, the ecological system of rivers and lakes, flood & slope failure disasters, the integrated river basin planning(flood defense, environmental improvement planning, sediment transport system), functions of dam reservoir and management.

【Grading】Reports & Attendance

【Course Goals】Students are requested to understand the fundamental knowledge to consider rivers and river basins comprehensively from the various points of view based on natural & social sciences and engineering & technology.

【Course Topics】

Theme	Class number of times	Description
Various view points to consider rivers and river basins	2	Various viewpoints to consider rivers and river basins, Various rivers on the earth, Formation processes of river basins, long term environmental changes of rivers and its main factors
Ecological system in rivers	1	The fundamental knowledge on river ecological system
Applications of computational methods to environmental problems	2	The following items are lectured: Computational method to predict river flows and river channel processes with sediment transport and river bed deformation, Hydrodynamics in Lake Biwa.
Recent flood disasters & Integrated river basin planning	3	Characteristics of recent flood and slope failure disasters, the Fundamental river management plan and the River improvement plan based on the River Law, Procedures to make the flood control planning, Flood invasion analysis and hazard map.
Groundwater and its related field	1	Simulation technology of groundwater, Geo-environmental issues, Reservoir Engineering, Contaminant Transport Processes.
Sustainable development of dam	1	Needs of dam development and history of dam construction, Maintenance of Dam reservoir.
Economic evaluation of environmental improvement projects	2	Evaluation of people's awareness & WTP to river improvement projects by means of CVM, Conjoint Analysis, etc.
Riverbank and Dam structure and its maintenance	2	River bank and dam structure, foundation, grouting. Design of River bank, Arch Dam and Gravity Dam.
Achievement Confirmation and Feedback	1	Comprehension check of course contents (Reports & Quiz)

【Textbook】Printed materials regarding the contents of this class are distributed in the class.

【Textbook(supplemental)】

【Prerequisite(s)】Fundamental knowledge on Hydraulics, Hydrology and Ecology

【Independent Study Outside of Class】

【Web Sites】http://www.geocities.jp/kyoto_ivereng/

【Additional Information】Students can contact with professors by visiting their rooms and sending e-mails.

Prof. Hosoda: hosoda.takashi.4w@kyoto-u.ac.jp

Prof. Kishida: kishida.kiyoshi.3r@kyoto-u.ac.jp

Associate Prof. Onda: onda.shinichiro.2e@kyoto-u.ac.jp

Sediment Hydraulics

流砂水理学

【Code】10A040 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 2nd
 【Location】C1-191 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
 【Instructor】Hitoshi Gotoh and Eiji Harada,

【Course Description】Natural flows in river and coast are movable bed phenomena with the interaction of flow and sediment. At a river and a coast, a current and a wave activate a sediment transport and bring the topographical change of a bed such as sedimentation or erosion. This lecture provides an outline about the basics of sediment (or movable bed) hydraulics, and detail of the computational mechanics of sediment transport, which has been developed on the basis of dynamics of flow and sediment by introducing a multiphase flow model and a granular material model. Furthermore, about sediment and water-environment relationship, some of frontier technologies, such as an artificial flood, removal works of dam sedimentation, coastal protection works, and sand upwelling work for covering contaminated sludge on flow bottom etc., are mentioned.

【Grading】Grading is based on student ' s activities in lectures and written examination.

【Course Goals】Students understand the basics of sediment hydraulics and outline of advanced models for computational sediment hydraulics, such as multiphase flow model and granular material model. Students understand the present conditions of sediment control works.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The purpose and constitution of the lecture, the method of the scholastic evaluation are explained.
Basics of sediment hydraulics	5	Physical characteristic of a movable bed and a non-equilibrium sediment transport process and its description are explained. Furthermore, the prediction technique of topographical change due to current and waves is outlined.
Computational mechanics of sediment transport: The state of the art	8	Essential parts of numerical models of the movable bed phenomena, which has been developed by introducing dynamic models such as a granular material model to describe a collision of sediment particles and a multiphase flow model to describe a fluid-sediment interaction, are described. In comparison with the conventional movable bed computation, the points on which has been improved to enhance the applicability of the models are concretely mentioned. Some frontier studies of sediment transport mechanics are also introduced.
Achievement confirmation	1	Comprehension check of course contents.

【Textbook】Hitoshi Gotoh: Computational Mechanics of Sediment Transport, Morikita Shuppan Co., Ltd., p.223, 2004 (in Japanese).

【Textbook(supplemental)】Non

【Prerequisite(s)】Undergraduate-level Hydraulics or Hydrodynamics is required. Because a commentary easy as possible is kept in mind by lectures, students without these prerequisite are welcomed.

【Independent Study Outside of Class】Review fundamental items of hydraulics or hydrodynamics.

【Web Sites】Non

【Additional Information】Non

Hydrologic Design and Management

水工計画学

【Code】10F464 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 2nd
 【Location】C1-191 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
 【Instructor】Yasuto TACHIKAWA and Yutaka ICHIKAWA

【Course Description】Hydrologic design and real-time rainfall-runoff prediction methods are described. The frequency analysis of hydrologic extreme values and the time series analysis of hydrologic variables are described, and then a procedure to determine an external force for the hydrologic design are explained. Next, a physically based hydrologic model which includes various processes of human activities for the hydrologic cycle is described. A flood control planning and water resources management with the use of innovative hydrologic simulation tools is described. Then, A real-time rainfall runoff prediction method with the use of Kalman filter theory is described.

【Grading】Final report (100)

【Course Goals】The class aims to understand the probabilistic and statistical analysis of hydrologic variables to determine the external force of hydrologic designs, applications of hydrologic simulations for hydrologic designs, and real-time rainfall and runoff prediction methods for water resources management.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	A flood control planning and water resources planning are introduced.
Frequency analysis and hydrologic design	3	The frequency analysis of hydrologic extreme values is described. The methods to set the external force for the hydrologic design are explained.
Time series analysis and hydrologic design	2	The time series analysis of hydrologic variables is described. The methods to develop time series models, time series data generation methods, spatiotemporal variation of hydrologic variables and a random field model, disaggregation methods are explained.
Hydrologic modeling and predictive uncertainty	2	Hydrologic models which include the process of human activities for the hydrologic cycle is described. Then, hydrologic predictive uncertainty is explained, which is inevitable coming from model structure uncertainty, parameter identification uncertainty and model input uncertainty. Especially, the relation between spatiotemporal scales of hydrologic modeling and model parameter values is described.
Hydrologic modeling system	2	A hydrologic modeling system which helps to develop complicated hydrologic simulation models and its importance for a flood control planning is also described.
Watershed management for flood disaster	2	Watershed management to mitigate flood disasters is described. A cost-benefit analysis of flood control measures is discussed.
Real-time rainfall runoff prediction	2	A real-time rainfall runoff prediction method with the use of Kalman filter theory and a new filter theory is described.
Feedback of study achievement	1	Feedback of study achievement is conducted.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】Basic knowledge of hydrology, probability and statistics are required.

【Independent Study Outside of Class】Read the textbook and/or related documents in advance and work on assignments to improve understanding of the lecture contents.

【Web Sites】<http://hywr.kuciv.kyoto-u.ac.jp/lecture/lecture.html>

【Additional Information】

Open Channel Hydraulics

開水路の水理学

【Code】 10F245 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 1st

【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 HOSODA, Takashi and ONDA, Shinichiro

【Course Description】 Hydraulic engineers and river engineers are requested to understand Open Channel Hydraulics to handle practical problems properly. In this class, the basic theory on open channel hydraulics is lectured showing various applications in Hydraulic Engineering Field. The contents include the following items: Application of a singular point theory to water surface profile analysis, Derivation of 2-D depth averaged flow model, 1-D analysis of unsteady open channel flows based on the method of characteristics, Plane 2-D analysis of steady high velocity flows, Plane 2-D analysis of unsteady flows, Higher order theories such as Boussinesq equation, etc.

【Grading】 This class is available for 2018. The regular examination is held for grading.

【Course Goals】 Students are required to understand the basic theory of Open Channel Hydraulics and to learn how to apply the basic theory to practical problems in hydraulic engineering field including computational methods.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	The contents of this subject are introduced showing the whole framework of Open Channel Hydraulics with several theoretical and computational results.
Derivation of 2-D depth averaged model	1	Derivation procedures of plane 2-D depth averaged flow model are explained in details.
Application of singular point theory to water surface profile analysis	1	The application of a singular point theory to water surface profile analysis for steady open channel flows is explained.
1-D analysis of unsteady open channel flows	3	The following items are lectured: Fundamental characteristics of 1-D unsteady open channel flows, Method of Characteristics, Dam break flows, Computational methods for shallow water equations.
Fundamentals of numerical simulation	1	basic theory of numerical simulation is explained by means of finite difference method, finite element method, etc. Applications of these method to unsteady open channel flow equations are also shown with some practical applications in river engineering.
Plane 2-D analysis of steady high velocity flows	1	Characteristics of steady plane 2-D flows are explained based on the method of characteristics.
Plane 2-D analysis of unsteady flows	3	The following items are lectured: The propagation of a characteristic surface, the shear layer instability in 2-D flow fields, the application of a generalized curvilinear coordinate system to river flow computation, the application of a moving coordinate system, etc.
Higher order theory	3	Boussinesq equation with the effect of vertical acceleration, full/partially full pressurized flows observed in a sewer network, traffic flow theory based on a dynamic wave model and its application
Achievement Confirmation & Feedback	1	Understanding of the contents on Open Channel Hydraulics is confirmed through the regular examination.

【Textbook】 Printed materials on the contents of this class are distributed in class.

【Textbook(supplemental)】

【Prerequisite(s)】 The Basic knowledge on fluid dynamics and hydraulics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Students can contact with Hosoda by sending e-mail to hosoda.takashi.4w@kyoto-u.ac.jp.

Coastal Wave Dynamics

海岸波動論

【Code】10F462 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 3rd
 【Location】C1-173 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English
 【Instructor】Hitoshi Gotoh , Khayyer Abbas, Eiji Harada and Hiroyuki Ikari

【Course Description】Wave motion, which is the main driving force in coastal zone, is explained focusing on wave transformation theory and computational fluid dynamics, and design for coastal structures of their engineering applications is illustrated. As for the computational fluid dynamics for waves, methodology of free-surface wave based on the Navier-Stokes equation, which has been significantly developed in recent years, is explained in detail.

【Grading】Grading is based on student ' s activities in lectures and written examination.

【Course Goals】Goal of this course is a detailed understanding of fundamental of wave transformation theory and computational fluid dynamics related to wave motion, and is also acquiring a design concept for coastal structures as their engineering applications.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The purpose and constitution of the lecture the method of the scholastic evaluation are explained.
Conservation laws of fluid	4	Fundamentals of fluid mechanics, liner / non-liner wave theories and numerical mathematics are explained.
Modeling of surf zone dynamics	6	Several methodologies against free-surface wave including breaking waves (i.e. VOF, MPS, SPH) are illustrated. Especially advanced approaches of MPS and SPH are explained in detail.
Introduction of turbulence models	1	Reynolds averaging models and large eddy simulation are outlined.
Modeling of rock mound dynamics	2	Method for tracking of armor blocks under high waves using Distinct Element Method is described.
Achievement Confirmation	1	Comprehension check of course contents.

【Textbook】Computational Wave Dynamics by Hitoshi Gotoh, Akio Okayasu and Yasunori Watanabe 234pp, ISBN: 978-981-4449-70-0

【Textbook(supplemental)】Non

【Prerequisite(s)】Non. It is desirable to have knowledge about hydraulics, fluid mechanics.

【Independent Study Outside of Class】Review fundamental items of hydraulics or hydrodynamics.

【Web Sites】

【Additional Information】If there are any questions, please send e-mail to the staff. This course will be offered in 2015.

Hydro-Meteorologically Based Disaster Prevention

水文気象防災学

【Code】10F267 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 3rd

【Location】C1-191 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Kaoru Takara, Eiichi Nakakita, Takahiro Sayama, Kosei Yamaguchi

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	1	
	2	
	2	
	2	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Every two years. No class is provided in year 2018.

Water Resources Systems

水資源システム論

【Code】 10A222 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 1st
 【Location】 C1-192 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese
 【Instructor】 Hori, T.(DPRI) and Tanaka, K.(DPRI)

【Course Description】 Systems approach to natural and social phenomena associated to water resources is introduced in terms of planning and design of sustainable water resources systems.

【Grading】 Grading is done based on examination and commitment to classes.

【Course Goals】 Deep understanding of fundamentals for systems modeling of water-related natural and social processes and ability to perform data collection, analyses and design of sustainable water management systems.

【Course Topics】

Theme	Class number of times	Description
Optimum design of water resources systems	3	
decision support for water resources management	2	
Recent topics on water management	2	
Water management practices in the world	3	
Land surface model and its application to water management	4	
achievement check	1	

【Textbook】 Not specified.

【Textbook(supplemental)】 Supplemental documents will be introduced in classes.

【Prerequisite(s)】 Fundamentals of hydrology and water resources engineering.

【Independent Study Outside of Class】 Review work based on handouts and report work for issues given in the classes are required.

【Web Sites】

【Additional Information】 Open every two years. Not available in 2018.

River basin management of flood and sediment

流域治水砂防学

【Code】10F077 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 1st

【Location】C1-173 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】(DPRI) Nakagawa, H., (DPRI) Sumi, T., (DPRI) Takebayashi, H. and (DPRI) Kawaike, K.

【Course Description】In a river basin, various kinds of disasters such as debris flow, land slide, flood inundation, storm surge, and etc. sometimes happen from the origin to the mouth. This lecture presents occurrence examples, mechanisms, theory and methods of prediction and prevention/mitigation methods against those disasters. Also this lecture mentions comprehensive management in a sediment routing system focusing on sediment management strategy in dam reservoirs.

【Grading】Grading is based on 2 reports out of 4 topics and attendance.

【Course Goals】The goals of the class are to understand phenomena within a river basin and to have wide knowledge of problems of flood and sediment disasters and countermeasures against them.

【Course Topics】

Theme	Class number of times	Description
About Sabo Works	4	About Sabo works, sediment disasters, countermeasures against sediment disasters, Sabo projects.
About Reservoir Sediment Management	3	Reservoir sediment management focusing on reservoir sustainability and comprehensive management in a sediment routing system is overviewed including worldwide perspective and Japanese advanced case studies.
About basin-wide sediment routing	4	About the one dimensional bed deformation analysis and the sediment runoff model are introduced. Furthermore, some examples of the application of those models are introduced.
About basin-wide flood management	4	Flood disasters and countermeasures against them are overviewed along the history of flood management in Japan.

【Textbook】No designation. Printed materials regarding the contents of this class are distributed in class.

【Textbook(supplemental)】Instructed in class

【Prerequisite(s)】Fundamental knowledge of Hydraulics and river engineering

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】This class is held biennially and is held in 2019. Attendance is taken every time.

Coastal and Urban Water Disasters Engineering

沿岸・都市防災工学

【Code】10F269 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 2nd
 【Location】C1-192 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
 【Instructor】T. Hiraishi, A. Igarashi, N. Yoneyama, N. Mori

【Course Description】The coastal and densely populated urban areas with highly concentrated economic and social activities and infrastructures are exposed to the threat of coastal disasters such as tsunamis, storm surges, high waves, urban flood damage and urban earthquake disasters caused by particular conditions associated with their characters. This course provides the factors, examples and characteristics of coastal and urban regional disasters, as well as disaster prevention measures taking these factors into consideration.

【Grading】Grading will be based on the report and achievements in the class.

【Course Goals】In-depth understanding of concepts and knowledge necessary for taking measures against disasters, based on fundamental theories of hydraulics and structural mechanics, occurrence, propagation and deformation of external actions caused by coastal and urban earthquake disasters, as well as information on the past disaster and damage examples.

【Course Topics】

Theme	Class number of times	Description
Outline of coastal and urban disasters	1	Introduction of coastal and urban disasters will be lectured. The type and cause of coastal and urban disasters will be explained for sequential lectures.
Modeling of tsunami, storm surge and waves	3	The fundamental physics and governing equations of tsunami, storm surge and ocean waves will be described and applications and historical events will be explained in detail.
Reduction of coastal disasters	3	Characteristics of historical tsunamis, storm surges and coastal erosion will be presented with countermeasures by engineering approaches. Reliability design for coastal structures will be explained following Japanese standard.
Earthquake disaster in urban areas	1	Review of recent earthquake disasters in urban areas in Japan and other countries
Prediction of regional damage due to earthquake and tsunami	3	Fundamental principles of regional damage prediction for scenario earthquakes and tsunami events
	1	
	2	
Achievement Evaluation	1	Submission of reports to integrate the idea of prevention and reduction of coastal and urban disasters, to evaluate students' achievements in understanding of the course material.

【Textbook】Not specified. Hand-outs and research papers are distributed when necessary.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】The methodology and idea developed in the lecture should be explored by relating your own field of research.

【Web Sites】

【Additional Information】

Basin Environmental Disaster Mitigation

流域環境防災学

【Code】10F466 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 3rd 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Masaharu FUJITA(DPRI), Tetsuya HIRAISHI(DPRI), Yasuhiro TAKEMON(DPRI), Yasuyuki BABA(DPRI),

【Course Description】In a concept of the environmental disaster prevention, an idea that the disaster prevention could provide continuously the environmental benefits is contained as well as an idea of preventing the environmental deterioration. In this lecture, an environment system formation function of a debris flow, a flood, an ocean wave is explained. Also their values as natural resources are discussed. The influence of structural countermeasures on the environment conservation is evaluated from this point of view. A new idea of disaster prevention is introduced considering the function of the natural impacts and the value of the natural phenomena as resources is discussed. Also a new method for basin management is introduced.

【Grading】Presentation, Discussion and Report

【Course Goals】The course goal is to understand a concept of the basin management balanced between disaster prevention and environment conservation based on the sediment transport hydraulics and the ecology.

【Course Topics】

Theme	Class number of times	Description
Introduction of the environmental disaster prevention	3	First of all, a concept of the environmental disaster prevention is introduced. The utilization of flood plains as agricultural land and the history of rivers with bed above ground and so on are introduced, and the relation between the human being and rivers is explained. A method to balance the sustained resources use with disaster prevention is discussed.
Basin scale ecosystem function	3	A role of the disturbance in maintaining of the structure and function of the basin scale ecosystem is explained. For example, a role of the natural phenomenon such as a debris flow, a flood inundation is explained.
Coastal disasters and environment	4	The actual situation of the coastal erosion in our country and the causes are explained. Then, the problems on disaster prevention, environment conservation and utilization in coastal areas are introduced. Technology development to solve these problems is introduced. Also, the relation between environment in river mouth and river basin is discussed.
Sediment disasters and environment	2	Sediment hazards give a big impact to river environment as well as the human beings. As one of the sediment hazards landslides are taken up and the occurrence mechanism is explained.
Sediment management with consideration of environment conservation	2	The basin scale sediment management is carried out for the purpose of safety, appropriate utilization and environmental conservation. Actual sediment management and the related researches are introduced. A concept, new ideas and new technology are discussed.
Evaluation of proficiency level	1	Students confirm the proficiency level in this lecture.

【Textbook】None.

【Textbook(supplemental)】None.

【Prerequisite(s)】Hydraulics, River Engineering, Coastal Engineering, Sediment Transport Hydraulics, Ecology

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】This lecture is open every 2 years and open in 2018.

Computational Fluid Dynamics

数值流体力学

【Code】10F011 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Mon 4th

【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English

【Instructor】Satoru Ushijima, Hitoshi Gotoh, Abbas Khayyer

【Course Description】Computational Fluid Dynamics (CFD) is largely developed according to the progress of computer technology in recent years. It is the powerful and effective technique to predict the various fluid phenomena, which show the complicated behaviors due to the non-linearity and other conditions. This course provides the dynamics of fluids and eddies as well as the discretization and numerical techniques, such as finite difference, finite volume and particle methods.

【Grading】The grading will be based on homework assignments.

【Course Goals】Course goal is to understand the basic theory and numerical techniques for CFD.

【Course Topics】

Theme	Class number of times	Description
computational method for incompressible fluids	7	The course introduces the MAC algorithm, which is generally used for incompressible Newtonian fluids on the basis of finite difference and finite volume methods (FDM and FVM). The outline of numerical methods is also discussed for parabolic, hyperbolic or elliptic partial differential equations, in terms of the numerical stability and accuracy. Homework will be assigned each week.
Particle method - basic theory and improvements	7	To simulate violent flow with gas-liquid interface which is characterized by fragmentation and coalescence of fluid, particle method shows excellent performance. Firstly, basics of the particle method, namely discretization and algorithm, which is common to SPH(Smoothed Particle Hydrodynamics) and MPS(Moving Particle Semi-implicit) methods, are explained. Particle method is superior in robustness for tracking complicated interface behavior, while it suffers from existence of unphysical fluctuation of pressure. By revisiting the calculation principle of particle method, various improvements have been proposed in recent years. In this lecture, the state-of-the-art of accurate particle method is also described.
Feedback	1	Discuss the contents of all classes and assignments. The details will be introduced in the course.

【Textbook】No textbook assigned to the course

【Textbook(supplemental)】Recommended books and papers will be introduced in the course.

【Prerequisite(s)】Basic knowledge of fluid dynamics, continuum mechanics and computational technique

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Hydraulic Engineering for Infrastructure Development and Management

水域社会基盤学

【Code】10F065 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Tue 3rd
 【Location】C1-117 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English
 【Instructor】Hosoda Takashi, Toda Keiichi, Gotoh Hitoshi, Tachikawa Yasuto, Kishihida Kiyoshi, Ichikawa Yutaka,
 Onda Shinichiro, Harada Eiji, Sanjou Michio, Khayyer Abbas and Kim Sunmin,

【Course Description】 This lecture picks up various water-related problems and provides their explanation and solution methodology related to hydrodynamic and hydrological infrastructure improvements, maintenance, disaster prevention against flood and damage of water environment, interweaving several leading-edge cases in the real world. Turbulent flow and CFD, sediment transport system and design/planning of hydraulic structure are described on the basis of the integrated management of river-and-coast systems with sediment control and these relationship with infrastructure improvement. Perspective from the viewpoint of public environmental infrastructure on water environment is presented.

【Grading】 Grading is based on students activities in lectures and reports.

【Course Goals】 Students learn about case-based practical solutions against various problems related to hydraulic engineering, and students acquire academic preparation of how to approach to public environmental infrastructure on water area.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The purpose and constitution of the lecture, the method of the scholastic evaluation are explained.
Hydraulics in open-channel flows	3	Several problems and exciting topics related to hydraulics in open-channel flows are discussed with advanced practical examples.
River basin management	3	Introduction of flood disasters during a few decades in the world, flood control planning in Japan, Economic evaluation and analysis of people ' s awareness to river improvement projects with dam construction.
Beach erosion	3	Several problems and their solution methodology against sediment transport process in coastal zone are explained. Advanced approaches for sediment control are overviewed.
Rainfall-runoff prediction and hydrologic design	3	Water resources issues related to rainfall-runoff prediction and hydrologic design are discussed with advanced practical examples.
Numerical simulation for Hydraulic engineering	1	Recent numerical simulation development and related state-of-the-art technologies are overviewed.
Achievement Confirmation	1	Comprehension check of course contents. The exercises to the given subjects are performed.

【Textbook】 Non

【Textbook(supplemental)】 Non

【Prerequisite(s)】 hydraulics, fluid mechanics, river engineering, coastal engineering, hydrology, etc.

【Independent Study Outside of Class】

【Web Sites】 Non

【Additional Information】 Non

Applied Hydrology

応用水文学

【Code】10F100 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 4th

【Location】C1-173 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English

【Instructor】Hori(DPRI), Sumi(DPRI), S.Tanaka(DPRI), Takemon(DPRI), K.Tanaka(DPRI), Kantoush(DPRI)

【Course Description】Applied and integrated approach to the problems closely related to the water circulation system, such as floods, droughts, water contamination, ecological change, and social change is introduced mainly from the hydrological viewpoint with reference to water quantity, quality, ecological and socio-economic aspects. In the course, several actual water problems are taken up and solving process of each problem which comprises of problem-identification and formulation, impact assessment, countermeasures design and performance evaluation is learned through the lectures' description and also investigation and discussion among the students.

【Grading】Grading is based on student activities in lectures, presentation and reports.

【Course Goals】To obtain fundamental Knowledge and skills to perform problem definition, survey and countermeasure design on problems about water use, water hazard mitigation and water environment.

【Course Topics】

Theme	<small>Class number of times</small>	Description
Water disasters and risk management	2	Risk assessment of water disasters, countermeasures and adaptation design, water disasters and human security
Reservoir Systems and Sustainability	2	Reservoir system and its environmental impacts, Sustainable management of reservoir system
Hydrological Frequency Analysis	3	Basic theory and application of Hydrological Frequency Analysis, which is the basis for hydrologic design.
Land Surface Processes	2	Modelling of land surface processes, Application of land surface model
Hydrological Measurements of Large River Basins	2	Design and management of hydrological measurement system in large river basins
Hydro-eco Systems	2	Ecohydrological management of habitats in river ecosystems, Ecohydrological management of biodiversity in wetland ecosystems
Presentation and Discussion	2	study and exercise for given topics

【Textbook】Printed materials on the contents of this class are distributed in class.

【Textbook(supplemental)】None

【Prerequisite(s)】Elementary knowledge of hydrology and water resources engineering.

【Independent Study Outside of Class】Review work based on handouts and report work for issues given in the classes are required.

【Web Sites】

【Additional Information】

Case Studies Harmonizing Disaster Management and Environment

Conservation

環境防災生存科学

【Code】10F103 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 4th
 【Location】C1-191 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】English
 【Instructor】H. NAKAGAWA(DPRI), E. NAKAKITA(DPRI), N. MORI(DPRI), T. SAYAMA(DPRI), K. YAMAGUCHI(DPRI)

【Course Description】Environmental impacts by infrastructure for disaster prevention and mitigation are discussed. Introducing various examples of natural disasters, degradation of the environment, and harmonizing disaster management and environmental conservation in the world, this classroom carries on a dialogue about effective measures for reducing negative environmental impacts and serious disasters.

【Grading】Considering both the number of attendances and the score of final test at the end of the semester.

【Course Goals】Conservation of the environment and prevention/mitigation of natural disasters, which are very important for human's survivability, often conflict with each other. This course introduces various examples. Students will learn many examples harmonizing these two issues, and shall consider technical and social countermeasures fitting to the regional characteristics.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction
Heavy rainfall and climate change	3	Heavy rainfall -using radar nowcasts and climate change
Flood disaster prevention and the environment	2	River environment and disaster
Coastal hazards and climate change	3	Climate change and impact assessment/adaptation on coastal environment
Water disaster and climate change	3	Hydrological processes and water disaster predictions
Extreme weather and climate change	3	Heavy rainfall -prediction of severe storm

【Textbook】No particular textbook for this course. Necessary documents and literature introduction are provided in the class room from time to time.

Lecture material for Coastal disasters due to tsunamis and storm surges

<http://urx3.nu/t4sq>

<http://urx3.nu/t4sA>

<http://urx3.nu/t4sC>

【Textbook(supplemental)】Some literature would be introduced by professors.

【Prerequisite(s)】No special knowledge and techniques are necessary, but requires reading, writing and discussing in English in the class.

【Independent Study Outside of Class】No specific requirement for independent study. Collect information broadly regarding environment and disaster related topics.

【Web Sites】

【Additional Information】Contact Associate Professor Mori at <mori.nobuhito.8a@kyoto-u.ac.jp> if you have any query.

Integrated Disasters and Resources Management in Watersheds

流域管理工学

【Code】 10F106 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 1st

【Location】 Katsura Campus, Ujigawa Open Laboratory 【Credits】 2 【Restriction】

【Lecture Form(s)】 Lecture and Exercise 【Language】 English

【Instructor】 Masaharu FUJITA(DPRI), Tetsuya HIRAISHI(DPRI), Nozomu YONEYAMA(DPRI), Kenji KAWAIKE(DPRI), Hiroshi TAKEBAYASHI(DPRI), Yasuyuki BABA(DPRI),

【Course Description】 Mechanism and countermeasures of sediment disasters, flood disasters, urban flood disasters and coastal disasters are explained. An integrated watershed management of these disasters and water/sediment resources is also introduced. This lecture will be open at Katsura Campus and Ujigawa Open Laboratory.

【Grading】 Presentation, Discussion and Report

【Course Goals】 Learn an integrated basin management system for natural disasters (sediment disasters, food disasters, coastal disasters, urban flood disasters) mitigation and water/sediment resources utilization considering environmental conservation.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Contents of this lecture are explained.
Urban flood disaster managemnet	2	We review urban floods from the viewpoint of river basins, flood causes, and features, together with the results of recent studies. Based on these studies, we propose comprehensive measures against urban floods, including underground inundations. In addition, we discuss on prediction methods of the tsunami disaster in urban area.
Flood disaster management	2	Prevention / mitigation measures against flood disasters and flood prediction methods are explained as well as examples of recent flood disasters in Japan.
Sediment disaster management	2	Showing the problems on sediment disasters and sediment resources, I explain an integrated sedimnet management system both for sediment disasters and sediment resources.
Coastal disaster management	2	Coastal erosion and tsunami hazard become remarkable in these days in Japanese coast. In a lecture, we discuss on characteristics of such coastal disasters.
Exercise on flood disaster at Ujigawa Open Laboratory	5	Experiment and analysis on debris flows, riverbed variation and flooding at Ujigawa Open Laboratory, Fushimi-ku, Kyoto city.
Evaluation of proficiency level	1	Students confirm the proficiency level in this lecture.

【Textbook】 None

【Textbook(supplemental)】 None

【Prerequisite(s)】 Hydraulics, River Engineering, Coastal Engineering, Sediment Transport Hydraulics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Geomechanics

地盤力学

【Code】10F025 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 2nd

【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Mamoru Mimura, Sayuri Kimoto,

【Course Description】Mechanical behavior of soils and problems of its deformation and failure will be covered based on the multiphase mixture theory and the mechanics of granular materials.

【Grading】Final examination (70) and homeworks, class performance (30)

【Course Goals】The objectives of this course are to understand the basics of geomechanics, and the advanced theories.

【Course Topics】

Theme	Class number of times	Description
Deformation of geomaterials	1	Mechanical property of geomaterials, critical state soil mechanics, Failure criteria, modelling of geomaterials (by Prof. Mimura)
Field equations and constitutive model	2	Framework and field equations for continuum, stress-strain relations for soils, elastic model, elasto-plastic model, plasticity theory (by Prof. Mimura)
elasto-plastic constitutive model	3	Constitutive model for geomaterials, elasto-plastic model, Cam clay model (by Prof. Mimura)
Theory of viscosity and viscoplasticity	3	Viscoelasticity, viscoplasticity, Elasto-viscoplastic mode, Adachi-Oka model, Microstructure of soils, Temperature dependent behavior, Applications of constitutive models (by Prof. Mimura)
Consolidation analysis	3	Biot's consolidation theory and its application, Consolidation of embankment (by Assoc. Prof. Kimoto)
Liquefaction of soils	2	Liquefaction of sandy soil, Damage and failure due to liquefaction, Remedial measures for liquefaction (by Assoc. Prof. Kimoto)
Confirmation of achievement	1	

【Textbook】Handout will be given.

Soil mechanics, Fusao Oka, Asakura Publishing (in Japanese)

【Textbook(supplemental)】An elasto-viscoplastic constitutive model, Fusao Oka, Morikita Publishing (in Japanese)

【Prerequisite(s)】Soil mechanics, Fundamentals of continuum mechanics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Computational Geotechnics

計算地盤工学

【Code】 10K016 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 2nd

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture, Exercise

【Language】 English 【Instructor】 Sayuri Kimoto, PIPATPONGSA , Thirapong

【Course Description】 The course provides students with the numerical modeling of soils to predict the behavior such as consolidation and chemical transport in porous media. The course will cover reviews of the constitutive models of geomaterials, and the development of fully coupled finite element formulation for solid-fluid two phase materials. Students are required to develop a finite element code for solving boundary value problems. At the end of the term, students are required to give a presentation of the results.

【Grading】 Presentation and home works

【Course Goals】 Understanding the numerical modeling of soils to predict the mechanical behavior of prous media, such as, deformation of two-phase mixture and chemical transportation.

【Course Topics】

Theme	Class number of times	Description
Guidance and Introduction	1	Fundamental concept in continuum mechanics such as deformation, stresses, and motion.
Governing equations for fluid-solid two-phase materials	2	Motion, conservation of mass, balance of linear momeutum for fluid-solid two-phase materials. Constitutive models for soils, including elasticity, plasticity, and visco-plasticity.
Ground water flow and chemical transport	5	Chemical transport in porous media, advective-dispersive chemical transport.
Boundary value problem, FEM programming	5	The virtual work theorem and finite element method for two phase material are described for quasi-static and dynamic problems within the framework of infinitesimal strain theory. Programing code for consolidation analysis is presented.
Presentation	2	Students are required to give a presentation of the results.

【Textbook】 Handout will be given.

【Textbook(supplemental)】

【Prerequisite(s)】 Fundamental geomechanics and numerical methods

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Geo-Risk Management

ジオリスクマネジメント

【Code】10F238 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 4th
 【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English
 【Instructor】Ohtsu

【Course Description】 This lecture aims to provide interdisciplinary knowledge associated with geo-risk engineering, the topics of risk analysis focusing on geotechnical structures. In detail, the contents of lectures consist of following topics: Introduction to risk analysis, Mathematical background of geo-risk evaluation, Examples of risk evaluation mainly focusing on slopes and Risk management on road slopes.

【Grading】 Attendance(10%), Report(30%), Examination(60%)

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Guidance	1	Guidance Introduction of Geo-Asset Management
Basic	5	Basics of Risk Analysis (3)
Probability theory	8	Evaluation of Slope Risk
Feed back	1	Feed back

【Textbook】 Hiroyasu Ohtsu, Project Management, Corona Publishing, 2010. (in Japanese)

【Textbook(supplemental)】 C. Chapman and S. Ward, Project Risk Management, John Wiley & Sons, 1997.
 R. Flanagan and G. Norman, Risk Management and Construction, Blackwell Science
 V.M. Malhotra & N.J. Carino, CRC Handbook on Nondestructive Testing of Concrete, CRC Press, 1989.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Additional information is available by visiting the following professors. Appointment shall be made in advance by e-mail.

ohtsu.hiroyasu.6n@kyoto-u.ac.jp

Construction of Geotechnical Infrastructures

ジオコンストラクション

【Code】10F241 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Fri 1st
 【Location】C1-171 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
 【Instructor】Kimura, Kishida

【Course Description】Advanced construction technology of geo infrastructures, such as tunnel, large underground cavern, foundation, culvert, retaining wall, is introduced and explained. And, the practical projects applied by the advanced construction technology are also introduced.

【Grading】Attendance and Report (20 %), Examination (80 %)

【Course Goals】To learn to the advanced construction technology and to propose the project and design through the advanced construction technology.

【Course Topics】

Theme	Class number of times	Description
Guidance, Introduction of construction of geotechnical infrastructures	1	Guidance, Introduction of construction of geotechnical infrastructures
Geo-investigation and survey techniques	2	Introduction of the advanced geo-investigation and survey techniques. Explanation of inversion theory and technique.
Auxiliary methods of mountain tunnel	2	Introduction of NATM for construction of tunnel and underground cavern. In addition, the role of auxiliary methods, auxiliary method for safety in tunnel construction, auxiliary methods for preservation of the surrounding environment are explained
Rock physics and its applications	2	Introduction of the constitutive law of rock material and rock physics (pressure solution) and its application fields, such as special projects of underground space, namely, nuclear waste disposal, and Carbon Capture and Storage.
Field visit or special lecture	1	Visit the construction field or invite special lecture who is the expert engineer on the construction of geotechnical infrastructures.
Foundation	2	Design and construction of piles foundation and steel pipe sheet piles
Culvert	2	Design and construction of box type and arch type culverts
Retaining wall	2	Design and construction of retaining wall
Examination of understanding	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】Soil mechanics, Rock mechanics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Office hour will be explained at the guidance. Students can contact with professors as an e-mail.

kimura.makoto.8r@kyoto-u.ac.jp

kishida.kiyoshi.3r@kyoto-u.ac.jp

Fundamental Geofront Engineering

ジオフロント工学原論

【Code】 10F405 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 1st 【Location】 C1 Jin-Yu Hall
 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Prof. Mamoru MIMURA, Prof. Makoto KIMURA, Assoc. Prof. Yosuke HIGO

【Course Description】 This course deals with near-surface quaternary soft soil deposits that are the most important in the engineering sense.

Physical properties and the mechanical characteristics of partially saturated and fully saturated soils are explained, and then various problems in terms of disaster prevention and infrastructure construction are discussed.

【Grading】 Performance grading will be provided based on examination. Attendance and quality of assigned reports, etc. are considered.

【Course Goals】 The aim of this course is to understand engineering problems and their mechanical background in the following points:

- Physical properties and mechanical characteristics of quaternary soft soil deposits and relevant engineering problems in terms of disaster prevention

- Fundamentals of unsaturated soil mechanics and engineering problems of earth structures in terms of disaster prevention

- Concepts of innovative underground foundations and structures and engineering problems during construction

【Course Topics】

Theme	Class number of times	Description
Outline of the course, introduction to quaternary deposits	1	Introduction to quaternary deposits. Types and mechanisms of geotechnical disasters relevant to quaternary deposits.
Geo-informatic database	1	Geo-informatic database and its application to modelling soft alluvial soils, liquefaction hazard map, etc.
Evaluation of subsurface structure based on GID	1	Scheme to evaluate subsurface structures using Geo-informatic database including boring logs, geophysical exploration, geological structures. Application to Kyoto basin is given.
Evaluation of liquefaction for near-surface sand deposits	1	Evaluation of liquefaction for near-surface sand deposits using Geo-informatic database is explained. Applications to the 1995 Hyogo-ken Nanbu Earthquake and the 2011 Off the Pacific Coast of Tohoku Earthquake are given, through which open questions are discussed.
Problems of soft clay deposits	1	Deformation characteristics and stability of soft clay deposits and their evaluation methods are explained, e.g., effectiveness and limitation of ground improvement, long term settlement problem, and case histories of large scale reclamation.
Concept of innovative underground structures	1	Citizen-participate-type renovation technique for unpaved roads using sandbags.
Concept of innovative underground structures	1	New construction method of embankments using consecutive precast arch culvert.
Concept of innovative underground structures	2	Technical problems of steel pipe sheet pile. Development of consecutive steel pipe sheet pile and its application.
Outline of earth structures, Unsaturated soil mechanics	2	Roles of earth structures as an infrastructure. Unsaturated soil mechanics.
Damage of earth structures caused by rainfall and earthquake	1	Case examples and their mechanisms of the damages of earth structures caused by rainfall and earthquake.
Methods to evaluate and improve stability of earth structures subjected to rainfall and earthquake	1	Design methods of earth structures and their problems are outlined.
Site visit	1	Visit construction site relevant to the issues of this course.
Evaluation and feedback	1	Evaluation of achievement by examination, and its feedback.

【Textbook】 Handout will be distributed.

【Textbook(supplemental)】 References are indicated in the handout.

【Prerequisite(s)】 Undergraduate courses in geology, geotechnical engineering, and soil mechanics.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Environmental Geotechnics

環境地盤工学

【Code】 10A055 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 1st

【Location】 C1-192 / Engineering Bldg.No.8 Kyodo No.1 (Yoshida Campus) 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese/English 【Instructor】 Takeshi Katsumi, Toru Inui,

【Course Description】 Several issues on environmental geotechnics including geoenvironmental contamination and countermeasure, waste containment and reuse are introduced to understand the contribution of geotechnical engineering to global and local environmental issues. Geoenvironmental issues due to the 2011 East Japan Earthquake and Tsunami are also introduced.

【Grading】 Continuous assessment including attendance, some assignments, and final report

【Course Goals】 Students should understand the geotechnics to solve the following geoenvironmental issues; soil & groundwater contamination, waste disposal and waste utilization, and extend this knowledge to the development of concepts and technologies for creating and preserving the geo-environment.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction to Environmental Geotechnics, including goals, outline and grading policy of the course
Waste geotechnics	3-4	Functions and structures of waste containment facilities Geotechnics on the liner system (Geosynthetics, clay liner, Leachate collection layer) Post-closure utilization of waste landfill
Remediation geotechnics	3-4	Behaviors of contaminants in subsurface Mechanisms of soil and groundwater contamination Remediation of soil and groundwater contamination Case histories
Geo-environmental issues related to construction works, global environmental issues, and natural disasters	2-3	Mechanisms and remediation of geoenvironmental problems and geo-disasters caused by construction works Geoenvironmental issues caused by the 2011 East Japan Earthquake and Tsunami
Reuse of wastes in geotechnical applications	3-4	Engineering properties of recycled materials in geotechnical applications (Incineration ashes, coal ash, surplus soils, dredged soils) Geoenvironmental impact assessment and control of waste utilization Case histories
Presentation and discussion	2-3	Student presentation, discussion, and summary on above topics

【Textbook】 Not specified.

Several technical papers related to the course will be distributed.

【Textbook(supplemental)】 Geoenvironmental Engineering (Kyoritsu Shuppan Publishing, ISBN: 9784320074293)

Handbook of Geoenvironmental Engineering (Asakura Publishing, ISBN: 9784254261523)

Introduction to Environmental Geotechnics (Japanese Geotechnical Society, ISBN: 9784886444196)

【Prerequisite(s)】 Having knowledge on soil mechanics and geotechnical engineering at bachelor level is preferable, but not requirement.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Disaster Prevention through Geotechnics

地盤防災工学

【Code】10F109 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Mon 2nd
 【Location】C1-117 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English
 【Instructor】Ryosuke Uzuoka and Kyohei Ueda

【Course Description】The lecture covers nonlinear continuum mechanics and dynamic three-phase analysis of ground and geotechnical structures. In particular, the lecture covers the geo-hazards mechanism and prediction of failure modes, and mitigation measure against geo-hazards. The lecture ranges from fundamental mechanics of granular materials to numerical simulation.

【Grading】Based on reports to exercises and attendance.

【Course Goals】Successful students will have the ability to initiate their own research work on geo-hazards based on the solid understanding of the mechanics of granular materials and numerical analysis.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction to the course (objectives, contents, and grading procedure) - Geo-hazards induced by heavy rain and earthquake - Application of numerical analysis to predict the geo-hazards
Nonlinear continuum mechanics 1	3	Nonlinear continuum mechanics 1 - Vector and tensor algebra - Kinematics (motion and strain tensors) - Concept of stress tensors
Nonlinear continuum mechanics 2	3	Nonlinear continuum mechanics 2 - Balance Principles - Objectivity and stress/strain rates - Constitutive laws
Fundamentals of numerical analysis for geo-hazards	4	Fundamentals of numerical analysis for geo-hazards - Balance equations - Constitutive equations - Numerical method
Applications of Numerical analysis for geo-hazards	4	Applications of Numerical analysis for geo-hazards - Liquefaction - Landslide

【Textbook】Handouts

【Textbook(supplemental)】Gerhard A. Holzapfel: Nonlinear Solid Mechanics: A Continuum Approach for Engineering, Wiley.

Javier Bonet, Antonio J. Gil, Richard D. Wood: Nonlinear Solid Mechanics for Finite Element Analysis: Statics, Cambridge University Press.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Public Finance

公共財政論

【Code】10F203 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 4th

【Location】C1-173 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English

【Instructor】Kobayashi, Matsushima,

【Course Description】The concept of public finance will be taught based upon the framework of Macro economics.

【Grading】Final Exam: 60-70%

Mid-term Exam and Attendance: 30-40%

【Course Goals】Understand the concept of public finance

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Explain the outline of this course
GDP and Circular flow model of macro economics	2	Explain about the circular flow model of macro economics and the definition of GDP
Input Output Table and General Equilibrium Model	2	Explain about the input-output table and its role on general equilibrium model
IS-LM Model	2	Explain about IS-LM model to analyze both goods market and money market
International Economics	2	Explain about the international account balance and IS-LM model with trade
AD-AS Model	2	Explain about AD-AS model which analyze the mid term
Economic Growth Model	2	Explain about economic growth model in which long term economic growth is analyzed
Summary	1	Summarize classes and check whether students could achieved its goal.
feedback	1	Accept feedback from students

【Textbook】

【Textbook(supplemental)】Dornbusch et al., Macroeconomics 13rd edition, Mcgrow-hill, 2017
isbn9781259253409

【Prerequisite(s)】Basic Microeconomics

【Independent Study Outside of Class】

【Web Sites】will be notified in the first class.

【Additional Information】

Urban Environmental Policy

都市社会環境論

【Code】10F207 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 2nd

【Location】C1-173 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Ryoji Matsunaka

【Course Description】 This lecture aims to learn urban environmental policy and its fundamental theory and methodology to solve social and environmental problems that occur in urban area as well as to understand the structure of these problems.

【Grading】 evaluation by commitment, tests, reports and examination

【Course Goals】 to understand the structure of social and environmental problems in urban area and urban environmental policy, its fundamental theory and methodology to solve the problems

【Course Topics】

Theme	Class number of times	Description
Outline	1	
Structure of urban problems	3	Expansion of urban areas, Increase of Environmental impact, Making compact cities
Basic theory of transportation and environment	2	Downtown activation, Road space re-allocation, Pedestrianisation
Road traffic and Public transportation	2	Characteristics of traffic modes, Light Rail Transit, Bus Rapid Transit, Mobility Management
Fundamental theory for measurements of environmental values	3	Utility, Equivalent Surplus, Compensating Surplus
Methodology to measure environmental values	3	Travel Cost Method, Hedonic Approach, Contingent Valuation Method, Conjoint Analysis
Summary	1	

【Textbook】 No textbook

【Textbook(supplemental)】

【Prerequisite(s)】 basic knowledge of public economics is required

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantitative Methods for Behavioral Analysis

人間行動学

【Code】10F219 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 5th

【Location】C1-192 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Satoshi Fujii,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	3	
	3	
	3	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Intelligent Transportation Systems

交通情報工学

【Code】 10F215 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 2nd 【Location】 C1-173

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 N. Uno and T. Yamada

【Course Description】 This class provides you with the outlines of engineering methodology with information and communication technology as its core element for improving the safety, efficiency and reliability of traffic and transportation systems and reducing the environmental burden. Concretely, we discuss the applicability of countermeasures, such as Travel Demand Management, modal-mix in transportation systems, traffic safety improvement schemes for relieving contemporary problems in traffic and transportation systems, in addition to brief introduction of innovative approaches to collect high-quality of real-time traffic data. Moreover, the methodology for policy evaluation and the related basic theory are explained.

【Grading】 Final report: 45%, Mid-term report: 45% and Mark given for class participation: 10%

【Course Goals】 Goal of this class is to cultivate basic and critical abilities of students for implementing effective traffic and transportation management using ITS (Intelligent Transportation System).

【Course Topics】

Theme	Class number of times	Description
Basics for Transportation Network Analysis	1	
Estimation of OD Traffic Volume using Observed Link Traffic Counts	1	
Analytical Approaches Based on Transportation Network Equilibrium	4	
Outlines of ITS	1	
Traffic Management for Enhancing Efficiency	2	
Innovative Approaches for Data Collection Using ICT	1	
Application of ITS for Enhancing Traffic safety	1	
Travel Demand Management and Congestion Charging	2	
Application of Traffic Simulation	2	
Feedback of evaluation of report examination to students	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Remote Sensing and Geographic Information Systems

リモートセンシングと地理情報システム

【Code】 10A805 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 2nd 【Location】 C1-117 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture & Exercise 【Language】 Japanese 【Instructor】 Nobuhiro Uno and Junichi Susaki

【Course Description】 Geoinformatics is the science and technologies dealing with spatially distributed data acquired with remote sensing, digital photogrammetry, global positioning system, etc, to address the problems in natural phenomena or human activities. This course particularly focuses on remote sensing by using LiDAR and geographic information system (GIS) and explains the theory and applications. Unlike traditional surveying, LiDAR technique can sequentially obtain the data in a wide area within a short time, and thus it is now widely used in construction and management of civil infrastructure. GIS is a technique to handle digital maps and related information, and it is popular in the fields of urban planning, environmental management and infrastructure management. This course provides an understanding of remote sensing and GIS via applications presented by the exercises of remote sensing and lectures of GIS.

【Grading】 Grading is based on the achievements in exercise and assignments.

【Course Goals】 Students understand the basic theory and acquire the basic techniques of remote sensing for observation and analysis of environmental changes, disaster effects and human activities in urban areas. And, they understand the basic theory and applications of GIS.

【Course Topics】

Theme	Class number of times	Description
Object extraction and landscape analysis from LiDAR data	1	The principle of Light detection and ranging (LiDAR) and the method to generate digital surface model (DSM) from point clouds are explained. As applications of LiDAR data, methods to extract objects by using geometric features and estimate landscape indices are introduced.
(Exercise) Field measurement by using LiDAR	2	Field measurement by using LiDAR is conducted in Katsura Campus.
(Exercise) Co-registration of LiDAR data and its assessment	1	LiDAR data are co-registered and its accuracy is assessed.
(Exercise) Vegetation extraction from LiDAR data and green space ratio estimation	1	Vegetation is extracted by using scattergram of point clouds. Green space ratio from an arbitrary viewpoint is calculated, and the vegetation landscape is assessed.
Satellite remote sensing	1	Basic terms on electromagnetic radiation including radiation and reflection are introduced, and calculation of surface reflectance and temperature is explained. In addition, principles and applications of visible and infrared sensors are introduced.
(Exercise) Vegetation coverage ratio estimation from satellite images	1	Vegetation index is calculated from an optical satellite image, and vegetation coverage ratio is estimated.
Introduction to GIS	1	Structure of GIS (Geographic Information System) and its utilization for spatial analysis are outlined.
GIS and Network Analysis	1	Basic idea of network structure, evaluation indices and methods of network analysis are explained.
GIS and Spatial Correlation Analysis	1	Focusing on spatial correlation analysis useful for developing spatial model, regression analysis and spatial auto correlation analysis are explained.
Classification Method of Spatial Attribute	1	Classification method of spatial attribute is explained in order to classify the target area using attribute information in GIS.
Transportation Big Data Collected by Mobile Objects Observation and Its Utilization	1	The changes in transportation observation led by progress of location identification technologies is stated. In addition, utilizations and issues of big data in transportation are explained.
Realization of Smart City and Big Data Utilization	1	The concept of Smart City and corresponding projects are introduced, and utilization and issues of big data for smart city are explained.
Analyses of Big Data	1	Analysis methods to utilize information of big data are explained. Especially, multivariate analysis and machine learning are outlined.
Assessment of understanding	1	Assess students' understanding levels

【Textbook】

【Textbook(supplemental)】 - Junichi Susaki and Michinori Hatayama, Geoinformatics, Corona Publisher, 2013

- W. G. Rees , Physical Principles of Remote Sensing 3rd ed., Cambridge University Press, 2013.

- J. A. Richards and X. Jia , Remote Sensing Digital Image Analysis: An Introduction, 5th ed., Springer-Verlag, 2013.

-M. Netler and H. Mitasova, Open Source GIS: A GRASS GIS Approach 3rd ed., The International Series in Engineering and Computer Science, 2008.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】 <http://www.gi.ce.t.kyoto-u.ac.jp/user/susaki/rsgis/index.html>

【Additional Information】 Students may be required to use their own laptop computer for exercise. Two exercises offered in the 1st and 2nd hour in a row are planned in April.

Civic and Landscape Design

景観デザイン論

【Code】 10A808 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Tue 3rd

【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture and practice

【Language】 Japanese 【Instructor】 Masashi Kawasaki, Keita Yamaguchi, Keiichiro Okabe

【Course Description】 Lecture for Landscape Design, Design of Urban infrastructure, and Landscape Architecture Practice

【Grading】 Reports (Kawasaki: 50%) and design practice (Okabe: 50%)

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Guidance. Landscape and image	1	Guidance, Lecture on landscape and image.
Architectural Design of city and urban facilities	3	Lecture on planning and designing about landscape design of urban facilities such as roads and plazas, parks, waterfront and waterfront and public space.
Landscape Design and Management	4	The history of landscape policy, the method of evaluating landscape, the case and method of landscape planning, examples and methods of urban design both in Japan and abroad
Landscape Architecture Practice	6	Designed for streets, parks
Feedback	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Risk Management Theory

リスクマネジメント論

【Code】 10F223 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Wed 3rd

【Location】 C1-173 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture and exercise 【Language】 English

【Instructor】 Muneta Yokomatsu, Cruz Ana Maria

【Course Description】 The aim of the class is to provide the basic knowledge of risk management methods for various types of risks such as natural disaster, environment and natural resources in urban and rural areas. Students will learn the decision making principle under risks in Economics and asset pricing methods in Financial Engineering as well as have exercises of application on public project problems.

【Grading】 20% of score is valued on attendance and discussion in classes, and 80% on reports.

【Course Goals】 It is targeted to understand 1) representative concepts of risk and risk management process, 2) expected utility theory and 3) foundation of Financial Engineering, and examine 4) public project problems by applying the above knowledge.

【Course Topics】

Theme	Class number of times	Description
Basic framework of risk management	2	1-1 Representative concept of risk 1-2 Risk management technologies
Decision making theory under risks	3	2-1 The Bayes' theorem 2-2 The Expected utility theory
Financial engineering	6	3-1 The Capital Asset Pricing Model 3-2 Option pricing theory 3-3 The arbitrage theorem 3-4 The Black-Scholes formula
Decision making methods for projects	3	4-1 The decision tree analysis 4-2 The real option approach
Comprehension check	1	5 Comprehension check

【Textbook】

【Textbook(supplemental)】 1.Ross, S.M.: An Elementary Introduction To Mathematical Finance, Cambridge University Press, 1999

2.Sullivan W.G.: Engineering Economy, Pearson, 2012

【Prerequisite(s)】 Fundamental understanding of probability

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Disaster Risk Management

災害リスク管理論

【Code】 10X333 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Wed 4th

【Location】 Research Bldg.5Main Lecture Rm 2F, Katsura C1-171 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture

【Language】 English 【Instructor】 TATANO Hirokazu, YOKOMATSU Muneta,, SAMADDAR SUBHAJYOTI

【Course Description】 Natural disasters have low frequencies but high impacts. It is very important to make an integrated risk management plan that consists of various countermeasures such as prevention, mitigation, transfer, and preparedness. This class will present economic approaches to natural disaster risk management and designing appropriate countermeasures.

【Grading】 Evaluate mainly by the presentations in the class as well as end-of-term report, taking active and constructive participation in the class into account.

【Course Goals】 Students are expected to understand fundamental ways of economic analyses of disaster prevention such as economic valuation of disaster losses, decision making principle under risks, derivation of benefits of risk management.

【Course Topics】

Theme	Class number of times	Description
Introduction to disaster risk management	1	Introduction and Explanation of Course Outline, The Global Trends of Natural Disasters
1. Decision making theory under uncertainty	1	Bayes' theorem, Expected utility function
Methods of disaster risk management	1	Risk control and risk finance
Economic valuation of catastrophic risk mitigation	1	Cost-Benefit analysis, conventional valuation method, catastrophic risks and economic valuation of disaster mitigation
Risk perception bias, land-use and risk communication	2	Risk perception bias, land-use model, risk communication
Disaster risk finance	2	Recent issues of risk finance market, reinsurance, CAT bond, roles of government, derivatives
Risk curve and risk assessment	1	Fragility curve and risk assessment
General equilibrium analysis under disaster risk	1	General equilibrium model under disaster risk
Macrodynamics under disaster risk	1	GDP, economic growth
Disaster accounting	1	Accounting systems
Exercise and presentation	2	Students' exercise and presentation
Confirmation of the learning achievement degree	1	Confirmation of the learning achievement degree

【Textbook】 Tatano,H., Takagi,A.(ed.):Economic Analysis of disaster prevention, Keiso pub.,2005 (in Japanese).

【Textbook(supplemental)】 Froot ,K.A.(ed) “ The Financing of Catastrophic Risk ” , the University of Chicago Press Kunreuther H. and Rose, A., “ The Economics of Natural Hazards ” , Vol.1 & 2, The International Library of Critical Writings in Economics 178, Edward Elgar publishers, 2004

Okuyama, Y., and Chang, S.T.,(eds.) “ Modeling Spatial and Economic Impacts of Disasters ” (Advances in Spatial Science), Springer, 2004.

【Prerequisite(s)】 Nothing

【Independent Study Outside of Class】

【Web Sites】 No web site

【Additional Information】

Disaster Information

防災情報特論

【Code】 10X714 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Wed 3rd 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Hirokazu Tatano(DPRI), Katsuya Yamori(DPRI), Michinori Hatayama(DPRI), Onishi.Masamitsu(DPRI),

【Course Description】 This lecture gives an outline of disaster prevention and reduction countermeasures both inside and outside Japan with special reference to disaster information related topics. Concrete examples of disaster information systems are introduced to show that psychological aspect of information users under critical social conditions is carefully taken into account in such current disaster information systems.

【Grading】 Submit every class reports and end-of-term report Every class reports:

“ Point out 3 discoveries for you and 1 request which you want to know more with reasons in this class.

Submit report via Email by the following rules

1. Address: disaster,nfo@imdr.dpri.kyoto-u.ac.jp
2. subject: “ Disaster Information Report [Date] Student ID, Name ”
3. Don ' t use attached file.
4. Dead line: Next Tuesday

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
What is disaster prevention?	1	
Information system in emergency	2	
Information system in emergency	1	
Case examples on introduction of disaster information system	1	
Information system for evacuation planning,	1	
Information system for rescue activity	1	
Social psychological study of disaster information	2	
Disaster information and evacuation behavior	2	
Gaming approach to disaster risk communication	3	
Test	1	

【Textbook】 Nothing

【Textbook(supplemental)】 Only Japanese Books

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Office Hours: After Class, Make an appointment immediately after.

Questions via Email: disaster,nfo@imdr.dpri.kyoto-u.ac.jp

Theory & Practice of Environmental Design Research

環境デザイン論

【Code】10A845 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Mon 2nd

【Location】 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	6	
	5	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Resources Development Systems

資源開発システム工学

【Code】 10A402 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 1st
 【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese
 【Instructor】 Sumihiko Murata, Assoc. Prof., Dept. of Urban Management

【Course Description】 Development of mineral resources and energy resources is essential to the sustainable development of our society. In this class, the exploration and development process of natural resources are reviewed including the environmental conservation and harmony. In addition, fundamentals of reservoir engineering for the evaluation of production behavior and reserves of oil and natural gas are lectured.

【Grading】 Evaluation is made by the average score of report problems. They are presented 2 or 3 times in the semester.

【Course Goals】 The goal of this class is to understand the natural resources development concerning environment and master the reservoir engineering needed for the exploration and development of oil and natural gas resources.

【Course Topics】

Theme	Class number of times	Description
From exploration to development of natural resources	1	The exploration and development processes of mineral and energy resources, which are essential to the sustainable development of our society, are reviewed including the environmental conservation and harmony.
Fundamentals of reservoir engineering	3	The properties of reservoir fluids and the material balance method to evaluate the reserve of oil and natural gas are explained.
Fluid flow in the reservoir	7	Basic equations of multi-phase fluid flow in the reservoir and analytical solution for the flow of oil and natural gas around a well are explained. Furthermore, the concept and the method of well test analysis are also explained.
Enhanced oil and natural gas recovery	4	The displacement processes of oil and gas in a reservoir are explained. Furthermore, methods of enhanced oil and gas recovery (EOGR) are overviewed, and the essentials of each EOGR method are explained.

【Textbook】 Handouts are delivered.

【Textbook(supplemental)】 L.P.Dake, Fundamentals of Reservoir Engineering, Developments in petroleum science Vol.8, Elsevir, ISBN 0-444-41830-X

【Prerequisite(s)】 It is desirable to have knowledge of calculus of undergraduate level.

【Independent Study Outside of Class】 Self study is required using supplemental book.

【Web Sites】 Web page of this class is not provided. Information is shown in the class when it is needed.

【Additional Information】 Office hours are set 10:30-12:00 and 14:30-16:00 on the same day of the class.

Applied Mathematics in Civil & Earth Resources Engineering

応用数理解析

【Code】10F053 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 3rd

【Location】C1-192 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	2	
	4	
	5	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Environmental Geosphere Engineering

地殻環境工学

【Code】10A405 【Course Year】Master Course 【Term】1st term 【Class day & Period】Wed 2nd 【Location】C1-171

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】Katsuaki KOIKE,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction of structure and content of this course	1	
Physics of Earth system	2	
Chemistry of Earth system	3	
Fundamentals of Geoinformatics (1): Spatical modeling techniques	2	
Fundamentals of Geoinformatics (2): Scaling of geological structure	1	
Fundamentals of Geoinformatics (3): Remote sensing	2	
Fundamentals of Geoinformatics (4): Earth survey and geochemical exploration	1	
Geosphere environments (1): Weathering process and geohazards	2	
Geosphere environments (2): CCS and HLW	1	
Mineral and energy resources	1.5	

【Textbook】Handouts will be distributed at each class.

【Textbook(supplemental)】References will be introduced in the handouts.

【Prerequisite(s)】Fundamental knowledges on geology, physics, and chemistry are required.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Applied Elasticity for Rock Mechanics

応用弾性学

【Code】10F071 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Fri 3rd
 【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
 【Instructor】Sumihiko Murata, Assoc. Prof., Dept. of Urban Management

【Course Description】Theory of elasticity relating to the deformation and failure of rock and rock mass and design of rock structures is explained. Specifically, two-dimensional analysis of elasticity using the basic equations, constitutive equations, and the complex stress function are explained. In addition, poroelasticity is explained. Several applications of this analysis to rock mechanics, rock engineering, and fracture mechanics are also explained.

【Grading】Evaluation is made by the score of two report problems or homeworks (25% each) and semester final examination (50%).

【Course Goals】The goal of this class is to master the theory of elasticity so as to solve the elastic problem in rock mechanics, rock engineering, and fracture mechanics.

【Course Topics】

Theme	Class number of times	Description
Airy ' s stress function and complex stress function	2	Airy ' s stress function used to solve a two-dimensional elastic problem is first explained, and then the complex stress functions that are the representation of Airy ' s stress function by the complex variables are explained.
Two-dimensional elastic analysis using the complex stress function	8	Analytical solutions of two-dimensional elastic problems in fracture mechanics and rock engineering are derived by using the complex stress functions. The mechanical behavior of rock material is also explained based on the derived solutions.
Application of two-dimensional elastic analysis	2	The theory of rock support, ground characteristic curve, theoretical equations used for the evaluation of rock stress, which are derived from the solution of two-dimensional elastic problem, are explained.
Poroelasticity	2	Basic equations and parameters of poroelasticity are explained. Futhrermore, the applications of poroelasticity are explained.
Summary and Achievement check	1	The contents of this class are summarized. In addition, the achievement of course goals is checked.

【Textbook】Handouts are delivered.

【Textbook(supplemental)】J.C. Jaeger, N.G.W. Cook, and R.W. Zimmerman: Fundamentals of Rock Mechanics -4th ed., Blackwell Publishing, 2007, ISBN-13: 978-0-632-05759-7

【Prerequisite(s)】The knowledge and calculation skill of calculus, vector analysis and complex analysis are required.

【Independent Study Outside of Class】Review of the each class is required.

【Web Sites】Web page of this lecture is not provided. When preparing it by need, the information is shown in the class.

【Additional Information】Office hour is set 10:30-12:00 and 14:30-1600 on the same day of the class.

Fundamental Theories in Geophysical Exploration

物理探査の基礎数理

【Code】10F073 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 3rd
 【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
 【Instructor】Hitosih Mikada, Junichi Takekawa

【Course Description】We are outlining various basic mathematical principles used for the analysis of the dynamic and kinematic earth-scientific problems in conjunction with wave propagation, mass transfer, etc. in the crust, and presenting examples of such analysis techniques in the area of earth sciences and earth resources engineering.

【Grading】Rating is performed by the combination of exams (40%) and the attendance to the class (60%).

【Course Goals】The aims of the class is to understand various signal-processing theories, the applied seismology, and the applied geo-electromagnetics with respect to exploration geophysics as application tools in seismology and in geo-electromagnetics.

【Course Topics】

Theme	Class number of times	Description
Introduction to exploration geophysics	1	General introduction to the lecture.
Seismic wave propagation and signal processing	8	Acquire knowledge on the propagation phenomena of elastic waves to learn the equivalency of 1D propagation with the theory of system function. The topics included would be, z-transform, Levinson recursion, Hilbert transform, etc.
Fundamentals of geo-electromagnetics and their application to exploration geophysics	5	Learn fundamental theories of magnetotellurics, instantaneous potential, spontaneous potential, and apparent resistivity methods, etc. that deal with geo-electromagnetic phenomena. Case studies are introduced to understand the advantages of geo-electromagnetic exploration schemes.
Wave propagation problem in seismic exploration	1	Discussing fundamental theories of elastic wave propagation, used in subsurface structural surveys, in terms of the actual utilization and the theories of wave phenomena.

【Textbook】

【Textbook(supplemental)】Claerbout, J.F. (1976): Fundamentals of Geophysical Data Processing (Available online URL: <http://sep.stanford.edu/oldreports/fgdp2/>)

【Prerequisite(s)】Students should understand exploration geophysics of undergraduate level.

【Independent Study Outside of Class】

【Web Sites】Could be specified by the lecturers if any.

【Additional Information】

Underground space and petrophysics

地下空間と地殻物性

【Code】10F076 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Tue 3rd

【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Professor Weiren Lin, Professor Tsuyoshi Ishida, Professor Toshihiro Sakaki, Part-time Lecture
Tatsuya Yokoyama

【Course Description】In this course, we will give lectures on the physical properties and mechanical properties of rocks under large depths, in-situ stress, stability of underground spaces such as radioactive waste disposal and traffic tunnels.

【Grading】

【Course Goals】Understand the representative physical properties of rocks under high temperature and high pressure, measurement methods of in-situ stress and their applications in radioactive waste disposal and traffic tunnels.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	Introduce the contents of the course.
Physical properties and strength of rocks	4	Physical properties (elastic wave velocity, resistivity, fluid flow and thermal properties) and mechanical properties (strength and deformation).
Rock stress and its measurements	2	Measurement methods of in-situ stress such as relief method, hydraulic method etc.
Underground stability and rock stress problems	2	Stability of large underground spaces (e.g., South Africa gold mines) and their relations with in-situ stress.
Radioactive waste repository	3	Concept and designs of radioactive waste repository for a long time scale
Tunnel	2	Survey, designs, construction and maintenance of traffic tunnels
Feedback	1	

【Textbook】No set text

【Textbook(supplemental)】Instructed in class

【Prerequisite(s)】Taking Underground Development Engineering and Rock Engineering (when undergraduate) are desirable.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Lecture on Exploration Geophysics

探査工学特論

【Code】 10A420 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Wed 4th

【Location】 C1-117 【Credits】 2

【Restriction】 The class of Fundamental theories of geophysical exploration is recommended to acquire.

【Lecture Form(s)】 Lecture 【Language】 English 【Instructor】 Hitosih Mikada, Junichi Takekawa

【Course Description】 Applied geophysical exploration technologies in disaster mitigation, civil engineering, and earth resources engineering is discussed in terms of seismological and of electromagnetic theories. Students may be asked to process data or design digital filters in the course.

【Grading】 Brief explanations on the grading will be given at the time of the lecture.

【Course Goals】 Understanding seismological and electromagnetic theories used in geophysical exploration and subsurface-imaging technologies.

【Course Topics】

Theme	Class number of times	Description
Electromagnetic signal processing	3	Principles of magnetotelluric methods, electromagnetic sources and noise reduction.
Modeling technologies in electromagnetic methods	3	Subsurface structure modeling in EM methods. The effects of surface weathered layers, the identification of spatial dimensions, and modeling methodologies are discussed.
Signal processing in seismics	4	Digital filtering in seismic data processing.
Reflection seismology	3	Fundamental theories of reflection seismic data processing. Seismic migration is the one to be briefly discussed.
Petrophysics	2	Fundamental petrophysics, and fundamental measurement theories in geophysical logging are discussed.

【Textbook】 Specified in the course.

【Textbook(supplemental)】 J.F.Claerbout, 1976, Fundamentals of Geophysical Data Processing, (OOP:photocopies to be specified)

【Prerequisite(s)】 The credits of Exploration Geophysics in undergraduate course and Fundamental Theories of Geophysical Exploration in graduate course are requested to obtain before the classes.

【Independent Study Outside of Class】

【Web Sites】 Would be specified by the lecturers.

【Additional Information】

Measurement in the earth's crust environment

地殻環境計測

【Code】10F085 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 3rd 【Location】C1-192

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English

【Instructor】Tsuyoshi ISHIDA, Yoshitaka NARA, Koji YAMAMOTO, Kiyoshi AMEMIYA

【Course Description】Information necessary to understand environment in the upper layer of the earth's crust will be explained for various engineering projects. Among them, measurements of rock stress and mechanical properties of rock will be focused in the relation to the projects of oil and gas exploitation, underground disposal of radio active waste, geological sequestration of CO₂, construction of underground power houses and hot dry rock geothermal power extraction.

【Grading】Grading will be made from scores of the followings; report for subjects, achievement tests and number of attendance to the classes.

【Course Goals】Goals of this course are the followings. 1) To understand effects of initial rock stress on stability of underground chambers for various purposes. 2) To understand a stress relief method as one of typical rock stress measurement. 3) To understand the principle of a least square method though learning a procedure to determine initial rock stress condition from released strains measured on a borehole wall. 4) To understand effects of rock stress for oil and gas exploitation through borehole breakout problems and others. 5) To understand purposes and latest technologies for long term monitoring up to 100,000 years. 6) To understand mechanical properties of rock (strength, permeability, fracturing, etc.) under different environmental condition with methodology of their measurements.

【Course Topics】

Theme	Class number of times	Description
Importance of rock stress condition in underground development (by ISHIDA)	3	Necessity of rock stress measurements and their applications for various engineering projects will be explained. Among the projects, underground disposal of radio active waste, geological sequestration of CO ₂ , construction of underground power houses and hot dry rock geothermal power extraction will be focused.
Stress relief methods to measure rock stress and application of least square method (by ISHIDA)	3	Actual field works of stress relief methods to measure initial rock stress condition will be explained. Though learning a procedure to determine an initial rock stress condition from released strains measured on a borehole wall, the principle of a least square method will be explained. The report subject will be shown in the last week.
Effect of rock stress on oil and gas exploitation	4	Estimation of rock stress condition by hydraulic fracturing and logging, which is conducted at various steps for oil and gas exploitation, will be explained. Importance of rock stress affecting on borehole stability will be explained as well.
Monitoring in Deep Underground Facility - to ensure the long term stability-	2	The purposes and latest technologies of monitoring are shown in this lecture, focusing on the methods of ensuring the long term (up to 100,000 years) safety assessment of radioactive waste disposal.
Measurement of mechanical properties of rock under various environment	2	Mechanical properties of rock (strength, permeability, fracturing, etc.) under different environmental condition are shown, as well as the methodology of measurements. In addition, the relationship between the rock properties and radioactive waste disposal is described.
Confirmation of understanding	1	Feedback through tests and others.

【Textbook】None. Handouts will be given in classes when needed.

【Textbook(supplemental)】1) Amadei, B. & Stephansson, O.: Rock Stress and Its Measurements, Capman & Hall, 1977.

2) Vutukuri, V. S. & Katsuyama, K.: Introduction to Rock Mechanics, Industrial Publishing & Consulting, Inc., Tokyo, 1994.

【Prerequisite(s)】Elasticity, Linear Algebra (Calculation of Matrices) and Computer Literacy (for example, Excel, Word and so on.)

【Independent Study Outside of Class】When you make a report, it is necessary to calculate matrixes by using a Microsoft Excel and others.

【Web Sites】

【Additional Information】This class is made by English.

Earth Resources Engineering

地球資源学

【Code】10F088 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 2nd 【Location】C1-171

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English 【Instructor】Katsuaki Koike

【Course Description】Securance and development harmonious with natural environments of the mineral and fossil energy resources, and utilization of storage function of geologic strata have become important issues for constructing sustainable society. This subject introduces comprehensively the present situation of uses of mineral and energy resources, crust structure and dynamics, economic geology for the genesis and geologic environments of deposits, physical and chemical exploration methods of marine deposits, mathematical geology for reserve assessment, engineering geology for resource development and geological repository, and problems and promise of natural energy such as geothermal, solar, wind, and tide.

【Grading】Integrated evaluation of report grades and attendance to the classes. The attendance includes answer to short quiz to make sure the understanding, etc. Weight of these two items is about 9:1.

【Course Goals】To find out directionality about the technologies required for constructing sustainable society by yourself with full understandings of genetic mechanism, biased distribution, and the present situation of demand and supply of the mineral and energy resources.

【Course Topics】

Theme	Class number of times	Description
Introduction of this course and resources	1	Definition of renewable and non-renewable resources. Interaction among Earth environment, human society, and natural resources. Existence pattern of natural resources in the crust.
1. Internal structure of Earth and geodynamics	2	Inner structure of the Earth, geodynamics, geologic composition, temperature structure, rock physics, and chemical composition of crust.
2. Present and future of energy resources	1	Classification of energy sources, recent trend on social demand of energy, physical characteristics of each energy resources, and sustainability.
3. Present and future of mineral resources	1	Classification of minerals used for resources, recent trend on social demand of mineral resources, industrial uses of each mineral, and sustainability.
4. Economic geology (1)	1	Classification of ore deposits, distribution of each type of ore deposit, generation mechanism of deposit.
4. Economic geology (2)	1	General structure and distribution of fuel deposits (coal, petroleum, and natural gas), generation mechanism of deposits, and geological process of formation.
5. Resource exploration (1): Terrestrial area	1	Physical and chemical exploration technologies for natural resources in terrestrial area. Representative methods are remote sensing, electric sounding, electromagnetic survey, and seismic prospecting.
6. Resource exploration (2): Sea area	1	Introduction of marine natural resources such as methane hydrate, cobalt-rich crust, and manganese nodule, and exploration technologies for the deposits in sea area.
7. Assessment of ore reserves and deposit characterization	2	Fundamentals of geostatistics, variography for spatial correlation structure, spatial modeling by kriging, geostatistical simulation, integration of hard and soft data, and feasibility study.
8. Resource development	1	Development and management technologies of energy resources related to coal, petroleum, and natural gas.
9. Engineering geology	1	Fundamentals of deep geological repository for high-level nuclear waste, CCS (carbon dioxide capture and storage), and underground storage of petroleum and gas.
10. Sustainability	1	Characteristics of natural energy related to geothermal, solar, wind, and tide, and assessment of natural energy resources. Co-existence of natural resource development with environment, low-carbon society, and problems for human sustainability.
Feedback	1	Based on evaluation of the reports, contents that are not well understood will be explained additionally using KLUSIS or by personal interview.

【Textbook】Printed materials on the class contents are distributed at each class.

【Textbook(supplemental)】References on each topic will be instructed in the classes.

【Prerequisite(s)】Elementary knowledge of engineering, mathematics, physics, and geology are required.

【Independent Study Outside of Class】Deepen the understanding by solving assignments.

【Web Sites】

【Additional Information】This course is opened every two years, and not opened in 2018.

Urban Infrastructure Management

都市基盤マネジメント論

【Code】 10X311 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 3rd

【Location】 C1-173 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 OHTSU Hiroyasu,

【Course Description】 This lecture aims to provide interdisciplinary knowledge associated with how urban infrastructure is comprehensively management, from viewpoints of not only economy but also “ human security engineering ” . In detail, the contents of lectures consist of following topics: Urban Infrastructure Asset Management, Urban Disaster Risk Mitigation Management, Urban Transport/Logistics Management and Urban Food/Water Supply Management.

【Grading】 Attendance(20), Report(80)

【Course Goals】 Aquisition of interdisciplinary knowledge associated with how urban infrastructure is comprehensively management, from viewpoint of not only economy but also human security engineering.

【Course Topics】

Theme	Class number of times	Description
Guidance, Introduction of Urban Infrastructure Asset Management	1	Guidance & Introduction to Urban Infrastructure Asset Management
Urban Infrastructure Asset Management	4	Urban Infrastructure Asset Management on Geotechnical structures and Bridge
Urban Disaster Risk Mitigation Management	3	Urban Disaster Risk Mitigation Management
Urban Food/Water Supply Management	3	Urban Food/Water Supply Management
Urban Transport/Logistics Management	2	Urban Transport/Logistics Management
Report	1	Report
Feed back	1	Feed back

【Textbook】

【Textbook(supplemental)】 Hand-out

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Additional information is available by visiting the following professors. Appointment shall be made in advance by e-mail.

ohtsu.hiroyasu.6n@kyoto-u.ac.jp

Global Survivability Studies

グローバル生存学

【Code】10F113 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Thu 5th

【Location】Yoshida, Higashi Ichijokan, Shishukan Hall 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】English 【Instructor】Kaoru Takara, Junji Kiyono, Satoshi Fujii, Takahiro Sayama, Mika Shimizu

【Course Description】Modern global society is facing risks or social unrests that are caused by huge natural hazards and disasters, man-made disasters and accidents, regional environmental change/degradation including infectious diseases, and food security. Introducing such examples at global and regional scales, this subject lectures how to cope with them at national, local and community levels for making the society sustainable/survivable. Future countermeasures are also discussed under the uncertain circumstances such as climate change, population growth, energy and socio-economic issues.

【Grading】Attendance to lectures (40%) and Presentation and discussion (60 %).

【Course Goals】The objectives of this class are to have basic knowledge about global issues threatening safety and security of the earth society such as catastrophic natural disasters, man-made disasters and accidents, regional environmental change (including infectious diseases) and food security, and to enhance student's ability to express his/her own ideas and discuss with professors and students from other study areas.

【Course Topics】

Theme	Class number of times	Description
Introduction of Global Survivability Studies	1	Introduction of Global Survivability Studies.
Earthquake disaster mitigation	1	Discuss on earthquake disaster mitigation focusing on lessons learnt from Tohoku EQ.
Mitigation of earthquake damage to historic structures	1	Discuss on the mitigation of earthquake damage to historic structures.
Why we need GSS?	1	Discuss on why we need Global Survivability Studies (GSS).
Global agendas for sustainable development and resilient societies	1	Discuss on global agendas for sustainable development and resilient societies.
Building national resilience in Japan	1	Discuss on building national resilience based on Japanese experiences.
Globalism as totalitarianism	1	Discuss on globalism as totalitarianism.
Public policy and systems approach for global changes in disaster risks	1	Lecture and group work on public policy and systems approach for global changes in disaster risks.
Disaster risk management and governance for global changes	1	Lecture and group work on disaster risk management and governance for global changes.
Water-related disaster risk management	1	Discuss on water-related disaster risk management: concept and recent experiences.
Water cycle and climate change	1	Discuss on water cycle and climate change.
Presentation by students & discussions	4	Presentation by students related to this lectures and discussions on the presented topics.

【Textbook】Nothing special.

【Textbook(supplemental)】Nothing special.

【Prerequisite(s)】Nothing special.

【Independent Study Outside of Class】If handouts (teaching materials) are distributed (or downloaded from the website), students should read them prior to the class. They may be distributed at the classroom (or put on the website). Students can make use of them after the class for reviewing lectures and preparing presentation materials and discussion sessions which will be organized in the latter half of the semester.

【Web Sites】

【Additional Information】This subject is compulsory for students enrolled in the Inter-Graduate School Program for Sustainable Development and Survivable Societies. Students other than ones in Graduate School of Engineering should submit a registration card for taking this class.

Emergency Management Systems

危機管理特論

【Code】10X715 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Mon 3rd

【Location】Faculty of Engineering Integrated Research Bldg. 213 【Credits】2 【Restriction】No Restriction

【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】Haruo HAYASHI,Norio MAKI,Shingo SUZUKI,

【Course Description】Damage from disasters is defined by two factors: scale of hazard and social vulnerability. Two strategies exist to reduce damage from disasters?namely, crisis management as a post-event countermeasure and risk management as a pre-event measure. This course introduces students to a system for effective emergency management, consisting of response, recovery, mitigation, and preparedness.

【Grading】Every after lecture, please submit short report writing following things 1) Three points you could learn in this lecture, and reason 2) What you would like to explain more? Please send your short report to following address by following formats 1.address: disaster.reporti2@drs.dpri.kyoto-u.ac.jp 2.subject: 「Emergency Management Report “ date ”“ ID ” “ Name ” 3.No attach file

【Course Goals】Learning about Techniques for Business Continuity Management consisted of Risk Assessment, Strategic Planning, Emergency Response, and Training.

【Course Topics】

Theme	Class number of times	Description
Business Continuity Management	3	What is emergency response, and business continuity management.
Risk Assessment	3	Techniques for Risk Identification, and Risk Assessment
Strategic Planning	3	Techniques for Strategic Planning and Evaluation
Emergency Response	3	Incident Command System, and Design of Emergency Operation Center
Training	3	Learning, drill, Exercises for Emergency Response

【Textbook】Haruo Hayashi et.al., Soshiki no Kikikanri Nyuumon, Maruzen, 2008// Kyodai, NTT Resilience Kennkyuu Group, Shinayakana Syakai no Souzou, Nikkei BP, 2009

【Textbook(supplemental)】Tom Demarco et.al, Waltzing With Bears: Managing Risk on Software Projects, Dorset House, 2003// Project Management Institute : A Guide to the Project Management Body of Knowledge 2000 Edition , Project Management Institute, Inc , 2000// R. Max Wideman : Risk Management - A guide to Managing Project Risk & Opportunities - , Project Management Institute, Inc , 2000// Memorial Conference in Kobe, 12 sai karano hisaisya gaku, NHK Press, 2005//

【Prerequisite(s)】

【Independent Study Outside of Class】Submit a short report about what they have learned in a lecture before next lecture.

【Web Sites】

【Additional Information】

Information Technology for Urban Society

都市社会情報論

【Code】 10F201 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Thu 1st

【Location】 C1-192 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese (English in case of foreign teachers) 【Instructor】 Related teachers,

【Course Description】 The advancement of urban society by the use of information has been realized through the remarkable development of informational communication technology. This seminar has the discussions about the worth and affect in the urban society using engineering and economic estimation method, and lectures about the way of maintenance, operation and management of urban systems in the advanced informational and knowledge-intensive society.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Details will be provided in the first lecture.

Urban Transport Policy

都市交通政策フロンランナー講座

【Code】 10Z001 【Course Year】 Master and Doctor Course 【Term】 1st term

【Class day & Period】 see the handbook for course registration

【Location】 conference room, TPU karasuma office (see the handbook for course registration) 【Credits】 1

【Restriction】see the handbook for course registration 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】 Ryoji Matsunaka, Tetsuharu Oba

【Course Description】 This class will provide lectures on the new transport policy carried out in domestic and foreign cities and to understand the difference between the conventional transport policy and the new urban transport policy. Also, it will cover a process to realize the new urban transport policy.

【Grading】 evaluation by attendance and class participation

【Course Goals】 to understand the difference between the conventional transport policy and the new urban transport policy

【Course Topics】

Theme	Class number of times	Description
Outline	1	
Front runner of urban transport policy in the world	2	Reallocation of road space, Pedestrianisation
Front runner of urban transport policy in Japan	1	Downtown activation, Strategies of sustainable transport for our cities, Climate change
Front runner of urban transport policy in Kyoto	2	Eco model city, Transport demand management, Public transport network
Discussion	2	

【Textbook】 No textbook

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】 <http://www.upl.kyoto-u.ac.jp/index.html>

【Additional Information】

Policy for Low-Carbon Society

低炭素都市圏政策論

【Code】 10Z002 【Course Year】 Master and Doctor Course 【Term】 1st term

【Class day & Period】 see the handbook for course registration

【Location】 conference room, TPU karasuma office (see the handbook for course registration) 【Credits】 1

【Restriction】see the handbook for course registration 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】 Ryoji Matsunaka, Masashi Kawasaki

【Course Description】 This class will provide lectures on the contents of policies and the methods to realize a low carbon society. Also, it will cover the knowledge and the technical skill to relate to urban activation, reduction of the environmental load, compact city planning, and so on.

【Grading】 evaluation by attendance and class participation

【Course Goals】 to understand the knowledge and the technical skill to relate to urban activation, reduction of the environmental load, compact city planning, and so on.

【Course Topics】

Theme	Class number of times	Description
Measures against global warming	1	Plan for measures against global warming, Eco model city
Urban policy management for low-carbon society	1	Eco model city, Guideline for low-carbon city construction
Landscape & environmental planning	1	Landscape design in public space, View structure
Urban policy for low-carbon society and change of urban structure	1	Public transport, Pedestrianisation
Roles and issues of urban transport policy	1	Transport and urban policy, Transport policy in EU, Railways, Light Rial Transit
Discussion	3	

【Textbook】 No textbook

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】 <http://www.upl.kyoto-u.ac.jp/index.html>

【Additional Information】

Urban Transport Management

都市交通政策マネジメント

【Code】 10Z003 【Course Year】 Master and Doctor Course 【Term】 1st term

【Class day & Period】 see the handbook for course registration

【Location】 conference room, TPU karasuma office (see the handbook for course registration) 【Credits】 1

【Restriction】see the handbook for course registration 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】 Ryoji Matsunaka, Satoshi Fujii, Nobuhiro Uno

【Course Description】 This class will provide lectures on characteristics and problems of transport modes such as car, public transport, and foot. Also, it will cover the technical skill to analyze present urban traffic problems quantitatively.

【Grading】 evaluation by attendance and class participation

【Course Goals】 to understand characteristics and problems of transport modes such as car, public transport, and foot.

【Course Topics】

Theme	Class number of times	Description
Plan and practice of public transport	2	City activation and attractiveness, Public transport, Light rail transit, Bus
Basic concept of mobility management	1	Mobility management, Activation of the public transport, Downtown activation
Investigation, interpretation, and evaluation on urban traffic phenomenon	2	Person trip survey, Transportation demand management, Cost-benefit analysis
Exercise and discussion	3	

【Textbook】 No textbook

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】 <http://www.upl.kyoto-u.ac.jp/index.html>

【Additional Information】

Engineering Seminar for Disaster Resilience in ASEAN countries

強靱な国づくりのためのエンジニアリングセミナー

【Code】10F380 【Course Year】Master 1st 【Term】Late August 【Class day & Period】Late August

【Location】School of Engineering, Kasetsart University, Bangkok, Thailand 【Credits】2

【Restriction】Due to the capacity, students attending “ Study Area of Approaches for Disaster Resilience ” have priority.

【Lecture Form(s)】Intensive Lecture 【Language】English

【Instructor】Prof. Hiroyasu Ohtsu, Related lecturers in ASEAN collaborative universities,

【Course Description】The purpose of this course is to provide practical lessons in ASEAN countries associated with disaster risk mitigation such as early warning and evacuation program, and disaster recovery/restoration from viewpoints of problems-finding/problem-solving through short term intensive lecture and field work. By taking the applied practical programs of shared major classes under the instructions of teachers in charge, the students can improve the ability of resolving issues on practical projects. Topics taught in this seminar are earthquake, flood, landslide, land subsidence, and geo-risk engineering.

【Grading】40% for course work assignments and reports, 60% for final exam.

【Course Goals】Course aims to foster international leaders who are able to solve and manage problems concerned about natural disaster, disaster mitigation, health and environmental issues, especially about case studies in ASEAN countries.

【Course Topics】

Theme	Class number of times	Description
Introduction:		
Engineering for Disaster Resilience	1	
Earthquake Disaster	2	
Landslide Disaster	2	
Geo-Risk Engineering	2	
Flood Disaster	2	
Land Subsidence	2	
Site Visit	5	
Evaluation of understanding	1	

【Textbook】Lecture notes provided by the instructors.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】Consortium for International Human Resource Development for Disaster-Resilient Countries, Kyoto University <http://www.drc.t.kyoto-u.ac.jp/rsdc/eng/>

【Additional Information】Those who want to take this course have to apply for Study area of Approaches for Disaster Resilience. Refer the website above.

Disaster and Health Risk Management for Liveable City

安寧の都市のための災害及び健康リスクマネジメント

【Code】 10F382 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Intensive course (2 weeks)

【Location】 Meeting room at Research Bldg. No.5 【Credits】 2 【Restriction】 30 students, priority for DRC course students

【Lecture Form(s)】 Relay Lecture 【Language】 English 【Instructor】 Kiyono, Koyama, Kikuchi, Mitani, Fujii, Kawasaki, Ando, Teo,

【Course Description】 Various types of disasters constantly attack to Asian countries, and those countries sometimes are very vulnerable to the natural disasters and health risk. The interdisciplinary approach of engineering and medical science is indispensable to construct disaster-resilient countries. The 2011 Tohoku earthquake was one of the worst disasters in recent Japanese history.

However many lessons to mitigate and manage the disaster are learnt from the event. In order to solve the related issues, the course provides selected topics about natural disaster, disaster-induced human casualty, emergency response, urban search and rescue, emergency medical service, principle of behavior based on neuroscience, urban search and rescue, reconstruction and rehabilitation policy, social impact of disaster, transportation management, logistics during earthquake disaster and so on.

【Grading】 Course work assignments and reports

【Course Goals】 Course aims to foster international leaders who are able to solve and manage problems concerned about natural disaster, disaster mitigation, health and environmental issues, logistics and amenity for constructing liveable city.

【Course Topics】

Theme	Class number of times	Description
Guidance and Group Work	2	
ORT	3	
Earthquake disaster and human casualty	1	
Earthquake protection and emergency responses	1	
Human brain function and behavior	1	
Disaster medicine and epidemiology	1	
Resilient society	1	
Transition of the design for amenity in the river-front	1	
Concern that elderly people in rural area have over health and mobility	1	
Differences in logistics and humanitarian logistics	1	
Unique challenges of humanitarian logistics	1	
Advancement on humanitarian logistics	1	
Achievement evaluation	1	

【Textbook】 Textbook for the course is provided by the instructor on the first day.

【Textbook(supplemental)】 Some literatures would be introduced by professors.

【Prerequisite(s)】 No special knowledge and techniques are necessary.

【Independent Study Outside of Class】

【Web Sites】 Consortium for International Human Resource Development for Disaster-Resilient Countries, Kyoto University

<http://www.drc.t.kyoto-u.ac.jp/>

【Additional Information】 Contact person: Prof.Kiyono <kiyono@quake.kuciv.kyoto-u.ac.jp

エネルギービジネス展開論

【Code】 10X752 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Tue 5th

【Location】 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	9	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Project Management in Engineering

エンジニアリングプロジェクトマネジメント

【Code】 10i049 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 4th 【Location】 A2-308 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu

Assoc.Prof. Lintuluoto, J. Assoc. Prof. Tanaka

【Course Description】 This course provides a basic knowledge required for the project management in various engineering fields such as process design, plant design, construction, and R&D projects. Also, visiting lecturers from industry and public works provide management insights of actual engineering projects.

【Grading】 Evaluated by assignments (project report exercise) and class contribution

【Course Goals】 This course will help students gain a fundamental knowledge of what project management in engineering is. Throughout the course, students will learn various tools applied in project management. Students will also understand the importance of costs and money, risks, leadership, and environmental assessment in managing engineering projects. This course is followed with the course Seminar on Project Management in Engineering. in the second semester.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	4/13 (Matsumoto) Course guidance
Special lecture by extramural instructor 1	1	4/20 (Inaoka(JICA))@A2-306 Project management in the case of Japanese ODA
Introduction to project management	1	4/27 (Maeda) Introduction to project management Project phases
Tools for project management I	1	5/11 (Lintuluoto) Tools for project management, cost, and cash flows I
Tools for project management II	1	5/18 (Lintuluoto) Tools for project management, cost, and cash flows II
Tools for project management III	1	5/25 (Lintuluoto) Tools for project management, cost, and cash flows III
Project scheduling I	1	6/1 (Ashida) Project scheduling I
Project scheduling II	1	6/8 (Ashida) Project scheduling II
Leadership I	1	6/15 (Tanaka) Leadership I
Leadership II	1	6/22 (Tanaka) Leadership II
Risk management I	1	6/29 (Matsumoto) Risk management I
Risk management II	1	7/6 (Matsumoto) Risk management II
Environmental Impact Assessment	1	7/13 (Yorozu) Environmental Impact Assessment
Special lecture by extramural instructor 2	1	7/20 (Kumagai(JGC CORPORATION)) To be announced
Feedback	1	7/27 (Matsumoto) Feedback

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 1. Lock, Dennis. Project Management. 10th edition. Gower Publishing Ltd.

2. Cleland, David L., and Lewis R. Ireland. Project Management. 5th edition. McGraw-Hill Professional

3. Roger Miller and Donald R. Lessard. The strategic management of large engineering projects, Shaping Institutions, Risks, and Governance, The MIT Press

【Prerequisite(s)】 No pre-requisite

【Independent Study Outside of Class】

【Web Sites】 The web-site is opened in the home page of the GL education center.

【Additional Information】

Exercise on Project Management in Engineering

エンジニアリングプロジェクトマネジメント演習

【Code】 10i059 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day & Period】 Friday 4th period and 5th period 【Location】 B-Cluster 2F Seminar Room 【Credits】 2

【Restriction】 Student number will be limited. 【Lecture Form(s)】 Seminar 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu
Assoc.Prof. Lintuluoto

【Course Description】 In this course, students will apply the engineering know-how and the skills of management, and group leadership which they learned in the course of Project Management in Engineering to build and carry out a virtual inter-engineering project. This course provides a forum where students' team-plan based on ideas and theories, decision making, and leadership should produce realistic engineering project outcomes. The course consists of intensive group work, presentations, and a few intermediate discussions. A written report will be required.

【Grading】 Report, class activity, presentation

【Course Goals】 This course prepares engineering students to work with other engineers within a large international engineering project. In particular this course will focus on leadership and management of projects along with applied engineering skills where the students learn various compromises, co-operation, responsibility, and ethics.

【Course Topics】

Theme	Class number of times	Description
		10/5
Guidance	1	Introduction to Exercise on Project Management in Engineering Lecture on tools for the Project management in engineering Practice
Teamwork	7	Each project team may freely schedule the group works within given time frame. The course instructors are available if any need is required.
Mid-term presentation	1	Each project team will have a mid-term presentation.
Lecture & Teamwork	2	Some lectures will be provided, such as Leadership structuring, Risk Management, and Environmental Impact Assessment, depending on projects you propose.
Presentation	1	Each project team will have a presentation based on its proposed project.

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 Fundamental skills about group leading and communication, scientific presentation.

【Independent Study Outside of Class】

【Web Sites】 The web-site will be opened in the home page of the GL education center.

【Additional Information】 The number of students may be restricted. Students are requested to check in advance whether the credit from this course will be accepted as a graduation requirement for their department.

Information Technology for Urban Society

都市社会情報論

【Code】 10F201 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Thu 1st

【Location】 C1-192 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese (English in case of foreign teachers) 【Instructor】 Related teachers,

【Course Description】 The advancement of urban society by the use of information has been realized through the remarkable development of informational communication technology. This seminar has the discussions about the worth and affect in the urban society using engineering and economic estimation method, and lectures about the way of maintenance, operation and management of urban systems in the advanced informational and knowledge-intensive society.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Details will be provided in the first lecture.

Exercise on Project Planning

自主企画プロジェクト

【Code】 10F251 【Course Year】 Master 1st 【Term】 1st+2nd term

【Class day & Period】 1st term: Thu 3rd, 2nd term: Wed 5th 【Location】 1st term : C1-173 2nd term : C1-192

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Exercise 【Language】 Japanese and English

【Instructor】 Related instructors,

【Course Description】 The purpose of this seminar is to bring out the self-initiative, the planning ability, the creativity of students. From project and to practice, the students set up the goals of projects, go ahead with the projects by themselves, and finally make the presentations of project results. Specifically, about the internship activities in enterprises, the training activities in enterprises or universities at home and abroad, the planning and operation of collaborative projects with citizen, the student makes the perfect plannings including the purposes, the ways, the results and so on. For a final, the students do practice, they write the reports and make the presentations about the project results.

【Grading】 Planning, implementation of project and reports are comprehensively evaluated.

【Course Goals】 Goals are cultivating ability for self-initiative, planning and creativity.

【Course Topics】

Theme	Class number of times	Description
Course introduction	1	
Proposal of project	6	
Management of project	12	
Progress report	1	
Final report	8	
Presentation	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Details are provided in the first lecture.

Capstone Project

キャップストーンプロジェクト

【Code】 10F253 【Course Year】 Master 1st 【Term】 1st+2nd term

【Class day & Period】 1st term: Thu 2nd, 2nd term: Thu 4th 【Location】 1st term: C1-173, 2nd termC1-171

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Exercise 【Language】 Japanese/English

【Instructor】 Related instructors,

【Course Description】 The students plan and implement projects on various problems in the urban society by widely making use of the basic knowledge which you have gotten in Undergraduate or Master Course. Actually, the students simulate the actual problems for which you collect and analyze the data, and then evaluate the practice and effect of projects. At the end, the students write the reports about a series of project results and make the presentations about them.

【Grading】 Evaluation for each student is made comprehensively based on both report and presentation about the project, and usual contribution of student to the project.

【Course Goals】 Goals are to cultivate student ' s ability for planning, creativity and communication.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	
Exercises	4	
	6	
	12	
	6	
Presentation	1	

【Textbook】 N/A

【Textbook(supplemental)】 N/A

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Details will be provided in the first lecture.

Integrated Seminar on Urban Management A

都市社会工学総合セミナー A

【Code】10U201 【Course Year】Doctor 1st year 【Term】1st term 【Class day & Period】Fri 5th

【Location】C1-173 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】English

【Instructor】Related instructors,

【Course Description】The students pick up the various types of influential elements on the development of urban society, and the students make the collection and analysis of datas in detail about these elements by themselves. In addition, on the basis of results of investigation and analysis, the students develop the argument about the ideal style or the future vision of urban society, and the students make the presentation and discussion in English about these results each other.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	10	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Details will be provided in the guidance and first lecture.

Integrated Seminar on Urban Management B

都市社会工学総合セミナー B

【Code】 10U203 【Course Year】 Doctor 1st year 【Term】 2nd term 【Class day & Period】 Tue 5th

【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar 【Language】 English

【Instructor】 Related instructors,

【Course Description】 On the investigation of themes by the students, they make the presentation and discussion in English. The themes are about the urban policy on the world-wide viewpoint, the ideal style of urban management, the standardization of project technology for internationalization, the project management such as the contract, the tender, the management technology to country risk and so on, and about the problems on the structure of urban society for internationalization such as the technology movement or the role of Japan in the world on improving urban infrastructure.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	10	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Details will be provided in the guidance and first lecture.

Seminar on Urban Management A

都市社会工学セミナー A

【Code】 10F257 【Course Year】 Master Course 【Term】 1st+2nd term

【Class day & Period】 1st term: Fri 4&5th, 2nd term: Mon&Tue 5th 【Location】 【Credits】 4

【Restriction】 No Restriction 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 Related instructors,

【Course Description】 This seminar has the lectures about the movement and content of the most advanced research at home and abroad on Urban Management Engineering.. Also, the teachers in this seminar instruct the students individually about the planning of study schedule, the way of collecting datas, doing the research and summarizing the results of research on the concrete and specific themes.

【Grading】 Points are allocated for research activities such as a presentation at laboratory seminars, domestic conferences, international conferences, research paper presentation etc. Students are required to obtain the points in total which are more than predefined points.

Students are required to get no less than 10 points in total for two years from M1 to M2, no less than 3 points in each year.

1 point: Presentation at laboratory seminar (only if supervisor agrees), oral presentation in the annual meeting in the Society of Civil Engineers.

1 ~ 5 point: Attending the lecture held by Academic Society (Certification is required), number of points is determined by your supervisor in accordance to the level of difficulty for approval.

3 point : Presentation in English in international conference. If the papers are peer-reviewed, the points are determined as journal papers (see below).

5 ~ 10 point: First author or coauthor of published and/or accepted journal papers (e.g., for Journal of Society of Civil Engineers, ASCE Journal, etc.) (Number of points is determined by your supervisor depending on level of journal and/or your contribution.)

Others: Exercise on project or training course (Number of points is determined by your supervisor). However, the activities related to the other courses are not admitted, which are Exercise on Project Planning, Capstone Project, Internship on Infrastructure Engineering, Long-Term Internship, Practice in Infrastructure Engineering or Practice in Urban Management.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	6	
	8	
	6	
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Urban Management B

都市社会工学セミナー B

【Code】 10F259 【Course Year】 Master Course 【Term】 1st+2nd term

【Class day & Period】 1st term: Wed&Thu 5th, 2nd term: Thu&Fri 5th 【Location】 【Credits】 4

【Restriction】 No Restriction 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 Related instructors,

【Course Description】 The students make the collection of datas, research and summarize the research results about the concrete and specific themes on Urban Management Engineering.. In addition, the teachers in this seminar instruct the students individually about the way of presentations of research results through the presentations and questions at the conferences at home and abroad, the ones at laboratory and participation in lecture classes.

【Grading】 Points are allocated for research activities such as a presentation at laboratory seminars, domestic conferences, international conferences, research paper presentation etc. Students are required to obtain the points in total which are more than predefined points.

Students are required to get no less than 10 points in total for two years from M1 to M2, no less than 3 points in each year.

1 point: Presentation at laboratory seminar (only if supervisor agrees), oral presentation in the annual meeting in the Society of Civil Engineers.

1 ~ 5 point: Attending the lecture held by Academic Society (Certification is required), number of points is determined by your supervisor in accordance to the level of difficulty for approval.

3 point : Presentation in English in international conference. If the papers are peer-reviewed, the points are determined as journal papers (see below).

5 ~ 10 point: First author or coauthor of published and/or accepted journal papers (e.g., for Journal of Society of Civil Engineers, ASCE Journal, etc.) (Number of points is determined by your supervisor depending on level of journal and/or your contribution.)

Others: Exercise on project or training course (Number of points is determined by your supervisor). However, the activities related to the other courses are not admitted, which are Exercise on Project Planning, Capstone Project, Internship on Infrastructure Engineering, Long-Term Internship, Practice in Infrastructure Engineering or Practice in Urban Management.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	6	
	8	
	6	
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Long-Term Internship

長期インターンシップ

【Code】 10F150 【Course Year】 Master and Doctor Course 【Term】 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 Japanese

【Instructor】 Related instructors,

【Course Description】 Through the long-term internship outside the university, the students can get the practical techniques, the way of finding and solving the problems, the way of integrating the techniques, the way of summarizing the results and making the presentation in each field of Urban Management.

【Grading】 Writing plans, completing internship, final report and presentation are comprehensively evaluated.

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Practice in Urban Management

都市社会工学実習

【Code】 10U210 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 Wed 1st

【Location】 C1-173 【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese

【Instructor】 Related instructors,

【Course Description】 To develop integrated and holistic understandings on Urban Management and cultivate problem-solving abilities, students are encouraged to attend a practical education and engineering program offered by educational institutes such as universities, international and domestic associations. Students attend a program under the instructions of academic supervisors. Programs are limited to the ones certified by the department.

【Grading】 Attendance and reports are comprehensively evaluated.

【Course Goals】 To develop integrated and holistic understandings on Urban Management and cultivate problem-solving abilities by attending a practical education and engineering program offered by educational institutes such as universities, international and domestic associations.

【Course Topics】

Theme	Class number of times	Description
-------	--------------------------	-------------

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

ORT on Urban Management

都市社会工学 O R T

【Code】10U216 【Course Year】Doctor Course 【Term】1st+2nd term

【Class day & Period】1st term: Thu 3rd&4th, 2nd term: Thu 4&5th 【Location】C1-173 【Credits】4 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】Related instructors,

【Course Description】By practicing the research themes on Urban Management and making the presentations of research results at the conferences, the students can develop the advanced specialities, the ability of finding out the new fields of research. Also, the students can get the practical ability which is necessary for researchers and engineers. The students can participate in the conferences at home and abroad, the presentations of research at laboratory, some kinds of seminars and symposiums, lecture classes and internship to the enterprises or research organizations at home and abroad. The director of the department and the supervisor totally evaluate the reports made about these activities by the students.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	6	
	8	
	6	
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Details will be given in the guidance.

Practice in Advanced Urban Management A

都市社会学総合実習 A

【Code】 10U224 【Course Year】 Doctor 1st 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 1 【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	5	
	2	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Practice in Advanced Urban Management B

都市社会工学総合実習 B

【Code】 10U225 【Course Year】 Doctor 1st 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 1 【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	3	
	5	
	2	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Continuum Mechanics

連続体力学

【Code】10F003 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 2nd 【Location】C1-192
 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Kunitomo Sugiura, Tomomi Yagi,

【Course Description】Continuum mechanics is a unified basis for solid mechanics and fluid mechanics. The aims of this course are to introduce the continuum mechanics from their basics to the some forms of constitutive law and also to provide students with mathematical way of understanding the continuum mechanics. This course contains the fundamentals of vector and tensor calculus, the basic equations of continuum mechanics, the tensor expressions of elastic problems and further applications.

【Grading】Assessment will be based on exam, report and participation.

【Course Goals】Fundamental theorems on structural mechanics and design will be learned, and ability to judge the proprieties of each computational structural analysis will be acquired.

【Course Topics】

Theme	Class number of times	Description
Introductions	1	- Outline of Structural Analysis - Mathematical Preliminaries(Vectors and Tensors)
Matrices and tensors	1	- Summation Convention - Eigenvalues and Eigenvectors
differential and integral calculus of tensors	1	- Quotient Laws - Divergence Theorem
Kinematics	1	- Material Description - Spatial Description - Material derivative
Deformation and strain	2	- Strain tensors - Compatibility conditions
Stress and equilibrium equation	1	- Stress Tensors - Equilibrium Equations
Conservation law and governing equation	1	- Conservation of Mass - Conservation of Linear Momentum - Conservation of Energy
Constitutive equation of idealized material	1	- Perfect Fluid - Linear Elastic Material(Isotropic)
Elastic-plastic behavior and constitutive equation of construction materials	1	- Yield Criteria - Flow Rule - Hardening Rule
Boundary value problem	1	- Governing Equations and Unknowns - Navier-Stokes Equation - Navier Equation
Variational principle	1	- Principle of Virtual Work - Principle of Complementary Virtual Work
Various kinds of numerical analyses	2	- Weighted Residual Method - Finite Element Method
Confirmation of the attainment level of learning	1	Feedback based on the Final Examination

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】Basic knowledge for structural mechanics, soil mechanics and fluid mechanics are required.

【Independent Study Outside of Class】As appropriate, the assignments are given based on the content of Lecture.

【Web Sites】

【Additional Information】

Structural Stability

構造安定論

【Code】 10F067 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 2nd
 【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English
 【Instructor】 Kunitomo SUGIURA

【Course Description】 Fundamental concept of static and dynamic stability of large-scale structures such as bridges is to be introduced in addition to the way to keep/improve their safety and to evaluate their performance. Basic concept of structural stability and its application and technical subjects to improve safety will be lectured systematically. Furthermore, the practical solutions to the subjects are to be introduced to assure the safety of structures.

【Grading】 Grading will be evaluated by written examination, reports and attendance.

【Course Goals】 The class aims to cultivate the understanding of static and dynamic stability problems for structural system and make understand the methodology to clarify the limit state. To get knowledge on countermeasures to assure the stability which is applicable to practical design and manufacturing will be also required.

【Course Topics】

Theme	Class number of times	Description
Elastic Stability under Static Loading	7	Stability of Structures and Failures Basis of Structural Stability Elastic Buckling of Columns Elastic Buckling of Beams & Frames Elastic Buckling of Plates Elasto-plastic Buckling Buckling Analysis
Basic theory of dynamic stability and its application	7	The stability around the equilibrium points based on the state equation of motion in which the nonlinearity of external, damping and restrig forces are taken into account. Wind-induced vibration of a square prism (Galopping) and 1dof system with nonlinear spring will be introduced as practical examples. Chaotic motion of a pendulum subjected to periodic external force is also explained as an introduction of chaos theory.
Achievement Check	1	Summary and Achievement Check.

【Textbook】 Not specified.

【Textbook(supplemental)】 Introduced in class if necessary.

【Prerequisite(s)】 It is desired for participants to master structural mechanics, continuum mechanics, mathematical analysis as well as vibration theory.

【Independent Study Outside of Class】

【Web Sites】 none

【Additional Information】 none

Material and Structural System & Management

材料・構造マネジメント論

【Code】 10F068 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Wed 2nd

【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture

【Language】 English 【Instructor】 Hirotaka Kawano, Atsushi Hattori, Takashi Yamamoto,

【Course Description】 With regard to the maintenance of concrete structures, the deterioration prediction procedures in material and structural properties are discussed based on durability and deterioration processes of concrete structures. Repair materials and methods are also introduced. Note: strengthening materials and methods are discussed in Concrete Structural Engineering, provided in the second semester. In the later half of this lecture, structures are focused as groups rather than an individual structure to understand the difference between asset management and maintenance. By taking into consideration the economic aspect and human resources aspect as well as the physical aspect, the flow of the asset management for structures' groups with view points of the life cycle cost and the budget is provided.

【Grading】 Reports ,presentations and other activities are inclusively considered.

【Course Goals】 To understand the maintenance for a single structure and the asset management for structures' group.

【Course Topics】

Theme	Class number of times	Description
1. Outline of maintenance for concrete structures	1	
2. Deterioration mechanisms of concrete structures and deterioration prediction	4	
3. Repair materials and methods for concrete structures	1	
4. Maintenance and asset management	2	
5. Maintenance for structures' group	2	
6. Management for structures' group	2	
7. Presentations and discussions	3	

【Textbook】 Not specified. Some materials may be provided.

【Textbook(supplemental)】 Not specified.

【Prerequisite(s)】 Basic knowledge on Construction Materials and Concrete Engineering.

【Independent Study Outside of Class】 Check the handouts. Additional studies will also be instructed.

【Web Sites】

【Additional Information】 Positive presence in the lecture is expected by joining discussions for example.

Earthquake Engineering/Lifeline Engineering

地震・ライフライン工学

【Code】 10F261 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 4th
 【Location】 C1-191 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English
 【Instructor】 J. Kiyono, A. Igarashi

【Course Description】 This course deals with the mechanism and propagation characteristics of the seismic ground motion that often greatly affects the urban society, in particular the wave generation in the earthquake fault and the ground vibration analysis, and the elastic and elastoplastic response of the structures to the seismic ground motions. The topics include the dynamic response characteristics of RC/steel structures, current seismic response control technology, basic theory and technical development of lifeline earthquake engineering, thoretical aspect of lifeline management and safety assessment learned from past damage experience.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	1	
	1	
	1	
Principles of seismic design of structures	2	Fundamental thories on dynamic response of nonlinear elastoplastic structural systems and representative seismic design principles
Seismic performance of concrete and steel structures	1	Essentials and current issues related to seismic performance and design of RC and steel structures
Seismic response control and seismic retrofit of structures	1	Idea and current issues on seismic isolation, seismic response control techniques for enhancement of seismic performance of structures, and seismic retrofit and rehabilitation of existing structures
	1	
	2	
	1	
	1	
Achievement evaluation	1	Students' achievements in understanding of the course material are evaluated.

【Textbook】 Not specified

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Structural Engineering for Civil Infrastructure

社会基盤構造工学

【Code】 10W001 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 2nd

【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture

【Language】 English 【Instructor】 Related Faculty members,

【Course Description】 Structural engineering problems related to planning, design, construction and maintenance of the infrastructures are discussed. Topics concerning structural engineering and management are widely taken up including latest advanced knowledge and technology, future view and/or international topics. Special lectures by extramural lecturers are carried out if necessary.

【Grading】 Coursework will be graded based on the reports.

【Course Goals】 To grasp problems related to structural engineering and their specific solutions.
To understand applicability of advanced technologies and development prospects.

【Course Topics】

Theme	Class number of times	Description
Structural Materials, Structural Mechanics	4	Steel materials, Concrete materials, mechanical behavior of structures, Problems related to design, construction and maintenance
Applied Mechanics	1	Numerical analysis for structure performance evaluation
Earthquake and Wind Resistance of Structures	7	Infrastructure and natural disaster, Trends of disaster prevention technology, Problems related to Earthquake and wind resistant design
Maintenance of structure	3	International technology, Scenario design, International technological education and collaboration

【Textbook】 The textbook is not required. Materials will be supplied by instructors.

【Textbook(supplemental)】 Supplemental text books will be introduced by instructors.

【Prerequisite(s)】 Structural Mechanics, Wind Resistant Design, Construction Materials, Dynamics of Structures, etc.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Structural Design

構造デザイン

【Code】 10F009 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 2nd
 【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English
 【Instructor】 Yoshikazu Takahashi, Masahide Matsumura

【Course Description】 This course provides the knowledge of the structural planning and design for civil infrastructures. Fundamentals of the reliability of structures based on the probability and statistics are given. Emphasis is placed on the reliability index and the calibration of partial safety factors in the LRFD design format. Furthermore, the relationship between structure and form is discussed with various examples.

【Grading】 Assessed by term-end examination, reports and quizzes

【Course Goals】 To understand the structural planning and design for civil infrastructures.

To understand the reliability-based design of structures.

To deepen the understanding of the relationship between structure and form.

【Course Topics】

Theme	Class number of times	Description
Structural Planning	2	Structural Planning of civil infrastructures is introduced. The concept, significance of planning, characteristics of civil infrastructures are discussed. Practical planning process of a bridge is explained.
Structure and Form	3	The bridge types such as girder, truss, arch and suspension bridge that have been regarded individually are explained as an integrated concept from the viewpoint of acting forces to understand the structural systems which have continuous or symmetrical relationships. Furthermore, various examples are discussed based on the understanding of the structural systems.
Structural Design and Performance-based Design	3	Design theory of civil infrastructures is introduced. The allowable stress design method and the limit state design method are explained. The basic of earthquake resistant design is discussed based on the dynamic response of structures. Performance-based design is also introduced.
Random Variables and Functions of Random Variables	1	Fundamentals of random variables, functions of random variables, probability of failure and reliability index in their simplest forms are lectured.
Structural Safety Analysis	3	Limit states, probability of failure, FOSM reliability index, Hasofer-Lind reliability index, Monte Carlo method are lectured.
Design Codes	2	Code format as Load and Resistance Factors Design (LRFD) method, calibration of partial safety factors based on the reliability method are given.
Assessment of the Level of Attainment	1	Assess the level of attainment.

【Textbook】 Reliability of Structures, A. S. Nowak & K. R. Collins, McGraw-Hill, 2000

【Textbook(supplemental)】 U.Baus, M.Schleich, Footbridges, Birkhauser, 2008 (Japanese ver.: Footbridges(translated by Kubota, et al.), 鹿島出版会, 2011)

久保田善明, 『橋のディテール図鑑』, 鹿島出版会, 2010

Other books will be given in the lectures as necessary.

【Prerequisite(s)】 Fundamental knowledge on Probability and Statistics, and Structural Mechanics

【Independent Study Outside of Class】 N/A

【Web Sites】

【Additional Information】 Structural planning and design will be given by Y. Takahashi, and Structural reliability analysis by M. Matsumura.

Bridge Engineering

橋梁工学

【Code】 10F010 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 3rd 【Location】 C1-172 【Credits】 2
 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English 【Instructor】 Kunitomo Sugiura, Tomomi Yagi, Masahide Matsumura
 【Course Description】 The subject matter of bridge engineering can be divided into two main parts, which are steel structure and wind loading/wind resistant structure. The aim of this course is to provide details of mechanical behaviors, maintenance and design of bridge structures. The former part of this course contains the static instability of steel structures and the problems of corrosion, fatigue, brittleness, weldability on steel bridges. In the latter part, the basics of wind engineering, bridge aerodynamics and wind-resistant design including current problems to be solved are provided.
 【Grading】 Assessment will be based on exam, reports and participation.

【Course Goals】

Also, the basic knowledge for wind engineering and aerodynamic instabilities, which are necessary for the wind resistant design of bridges, will be acquired.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	- Fundamental knowledge on steel structures - Types of steel structures - Future trend of steel structures
Material behavior, Initial imperfections and Damages	1	- Construction of steel structures - Residual stresses and initial deformations - Damages
Stress-strain relationship, Joints	1	- Yield surfaces - Bauschinger effect - Hardening effect - Welded joint - Bolted joint
Fatigue fracture, fatigue life and fatigue design	1	- S-N design curve - Fatigue crack growth, stress intensity factor - Miner's rule on damage accumulation - Repair of fatigue damage
Structural stability and design for buckling	1	- Structural instability and accident - Theory of Stability - Compressive members, etc.
Corrosion and anti-corrosion of steel structures	1	- Mechanism of corrosion - Micro- and Macro- cells - Anti-corrosion - Life-cycle costs
Wind resistant design of structures	3	- Natural winds due to Typhoon, Tornado and so on - Evaluation and estimation of strong winds - Wind resistant design methods - Various kinds of design codes
Aerodynamic instabilities of structures	3	- Introduction of aerodynamic instabilities (ex. vortex-induced vibration, galloping, flutter, buffeting, cable vibrations) - Mechanisms of aerodynamic instabilities - Evaluation methods and Countermeasures
Wind-induced disaster	1	- Accidents on structures due to strong winds - Disaster prevention
Topics	1	Introduction of current topics on bridge engineering by a visiting lecturer
Confirmation of the attainment level of learning	1	Confirm the attainment level of learning

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 Basic knowledge for construction materials, structural mechanics and fluid mechanics are required.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Concrete Structural Engineering

コンクリート構造工学

【Code】 10A019 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Tue 2nd

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Yoshikazu Takahashi, Takashi Yamamoto, Satoshi Takaya, Katsuhiko Mizuno (Sumitomo Mitsui Construction Co., LTD.)

【Course Description】 Concrete is one of the most useful construction materials employed for an infrastructure. The structural properties of a reinforced concrete including a prestressed concrete are introduced among the various structural components of concrete. The engineering techniques in design, execution, diagnosis, repair, strengthening and management of reinforced and/or prestressed concrete structures are discussed from the point of view of the performance based system.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	6	
	6	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Structural Dynamics

構造ダイナミクス

【Code】 10F227 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 2nd
 【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese
 【Instructor】 A. Igarashi, A. Furukawa

【Course Description】 This course deals with dynamics of structural systems and related topics, to provide the theoretical basis to deal with the problems of vibration, safety under dynamic loads and health monitoring associated with infrastructures. The students will study the dynamic response, properties of natural modes and methods of eigenvalue analysis for multi-DOF systems. The topics on the numerical time integration schemes, probabilistic evaluation of structural response to random excitation, and dynamic response control techniques for structures are also studied.

【Grading】 Based on the results of a final examination, plus homework assignments

【Course Goals】 (1) To acquire the knowledge on theories and principles of analysis of MDOF systems (2) Systematic understanding of frequency-domain structural response analysis (3) Concept of analysis of numerical time integration schemes (4) Understanding of fundamentals of the random vibration theory

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The fundamental concepts of structural dynamics and the scope of the problem to be treated are described, and the outline of the theoretical framework of methodologies for analysis is overviewed.
Dynamics of Multi-Degree-Of-Freedom Systems	2	Basic concepts, including the formulation of vibration model of multi-degree of freedom systems, eigenvalue analysis, normal modes and modal analysis of linear systems and modeling of system damping, are described.
Frequency-Domain Analysis of System Response	1	Methodology of response analysis of linear systems based on the concept of the frequency response function, and the relationship between the frequency-domain analysis and time-domain response via Fourier integral, mathematical operation and numerical procedure are described.
Numerical Time Integration	2	Overview of the step-by-step time integration method used for numerical response analysis in the time domain is followed by the implication and mathematical analysis of the characteristics of the integration method, including stability and accuracy.
Random Vibration	6	The methodology for stochastic modeling of inputs when the dynamic load on the structure can not be deterministically specified is shown, and the concept, theory and method for probabilistic evaluation of the dynamic response of the structures are described.
Structural Response Control	2	The concept of dynamic response control of structures, in particular the active control and semi-active control, is described, and the standard theories for analysis and design are introduced.
Achievement Evaluation	1	Students' achievements in understanding of the course material are evaluated.

【Textbook】 Not used; Class hand-outs are distributed when necessary.

【Textbook(supplemental)】

【Prerequisite(s)】 Mechanical vibration (undergraduate level), Complex calculus (integration of analytic functions, Fourier transform, etc.), Probability theory, Linear algebra

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There will be homework assignments at the end of most of the lectures.

Seismic Engineering Exercise

サイスマックシミュレーション

【Code】 10F263 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 4th

【Location】 C1-192 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture and Exercise

【Language】 Japanese 【Instructor】 Sawada, Takahashi, Goto

【Course Description】 This course provides the knowledge of simulation methods for earthquake engineering.

Small groups of students are exercised in the prediction of ground motion generated by a specified seismic fault and the response analysis of structure selected by themselves considering soil-structure interaction.

【Grading】 Based on the performance during the course (including homework) and the results of presentation and reports.

【Course Goals】 At the end of this course, students will be required to have a good understanding of: - Prediction of ground motion generated by a specified seismic fault - Dynamic response analysis of structures and foundation (linear/nonlinear)

【Course Topics】

Theme	Class number of times	Description
Frequency domain analysis	1	Basics of Fourier transformation is introduced.
Modeling of structure - soil system and time domain analysis	1	Equation of motion of SR model is introduced and the integration method of the equation in time domain is explained.
Exercise of linear seismic response analysis	2	Small groups of students are exercised in elastic modeling of structures and linear response analysis in time domain and frequency domain.
Prediction of ground motion by empirical Green's function method	3	Empirical Green's function method is introduced to predict large earthquakes based on observed small earthquakes.
Seismic analysis method of soil	2	Seismic analysis method of layered half-space based on equivalent linearization method is introduced.
Nonlinear seismic analysis method of structures	2	Nonlinear modeling of structures and the integration and iterative methods of the nonlinear equation of motion in time domain are introduced.
Exercise of nonlinear seismic response analysis	3	Small groups of students are exercised in the prediction of ground motion generated by a specified seismic fault and the nonlinear response analysis of structures and foundation.
Achievement Check	1	All students give presentations and discussions.

【Textbook】 Not used; Class hand-outs are distributed when necessary.

【Textbook(supplemental)】

【Prerequisite(s)】 Earthquake Engineering/Lifeline Engineering (10F261), Structural Dynamics (10F227)

【Independent Study Outside of Class】 Students require to review and analyze in preparation for final presentations.

【Web Sites】

【Additional Information】

Ecomaterial and Environment-friendly Structures

環境材料設計学

【Code】 10F415 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Wed 1st

【Location】 C1-117 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Hirotaka KAWANO, Atsushi HATTORI, Toshiyuki ISHIKAWA,

【Course Description】 Lecture on outline of impact of construction materials to environment and influence on materials and structures from environment. Discuss how to use materials sustainably. Keywords are concrete, steel, composite materials, CO₂, durability, recycle and reuse, life-cycle assessment.

【Grading】 Attendance(%), Report(%), Presentation(%)

【Course Goals】 To understand the limit of resources and effect of material use to environment. and to understand the basic theory to make environmental-friendly infrastructures from the view point of materials use.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	Object of the Course, Grading and Goals
product of materials and impact to environment	1	Product of cement, steel, concrete CO ₂ product and its influence
recycle and reuse of materials	3	Recycle and reuse of steel, metals, concrete, asphalt, plastics Technology development of construction materials
deterioration of concrete structures	1	Mechanism of deterioration of concrete structures: carbonation, salt attack, alkali-aggregate reaction Maintenance and retrofit methods
deterioration of steel structures	1	Mechanism of deterioration of steel structures: corrosion, fatigue Maintenance and retrofit methods
deterioration of composite structures	1	Mechanism of deterioration of composite structures: Maintenance and retrofit methods
life-cycle assessment of structures	1	Life-cycle assessment of structures considering initial cost as well as maintenance cost
topics and discussion	2	Recent topics on construction materials and discussion
presentation by students and discussion / feedback	4	Presentation by students on the individual topics Discussion on the topics. Feedback at the last class

【Textbook】 No set text

【Textbook(supplemental)】 Instructed in class

【Prerequisite(s)】 Basic knowledge of construction materials, concrete engineering

【Independent Study Outside of Class】 Check the handouts. Additional studies will also be instructed.

【Web Sites】

【Additional Information】 Questions and discussions are welcome

Infrastructure Safety Engineering

社会基盤安全工学

【Code】10F089 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 3rd
 【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
 【Instructor】Tomoyasu Sugiyama、Tsutomu Iyobe

【Course Description】The issues concerning the safety and reliability of infrastructures such as tunnels and bridges and also the issues on natural disaster are reviewed in the lecture.

【Grading】This lecture involves reports (70%) and attendance(30%)

【Course Goals】To understand the basic technologies to enhance the safety of structures and also the fundamentals on disaster prevention.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction on the safety of infrastructures
Maintenance of railway structures	1	Planning, investigation, evaluation and repair in maintenance for mainly railway structures is generally explained
Weather information for disaster prevention	2	Overview of weather information for disaster prevention and its monitoring system, the evaluation method for climatological statistics and extreme value statistics.
Disaster prevention in railway structures	1	To sustain the users' safety in railway system, it is necessary to maintain the structures properly but also to consider the prevention against disaster. Thus herein disasters in railway structures and its counteractions are explained
Regulation and counteraction against rainfall	1	The need for regulation in railway operation at rainfall is explained
Risk assessment for rainfall disaster	1	Risk assessment for rainfall disaster is described and also some practical cases are introduced
Technical tour	3	Prevention technologies against natural disaster
Earthquake and its early detection	1	Warning system for earthquake and the algorithm of earthquake early detection, which is one of the regulations for Super expressway in earthquake, is explained
Basics of snow hydrology	2	Physical phenomenon of snow hydrology and its relationship with natural and social environment
Countermeasures of snow disasters for railway	1	Disorder caused by snow and ice and the countermeasures in railways
Report	1	Report

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】Basic knowledge on statistics is required. Students should have taken the course of geo-mechanics, structural mechanics and concrete engineering.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】confirm the attendance at every lecture

Hydraulics & Turbulence Mechanics

水理乱流力学

【Code】10F075 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 3rd

【Location】C1-191 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Toda,Sanjou,Okamoto,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Guidance	1	Guidance and entrance level lecture about fluid dynamics and turbulence
Theories of turbulence	3	Lectures about momentum equation, boundary layer, energy transport, vortex dynamics and spectrum analysis
Turbulence in natural rivers	4	Lectures about diffusion and dispersion phenomena observed in natural rivers.
Vegetation and turbulence	3	Lecture about turbulence transport in vegetation canopy together with introduction of recent researches
Practical topics in natural rivers	2	Lectures about compound channel and sediment transport
Practical topics in hydraulic engineering	2	Lectures about drifting object in flood and fish way

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】Hydraulics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Hydrology

水文学

【Code】10A216 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Tue 2nd
 【Location】C1-117 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English
 【Instructor】Yasuto TACHIKAWA, Yutaka ICHIKAWA and Kazuaki YOROZU

【Course Description】Physical mechanisms of the hydrologic cycle are described from the engineering viewpoint. The rainfall-runoff modeling and its prediction method are emphasized. Physical hydrological processes explored are surface flow, saturated-unsaturated subsurface flow, streamflow routing, and evapotranspiration. Physical mechanism of each hydrological process and its numerical modeling method are explained. The basic equations and numerical simulation methods are provided. Then, detail of distributed hydrological modeling is explained through exercise.

【Grading】Examination and report

【Course Goals】The goals of the class are to understand the physical mechanism of hydrological processes, their basic equations, and numerical simulation methods.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The hydrologic cycle and the hydrological processes are explained.
Surfaceflow	2	The physical process of the surface flow and its numerical modeling method are described. The basic equations of the surface flow and the numerical simulation methods are explained.
Streamflow routing	2	The physical process of the streamflow routing and its numerical modeling method are described. The basic equations of the streamflow routing and the numerical simulation methods are explained.
Channel network and watershed modeling	1	Numerical representations of channel networks and catchments are explained.
Distributed hydrological model	5	A physically-based distributed hydrological model is described, which is constructed with numerical representations of channel networks and catchments.
Climate change and hydrologic cycle	1	Data analysis of the latest GCM simulation is presented and the impact of climate change on the hydrologic cycle is discussed.
Evapotranspiration	2	The physical process of the evapotranspiration and its numerical modeling method are described. The basic equations of the evapotranspiration and the numerical simulation methods are explained.
Feedback of study achievement	1	Feedback of study achievement is conducted.

【Textbook】Handouts are distributed at each class.

【Textbook(supplemental)】

【Prerequisite(s)】Basic knowledge of hydraulics and hydrology

【Independent Study Outside of Class】Read the textbook and/or related documents in advance and work on assignments to improve understanding of the lecture contents.

【Web Sites】<http://hywr.kuciv.kyoto-u.ac.jp/lecture/lecture.html>

【Additional Information】This course is open in English every other year. The course will be open in AY2018.

River Engineering and River Basin Management

河川マネジメント工学

【Code】10F019 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 1st 【Location】C1-173

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Hosoda,T., Kishida, K., Onda, S.

【Course Description】It is important to consider about rivers comprehensively from the various points of view based on natural & social sciences and engineering & technology. The fundamental knowledge to consider rivers and to make the plans for river basins is explained with the following contents: various view points to consider rivers, long term environmental changes of rivers and its main factors, river flows and river channel processes, the ecological system of rivers and lakes, flood & slope failure disasters, the integrated river basin planning(flood defense, environmental improvement planning, sediment transport system), functions of dam reservoir and management.

【Grading】Reports & Attendance

【Course Goals】Students are requested to understand the fundamental knowledge to consider rivers and river basins comprehensively from the various points of view based on natural & social sciences and engineering & technology.

【Course Topics】

Theme	Class number of times	Description
Various view points to consider rivers and river basins	2	Various viewpoints to consider rivers and river basins, Various rivers on the earth, Formation processes of river basins, long term environmental changes of rivers and its main factors
Ecological system in rivers	1	The fundamental knowledge on river ecological system
Applications of computational methods to environmental problems	2	The following items are lectured: Computational method to predict river flows and river channel processes with sediment transport and river bed deformation, Hydrodynamics in Lake Biwa.
Recent flood disasters & Integrated river basin planning	3	Characteristics of recent flood and slope failure disasters, the Fundamental river management plan and the River improvement plan based on the River Law, Procedures to make the flood control planning, Flood invasion analysis and hazard map.
Groundwater and its related field	1	Simulation technology of groundwater, Geo-environmental issues, Reservoir Engineering, Contaminant Transport Processes.
Sustainable development of dam	1	Needs of dam development and history of dam construction, Maintenance of Dam reservoir.
Economic evaluation of environmental improvement projects	2	Evaluation of people's awareness & WTP to river improvement projects by means of CVM, Conjoint Analysis, etc.
Riverbank and Dam structure and its maintenance	2	River bank and dam structure, foundation, grouting. Design of River bank, Arch Dam and Gravity Dam.
Achievement Confirmation and Feedback	1	Comprehension check of course contents (Reports & Quiz)

【Textbook】Printed materials regarding the contents of this class are distributed in the class.

【Textbook(supplemental)】

【Prerequisite(s)】Fundamental knowledge on Hydraulics, Hydrology and Ecology

【Independent Study Outside of Class】

【Web Sites】http://www.geocities.jp/kyoto_ivereng/

【Additional Information】Students can contact with professors by visiting their rooms and sending e-mails.

Prof. Hosoda: hosoda.takashi.4w@kyoto-u.ac.jp

Prof. Kishida: kishida.kiyoshi.3r@kyoto-u.ac.jp

Associate Prof. Onda: onda.shinichiro.2e@kyoto-u.ac.jp

Sediment Hydraulics

流砂水理学

【Code】10A040 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 2nd
 【Location】C1-191 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
 【Instructor】Hitoshi Gotoh and Eiji Harada,

【Course Description】Natural flows in river and coast are movable bed phenomena with the interaction of flow and sediment. At a river and a coast, a current and a wave activate a sediment transport and bring the topographical change of a bed such as sedimentation or erosion. This lecture provides an outline about the basics of sediment (or movable bed) hydraulics, and detail of the computational mechanics of sediment transport, which has been developed on the basis of dynamics of flow and sediment by introducing a multiphase flow model and a granular material model. Furthermore, about sediment and water-environment relationship, some of frontier technologies, such as an artificial flood, removal works of dam sedimentation, coastal protection works, and sand upwelling work for covering contaminated sludge on flow bottom etc., are mentioned.

【Grading】Grading is based on student ' s activities in lectures and written examination.

【Course Goals】Students understand the basics of sediment hydraulics and outline of advanced models for computational sediment hydraulics, such as multiphase flow model and granular material model. Students understand the present conditions of sediment control works.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The purpose and constitution of the lecture, the method of the scholastic evaluation are explained.
Basics of sediment hydraulics	5	Physical characteristic of a movable bed and a non-equilibrium sediment transport process and its description are explained. Furthermore, the prediction technique of topographical change due to current and waves is outlined.
Computational mechanics of sediment transport: The state of the art	8	Essential parts of numerical models of the movable bed phenomena, which has been developed by introducing dynamic models such as a granular material model to describe a collision of sediment particles and a multiphase flow model to describe a fluid-sediment interaction, are described. In comparison with the conventional movable bed computation, the points on which has been improved to enhance the applicability of the models are concretely mentioned. Some frontier studies of sediment transport mechanics are also introduced.
Achievement confirmation	1	Comprehension check of course contents.

【Textbook】Hitoshi Gotoh: Computational Mechanics of Sediment Transport, Morikita Shuppan Co., Ltd., p.223, 2004 (in Japanese).

【Textbook(supplemental)】Non

【Prerequisite(s)】Undergraduate-level Hydraulics or Hydrodynamics is required. Because a commentary easy as possible is kept in mind by lectures, students without these prerequisite are welcomed.

【Independent Study Outside of Class】Review fundamental items of hydraulics or hydrodynamics.

【Web Sites】Non

【Additional Information】Non

Hydrologic Design and Management

水工計画学

【Code】 10F464 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 2nd
 【Location】 C1-191 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese
 【Instructor】 Yasuto TACHIKAWA and Yutaka ICHIKAWA

【Course Description】 Hydrologic design and real-time rainfall-runoff prediction methods are described. The frequency analysis of hydrologic extreme values and the time series analysis of hydrologic variables are described, and then a procedure to determine an external force for the hydrologic design are explained. Next, a physically based hydrologic model which includes various processes of human activities for the hydrologic cycle is described. A flood control planning and water resources management with the use of innovative hydrologic simulation tools is described. Then, A real-time rainfall runoff prediction method with the use of Kalman filter theory is described.

【Grading】 Final report (100)

【Course Goals】 The class aims to understand the probabilistic and statistical analysis of hydrologic variables to determine the external force of hydrologic designs, applications of hydrologic simulations for hydrologic designs, and real-time rainfall and runoff prediction methods for water resources management.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	A flood control planning and water resources planning are introduced.
Frequency analysis and hydrologic design	3	The frequency analysis of hydrologic extreme values is described. The methods to set the external force for the hydrologic design are explained.
Time series analysis and hydrologic design	2	The time series analysis of hydrologic variables is described. The methods to develop time series models, time series data generation methods, spatiotemporal variation of hydrologic variables and a random field model, disaggregation methods are explained.
Hydrologic modeling and predictive uncertainty	2	Hydrologic models which include the process of human activities for the hydrologic cycle is described. Then, hydrologic predictive uncertainty is explained, which is inevitable coming from model structure uncertainty, parameter identification uncertainty and model input uncertainty. Especially, the relation between spatiotemporal scales of hydrologic modeling and model parameter values is described.
Hydrologic modeling system	2	A hydrologic modeling system which helps to develop complicated hydrologic simulation models and its importance for a flood control planning is also described.
Watershed management for flood disaster	2	Watershed management to mitigate flood disasters is described. A cost-benefit analysis of flood control measures is discussed.
Real-time rainfall runoff prediction	2	A real-time rainfall runoff prediction method with the use of Kalman filter theory and a new filter theory is described.
Feedback of study achievement	1	Feedback of study achievement is conducted.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 Basic knowledge of hydrology, probability and statistics are required.

【Independent Study Outside of Class】 Read the textbook and/or related documents in advance and work on assignments to improve understanding of the lecture contents.

【Web Sites】 <http://hywr.kuciv.kyoto-u.ac.jp/lecture/lecture.html>

【Additional Information】

Open Channel Hydraulics

開水路の水理学

【Code】 10F245 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 1st

【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 HOSODA, Takashi and ONDA, Shinichiro

【Course Description】 Hydraulic engineers and river engineers are requested to understand Open Channel Hydraulics to handle practical problems properly. In this class, the basic theory on open channel hydraulics is lectured showing various applications in Hydraulic Engineering Field. The contents include the following items: Application of a singular point theory to water surface profile analysis, Derivation of 2-D depth averaged flow model, 1-D analysis of unsteady open channel flows based on the method of characteristics, Plane 2-D analysis of steady high velocity flows, Plane 2-D analysis of unsteady flows, Higher order theories such as Boussinesq equation, etc.

【Grading】 This class is available for 2018. The regular examination is held for grading.

【Course Goals】 Students are required to understand the basic theory of Open Channel Hydraulics and to learn how to apply the basic theory to practical problems in hydraulic engineering field including computational methods.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	The contents of this subject are introduced showing the whole framework of Open Channel Hydraulics with several theoretical and computational results.
Derivation of 2-D depth averaged model	1	Derivation procedures of plane 2-D depth averaged flow model are explained in details.
Application of singular point theory to water surface profile analysis	1	The application of a singular point theory to water surface profile analysis for steady open channel flows is explained.
1-D analysis of unsteady open channel flows	3	The following items are lectured: Fundamental characteristics of 1-D unsteady open channel flows, Method of Characteristics, Dam break flows, Computational methods for shallow water equations.
Fundamentals of numerical simulation	1	basic theory of numerical simulation is explained by means of finite difference method, finite element method, etc. Applications of these method to unsteady open channel flow equations are also shown with some practical applications in river engineering.
Plane 2-D analysis of steady high velocity flows	1	Characteristics of steady plane 2-D flows are explained based on the method of characteristics.
Plane 2-D analysis of unsteady flows	3	The following items are lectured: The propagation of a characteristic surface, the shear layer instability in 2-D flow fields, the application of a generalized curvilinear coordinate system to river flow computation, the application of a moving coordinate system, etc.
Higher order theory	3	Boussinesq equation with the effect of vertical acceleration, full/partially full pressurized flows observed in a sewer network, traffic flow theory based on a dynamic wave model and its application
Achievement Confirmation & Feedback	1	Understanding of the contents on Open Channel Hydraulics is confirmed through the regular examination.

【Textbook】 Printed materials on the contents of this class are distributed in class.

【Textbook(supplemental)】

【Prerequisite(s)】 The Basic knowledge on fluid dynamics and hydraulics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Students can contact with Hosoda by sending e-mail to hosoda.takashi.4w@kyoto-u.ac.jp.

Coastal Wave Dynamics

海岸波動論

【Code】 10F462 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 3rd
 【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English
 【Instructor】 Hitoshi Gotoh , Khayyer Abbas, Eiji Harada and Hiroyuki Ikari

【Course Description】 Wave motion, which is the main driving force in coastal zone, is explained focusing on wave transformation theory and computational fluid dynamics, and design for coastal structures of their engineering applications is illustrated. As for the computational fluid dynamics for waves, methodology of free-surface wave based on the Navier-Stokes equation, which has been significantly developed in recent years, is explained in detail.

【Grading】 Grading is based on student ' s activities in lectures and written examination.

【Course Goals】 Goal of this course is a detailed understanding of fundamental of wave transformation theory and computational fluid dynamics related to wave motion, and is also acquiring a design concept for coastal structures as their engineering applications.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The purpose and constitution of the lecture the method of the scholastic evaluation are explained.
Conservation laws of fluid	4	Fundamentals of fluid mechanics, liner / non-liner wave theories and numerical mathematics are explained.
Modeling of surf zone dynamics	6	Several methodologies against free-surface wave including breaking waves (i.e. VOF, MPS, SPH) are illustrated. Especially advanced approaches of MPS and SPH are explained in detail.
Introduction of turbulence models	1	Reynolds averaging models and large eddy simulation are outlined.
Modeling of rock mound dynamics	2	Method for tracking of armor blocks under high waves using Distinct Element Method is described.
Achievement Confirmation	1	Comprehension check of course contents.

【Textbook】 Computational Wave Dynamics by Hitoshi Gotoh, Akio Okayasu and Yasunori Watanabe 234pp, ISBN: 978-981-4449-70-0

【Textbook(supplemental)】 Non

【Prerequisite(s)】 Non. It is desirable to have knowledge about hydraulics, fluid mechanics.

【Independent Study Outside of Class】 Review fundamental items of hydraulics or hydrodynamics.

【Web Sites】

【Additional Information】 If there are any questions, please send e-mail to the staff. This course will be offered in 2015.

Hydro-Meteorologically Based Disaster Prevention

水文気象防災学

【Code】10F267 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 3rd

【Location】C1-191 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Kaoru Takara, Eiichi Nakakita, Takahiro Sayama, Kosei Yamaguchi

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	1	
	2	
	2	
	2	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Every two years. No class is provided in year 2018.

Water Resources Systems

水資源システム論

【Code】 10A222 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 1st
 【Location】 C1-192 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese
 【Instructor】 Hori, T.(DPRI) and Tanaka, K.(DPRI)

【Course Description】 Systems approach to natural and social phenomena associated to water resources is introduced in terms of planning and design of sustainable water resources systems.

【Grading】 Grading is done based on examination and commitment to classes.

【Course Goals】 Deep understanding of fundamentals for systems modeling of water-related natural and social processes and ability to perform data collection, analyses and design of sustainable water management systems.

【Course Topics】

Theme	Class number of times	Description
Optimum design of water resources systems	3	
desicion support for water resources management	2	
Recent topics on water management	2	
Water management practices in the world	3	
Land surface model and its application to water management	4	
achievement check	1	

【Textbook】 Not specified.

【Textbook(supplemental)】 Supplemental documents will be introduced in classes.

【Prerequisite(s)】 Fundamentals of hydrology and water resouyrces engineering.

【Independent Study Outside of Class】 Review work based on handouts and report work for issues given in the classes are required.

【Web Sites】

【Additional Information】 Open every two years. Not available in 2018.

River basin management of flood and sediment

流域治水砂防学

【Code】10F077 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 1st

【Location】C1-173 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】(DPRI) Nakagawa, H., (DPRI) Sumi, T., (DPRI) Takebayashi, H. and (DPRI) Kawaike, K.

【Course Description】In a river basin, various kinds of disasters such as debris flow, land slide, flood inundation, storm surge, and etc. sometimes happen from the origin to the mouth. This lecture presents occurrence examples, mechanisms, theory and methods of prediction and prevention/mitigation methods against those disasters. Also this lecture mentions comprehensive management in a sediment routing system focusing on sediment management strategy in dam reservoirs.

【Grading】Grading is based on 2 reports out of 4 topics and attendance.

【Course Goals】The goals of the class are to understand phenomena within a river basin and to have wide knowledge of problems of flood and sediment disasters and countermeasures against them.

【Course Topics】

Theme	Class number of times	Description
About Sabo Works	4	About Sabo works, sediment disasters, countermeasures against sediment disasters, Sabo projects.
About Reservoir Sediment Management	3	Reservoir sediment management focusing on reservoir sustainability and comprehensive management in a sediment routing system is overviewed including worldwide perspective and Japanese advanced case studies.
About basin-wide sediment routing	4	About the one dimensional bed deformation analysis and the sediment runoff model are introduced. Furthermore, some examples of the application of those models are introduced.
About basin-wide flood management	4	Flood disasters and countermeasures against them are overviewed along the history of flood management in Japan.

【Textbook】No designation. Printed materials regarding the contents of this class are distributed in class.

【Textbook(supplemental)】Instructed in class

【Prerequisite(s)】Fundamental knowledge of Hydraulics and river engineering

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】This class is held biennially and is held in 2019. Attendance is taken every time.

Coastal and Urban Water Disasters Engineering

沿岸・都市防災工学

【Code】10F269 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 2nd
 【Location】C1-192 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
 【Instructor】T. Hiraishi, A. Igarashi, N. Yoneyama, N. Mori

【Course Description】The coastal and densely populated urban areas with highly concentrated economic and social activities and infrastructures are exposed to the threat of coastal disasters such as tsunamis, storm surges, high waves, urban flood damage and urban earthquake disasters caused by particular conditions associated with their characters. This course provides the factors, examples and characteristics of coastal and urban regional disasters, as well as disaster prevention measures taking these factors into consideration.

【Grading】Grading will be based on the report and achievements in the class.

【Course Goals】In-depth understanding of concepts and knowledge necessary for taking measures against disasters, based on fundamental theories of hydraulics and structural mechanics, occurrence, propagation and deformation of external actions caused by coastal and urban earthquake disasters, as well as information on the past disaster and damage examples.

【Course Topics】

Theme	Class number of times	Description
Outline of coastal and urban disasters	1	Introduction of coastal and urban disasters will be lectured. The type and cause of coastal and urban disasters will be explained for sequential lectures.
Modeling of tsunami, storm surge and waves	3	The fundamental physics and governing equations of tsunami, storm surge and ocean waves will be described and applications and historical events will be explained in detail.
Reduction of coastal disasters	3	Characteristics of historical tsunamis, storm surges and coastal erosion will be presented with countermeasures by engineering approaches. Reliability design for coastal structures will be explained following Japanese standard.
Earthquake disaster in urban areas	1	Review of recent earthquake disasters in urban areas in Japan and other countries
Prediction of regional damage due to earthquake and tsunami	3	Fundamental principles of regional damage prediction for scenario earthquakes and tsunami events
	1	
	2	
Achievement Evaluation	1	Submission of reports to integrate the idea of prevention and reduction of coastal and urban disasters, to evaluate students' achievements in understanding of the course material.

【Textbook】Not specified. Hand-outs and research papers are distributed when necessary.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】The methodology and idea developed in the lecture should be explored by relating your own field of research.

【Web Sites】

【Additional Information】

Basin Environmental Disaster Mitigation

流域環境防災学

【Code】 10F466 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 3rd 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Masaharu FUJITA(DPRI), Tetsuya HIRAISHI(DPRI), Yasuhiro TAKEMON(DPRI), Yasuyuki BABA(DPRI),

【Course Description】 In a concept of the environmental disaster prevention, an idea that the disaster prevention could provide continuously the environmental benefits is contained as well as an idea of preventing the environmental deterioration. In this lecture, an environment system formation function of a debris flow, a flood, an ocean wave is explained. Also their values as natural resources are discussed. The influence of structural countermeasures on the environment conservation is evaluated from this point of view. A new idea of disaster prevention is introduced considering the function of the natural impacts and the value of the natural phenomena as resources is discussed. Also a new method for basin management is introduced.

【Grading】 Presentation, Discussion and Report

【Course Goals】 The course goal is to understand a concept of the basin management balanced between disaster prevention and environment conservation based on the sediment transport hydraulics and the ecology.

【Course Topics】

Theme	Class number of times	Description
Introduction of the environmental disaster prevention	3	First of all, a concept of the environmental disaster prevention is introduced. The utilization of flood plains as agricultural land and the history of rivers with bed above ground and so on are introduced, and the relation between the human being and rivers is explained. A method to balance the sustained resources use with disaster prevention is discussed.
Basin scale ecosystem function	3	A role of the disturbance in maintaining of the structure and function of the basin scale ecosystem is explained. For example, a role of the natural phenomenon such as a debris flow, a flood inundation is explained.
Coastal disasters and environment	4	The actual situation of the coastal erosion in our country and the causes are explained. Then, the problems on disaster prevention, environment conservation and utilization in coastal areas are introduced. Technology development to solve these problems is introduced. Also, the relation between environment in river mouth and river basin is discussed.
Sediment disasters and environment	2	Sediment hazards give a big impact to river environment as well as the human beings. As one of the sediment hazards landslides are taken up and the occurrence mechanism is explained.
Sediment management with consideration of environment conservation	2	The basin scale sediment management is carried out for the purpose of safety, appropriate utilization and environmental conservation. Actual sediment management and the related researches are introduced. A concept, new ideas and new technology are discussed.
Evaluation of proficiency level	1	Students confirm the proficiency level in this lecture.

【Textbook】 None.

【Textbook(supplemental)】 None.

【Prerequisite(s)】 Hydraulics, River Engineering, Coastal Engineering, Sediment Transport Hydraulics, Ecology

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This lecture is open every 2 years and open in 2018.

Computational Fluid Dynamics

数值流体力学

【Code】10F011 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Mon 4th

【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English

【Instructor】Satoru Ushijima, Hitoshi Gotoh, Abbas Khayyer

【Course Description】Computational Fluid Dynamics (CFD) is largely developed according to the progress of computer technology in recent years. It is the powerful and effective technique to predict the various fluid phenomena, which show the complicated behaviors due to the non-linearity and other conditions. This course provides the dynamics of fluids and eddies as well as the discretization and numerical techniques, such as finite difference, finite volume and particle methods.

【Grading】The grading will be based on homework assignments.

【Course Goals】Course goal is to understand the basic theory and numerical techniques for CFD.

【Course Topics】

Theme	Class number of times	Description
computational method for incompressible fluids	7	The course introduces the MAC algorithm, which is generally used for incompressible Newtonian fluids on the basis of finite difference and finite volume methods (FDM and FVM). The outline of numerical methods is also discussed for parabolic, hyperbolic or elliptic partial differential equations, in terms of the numerical stability and accuracy. Homework will be assigned each week.
Particle method - basic theory and improvements	7	To simulate violent flow with gas-liquid interface which is characterized by fragmentation and coalescence of fluid, particle method shows excellent performance. Firstly, basics of the particle method, namely discretization and algorithm, which is common to SPH(Smoothed Particle Hydrodynamics) and MPS(Moving Particle Semi-implicit) methods, are explained. Particle method is superior in robustness for tracking complicated interface behavior, while it suffers from existence of unphysical fluctuation of pressure. By revisiting the calculation principle of particle method, various improvements have been proposed in recent years. In this lecture, the state-of-the-art of accurate particle method is also described.
Feedback	1	Discuss the contents of all classes and assignments. The details will be introduced in the course.

【Textbook】No textbook assigned to the course

【Textbook(supplemental)】Recommended books and papers will be introduced in the course.

【Prerequisite(s)】Basic knowledge of fluid dynamics, continuum mechanics and computational technique

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Hydraulic Engineering for Infrastructure Development and Management

水域社会基盤学

【Code】10F065 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Tue 3rd
 【Location】C1-117 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English
 【Instructor】Hosoda Takashi, Toda Keiichi, Gotoh Hitoshi, Tachikawa Yasuto, Kishida Kiyoshi, Ichikawa Yutaka,
 Onda Shinichiro, Harada Eiji, Sanjou Michio, Khayyer Abbas and Kim Sunmin,

【Course Description】 This lecture picks up various water-related problems and provides their explanation and solution methodology related to hydrodynamic and hydrological infrastructure improvements, maintenance, disaster prevention against flood and damage of water environment, interweaving several leading-edge cases in the real world. Turbulent flow and CFD, sediment transport system and design/planning of hydraulic structure are described on the basis of the integrated management of river-and-coast systems with sediment control and these relationship with infrastructure improvement. Perspective from the viewpoint of public environmental infrastructure on water environment is presented.

【Grading】 Grading is based on students activities in lectures and reports.

【Course Goals】 Students learn about case-based practical solutions against various problems related to hydraulic engineering, and students acquire academic preparation of how to approach to public environmental infrastructure on water area.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The purpose and constitution of the lecture, the method of the scholastic evaluation are explained.
Hydraulics in open-channel flows	3	Several problems and exciting topics related to hydraulics in open-channel flows are discussed with advanced practical examples.
River basin management	3	Introduction of flood disasters during a few decades in the world, flood control planning in Japan, Economic evaluation and analysis of people ' s awareness to river improvement projects with dam construction.
Beach erosion	3	Several problems and their solution methodology against sediment transport process in coastal zone are explained. Advanced approaches for sediment control are overviewed.
Rainfall-runoff prediction and hydrologic design	3	Water resources issues related to rainfall-runoff prediction and hydrologic design are discussed with advanced practical examples.
Numerical simulation for Hydraulic engineering	1	Recent numerical simulation development and related state-of-the-art technologies are overviewed.
Achievement Confirmation	1	Comprehension check of course contents. The exercises to the given subjects are performed.

【Textbook】 Non

【Textbook(supplemental)】 Non

【Prerequisite(s)】 hydraulics, fluid mechanics, river engineering, coastal engineering, hydrology, etc.

【Independent Study Outside of Class】

【Web Sites】 Non

【Additional Information】 Non

Applied Hydrology

応用水文学

【Code】10F100 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 4th

【Location】C1-173 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English

【Instructor】Hori(DPRI), Sumi(DPRI), S.Tanaka(DPRI), Takemon(DPRI), K.Tanaka(DPRI), Kantoush(DPRI)

【Course Description】Applied and integrated approach to the problems closely related to the water circulation system, such as floods, droughts, water contamination, ecological change, and social change is introduced mainly from the hydrological viewpoint with reference to water quantity, quality, ecological and socio-economic aspects. In the course, several actual water problems are taken up and solving process of each problem which comprises of problem-identification and formulation, impact assessment, countermeasures design and performance evaluation is learned through the lectures' description and also investigation and discussion among the students.

【Grading】Grading is based on student activities in lectures, presentation and reports.

【Course Goals】To obtain fundamental Knowledge and skills to perform problem definition, survey and countermeasure design on problems about water use, water hazard mitigation and water environment.

【Course Topics】

Theme	Class number of times	Description
Water disasters and risk management	2	Risk assessment of water disasters, countermeasures and adaptation design, water disasters and human security
Reservoir Systems and Sustainability	2	Reservoir system and its environmental impacts, Sustainable management of reservoir system
Hydrological Frequency Analysis	3	Basic theory and application of Hydrological Frequency Analysis, which is the basis for hydrologic design.
Land Surface Processes	2	Modelling of land surface processes, Application of land surface model
Hydrological Measurements of Large River Basins	2	Design and management of hydrological measurement system in large river basins
Hydro-eco Systems	2	Ecohydrological management of habitats in river ecosystems, Ecohydrological management of biodiversity in wetland ecosystems
Presentation and Discussion	2	study and exercise for given topics

【Textbook】Printed materials on the contents of this class are distributed in class.

【Textbook(supplemental)】None

【Prerequisite(s)】Elementary knowledge of hydrology and water resources engineering.

【Independent Study Outside of Class】Review work based on handouts and report work for issues given in the classes are required.

【Web Sites】

【Additional Information】

Case Studies Harmonizing Disaster Management and Environment

Conservation

環境防災生存科学

【Code】10F103 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 4th
 【Location】C1-191 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】English
 【Instructor】H. NAKAGAWA(DPRI), E. NAKAKITA(DPRI), N. MORI(DPRI), T. SAYAMA(DPRI), K. YAMAGUCHI(DPRI)

【Course Description】Environmental impacts by infrastructure for disaster prevention and mitigation are discussed. Introducing various examples of natural disasters, degradation of the environment, and harmonizing disaster management and environmental conservation in the world, this classroom carries on a dialogue about effective measures for reducing negative environmental impacts and serious disasters.

【Grading】Considering both the number of attendances and the score of final test at the end of the semester.

【Course Goals】Conservation of the environment and prevention/mitigation of natural disasters, which are very important for human's survivability, often conflict with each other. This course introduces various examples. Students will learn many examples harmonizing these two issues, and shall consider technical and social countermeasures fitting to the regional characteristics.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction
Heavy rainfall and climate change	3	Heavy rainfall -using radar nowcasts and climate change
Flood disaster prevention and the environment	2	River environment and disaster
Coastal hazards and climate change	3	Climate change and impact assessment/adaptation on coastal environment
Water disaster and climate change	3	Hydrological processes and water disaster predictions
Extreme weather and climate change	3	Heavy rainfall -prediction of severe storm

【Textbook】No particular textbook for this course. Necessary documents and literature introduction are provided in the class room from time to time.

Lecture material for Coastal disasters due to tsunamis and storm surges

<http://urx3.nu/t4sq>

<http://urx3.nu/t4sA>

<http://urx3.nu/t4sC>

【Textbook(supplemental)】Some literature would be introduced by professors.

【Prerequisite(s)】No special knowledge and techniques are necessary, but requires reading, writing and discussing in English in the class.

【Independent Study Outside of Class】No specific requirement for independent study. Collect information broadly regarding environment and disaster related topics.

【Web Sites】

【Additional Information】Contact Associate Professor Mori at <mori.nobuhito.8a@kyoto-u.ac.jp> if you have any query.

Integrated Disasters and Resources Management in Watersheds

流域管理工学

【Code】 10F106 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 1st

【Location】 Katsura Campus, Ujigawa Open Laboratory 【Credits】 2 【Restriction】

【Lecture Form(s)】 Lecture and Exercise 【Language】 English

【Instructor】 Masaharu FUJITA(DPRI), Tetsuya HIRAISHI(DPRI), Nozomu YONEYAMA(DPRI), Kenji KAWAIKE(DPRI), Hiroshi TAKEBAYASHI(DPRI), Yasuyuki BABA(DPRI),

【Course Description】 Mechanism and countermeasures of sediment disasters, flood disasters, urban flood disasters and coastal disasters are explained. An integrated watershed management of these disasters and water/sediment resources is also introduced. This lecture will be open at Katsura Campus and Ujigawa Open Laboratory.

【Grading】 Presentation, Discussion and Report

【Course Goals】 Learn an integrated basin management system for natural disasters (sediment disasters, food disasters, coastal disasters, urban flood disasters) mitigation and water/sediment resources utilization considering environmental conservation.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Contents of this lecture are explained.
Urban flood disaster managemnet	2	We review urban floods from the viewpoint of river basins, flood causes, and features, together with the results of recent studies. Based on these studies, we propose comprehensive measures against urban floods, including underground inundations. In addition, we discuss on prediction methods of the tsunami disaster in urban area.
Flood disaster management	2	Prevention / mitigation measures against flood disasters and flood prediction methods are explained as well as examples of recent flood disasters in Japan.
Sediment disaster management	2	Showing the problems on sediment disasters and sediment resources, I explain an integrated sedimnet management system both for sediment disasters and sediment resources.
Coastal disaster management	2	Coastal erosion and tsunami hazard become remarkable in these days in Japanese coast. In a lecture, we discuss on characteristics of such coastal disasters.
Exercise on flood disaster at Ujigawa Open Laboratory	5	Experiment and analysis on debris flows, riverbed variation and flooding at Ujigawa Open Laboratory, Fushimi-ku, Kyoto city.
Evaluation of proficiency level	1	Students confirm the proficiency level in this lecture.

【Textbook】 None

【Textbook(supplemental)】 None

【Prerequisite(s)】 Hydraulics, River Engineering, Coastal Engineering, Sediment Transport Hydraulics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Geomechanics

地盤力学

【Code】10F025 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 2nd

【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Mamoru Mimura, Sayuri Kimoto,

【Course Description】Mechanical behavior of soils and problems of its deformation and failure will be covered based on the multiphase mixture theory and the mechanics of granular materials.

【Grading】Final examination (70) and homeworks, class performance (30)

【Course Goals】The objectives of this course are to understand the basics of geomechanics, and the advanced theories.

【Course Topics】

Theme	Class number of times	Description
Deformation of geomaterials	1	Mechanical property of geomaterials, critical state soil mechanics, Failure criteria, modelling of geomaterials (by Prof. Mimura)
Field equations and constitutive model	2	Framework and field equations for continuum, stress-strain relations for soils, elastic model, elasto-plastic model, plasticity theory (by Prof. Mimura)
elasto-plastic constitutive model	3	Constitutive model for geomaterials, elasto-plastic model, Cam clay model (by Prof. Mimura)
Theory of viscosity and viscoplasticity	3	Viscoelasticity, viscoplasticity, Elasto-viscoplastic mode, Adachi-Oka model, Microstructure of soils, Temperature dependent behavior, Applications of constitutive models (by Prof. Mimura)
Consolidation analysis	3	Biot's consolidation theory and its application, Consolidation of embankment (by Assoc. Prof. Kimoto)
Liquefaction of soils	2	Liquefaction of sandy soil, Damage and failure due to liquefaction, Remedial measures for liquefaction (by Assoc. Prof. Kimoto)
Confirmation of achievement	1	

【Textbook】Handout will be given.

Soil mechanics, Fusao Oka, Asakura Publishing (in Japanese)

【Textbook(supplemental)】An elasto-viscoplastic constitutive model, Fusao Oka, Morikita Publishing (in Japanese)

【Prerequisite(s)】Soil mechanics, Fundamentals of continuum mechanics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Computational Geotechnics

計算地盤工学

【Code】 10K016 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 2nd

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture, Exercise

【Language】 English 【Instructor】 Sayuri Kimoto, PIPATPONGSA , Thirapong

【Course Description】 The course provides students with the numerical modeling of soils to predict the behavior such as consolidation and chemical transport in porous media. The course will cover reviews of the constitutive models of geomaterials, and the development of fully coupled finite element formulation for solid-fluid two phase materials. Students are required to develop a finite element code for solving boundary value problems. At the end of the term, students are required to give a presentation of the results.

【Grading】 Presentation and home works

【Course Goals】 Understanding the numerical modeling of soils to predict the mechanical behavior of prous media, such as, deformation of two-phase mixture and chemical transportation.

【Course Topics】

Theme	Class number of times	Description
Guidance and Introduction	1	Fundamental concept in continuum mechanics such as deformation, stresses, and motion.
Governing equations for fluid-solid two-phase materials	2	Motion, conservation of mass, balance of linear momeutum for fluid-solid two-phase materials. Constitutive models for soils, including elasticity, plasticity, and visco-plasticity.
Ground water flow and chemical transport	5	Chemical transport in porous media, advective-dispersive chemical transport.
Boundary value problem, FEM programming	5	The virtual work theorem and finite element method for two phase material are described for quasi-static and dynamic problems within the framework of infinitesimal strain theory. Programing code for consolidation analysis is presented.
Presentation	2	Students are required to give a presentation of the results.

【Textbook】 Handout will be given.

【Textbook(supplemental)】

【Prerequisite(s)】 Fundamental geomechanics and numerical methods

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Geo-Risk Management

ジオリスクマネジメント

【Code】 10F238 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 4th

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Ohtsu

【Course Description】 This lecture aims to provide interdisciplinary knowledge associated with geo-risk engineering, the topics of risk analysis focusing on geotechnical structures. In detail, the contents of lectures consist of following topics: Introduction to risk analysis, Mathematical background of geo-risk evaluation, Examples of risk evaluation mainly focusing on slopes and Risk management on road slopes.

【Grading】 Attendance(10%), Report(30%), Examination(60%)

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Guidance	1	Guidance Introduction of Geo-Asset Management
Basic	5	Basics of Risk Analysis (3)
Probability theory	8	Evaluation of Slope Risk
Feed back	1	Feed back

【Textbook】 Hiroyasu Ohtsu, Project Management, Corona Publishing, 2010. (in Japanese)

【Textbook(supplemental)】 C. Chapman and S. Ward, Project Risk Management, John Wiley & Sons, 1997.

R. Flanagan and G. Norman, Risk Management and Construction, Blackwell Science

V.M. Malhotra & N.J. Carino, CRC Handbook on Nondestructive Testing of Concrete, CRC Press, 1989.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Additional information is available by visiting the following professors. Appointment shall be made in advance by e-mail.

ohtsu.hiroyasu.6n@kyoto-u.ac.jp

Construction of Geotechnical Infrastructures

ジオコンストラクション

【Code】10F241 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Fri 1st
 【Location】C1-171 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
 【Instructor】Kimura, Kishida

【Course Description】Advanced construction technology of geo infrastructures, such as tunnel, large underground cavern, foundation, culvert, retaining wall, is introduced and explained. And, the practical projects applied by the advanced construction technology are also introduced.

【Grading】Attendance and Report (20 %), Examination (80 %)

【Course Goals】To learn to the advanced construction technology and to propose the project and design through the advanced construction technology.

【Course Topics】

Theme	Class number of times	Description
Guidance, Introduction of construction of geotechnical infrastructures	1	Guidance, Introduction of construction of geotechnical infrastructures
Geo-investigation and survey techniques	2	Introduction of the advanced geo-infestation and survey techniques. Explanation of inversion theory and technique.
Auxiliary mthods of mountain tunnel	2	Introduction of NATM for construction of tunnel and underground cavern. In addition, the role of auxiliary methods, auxiliary method for safety in tunnel construction, axiliary methods for preservation of the surrounding environment are explained
Rock physics and its applications	2	Introduction of the constitutive law of rock material and rock physics (pressure solution) and its application fields, such as special projects of underground space, namely, nuclear waste disposal, and Carbon Capture and Storage.
Field visit or special lecture	1	Visit the construction field or invite special lecture who is the expert engineer on the construction of geotechnical infrastructures.
Foundation	2	Design and construction of piles foundation and steel pipe sheet piles
Culvert	2	Design and construction of box type and arch type culverts
Retaining wall	2	Design and construction of retaining wall
Examination of understanding	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】Soil mechanics, Rock mechanics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Office hour will be explained at the guidance. Students can contact with professors as an e-mail.

kimura.makoto.8r@kyoto-u.ac.jp

kishida.kiyoshi.3r@kyoto-u.ac.jp

Fundamental Geofront Engineering

ジオフロント工学原論

【Code】 10F405 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 1st 【Location】 C1 Jin-Yu Hall

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Prof. Mamoru MIMURA, Prof. Makoto KIMURA, Assoc. Prof. Yosuke HIGO

【Course Description】 This course deals with near-surface quaternary soft soil deposits that are the most important in the engineering sense.

Physical properties and the mechanical characteristics of partially saturated and fully saturated soils are explained, and then various problems in terms of disaster prevention and infrastructure construction are discussed.

【Grading】 Performance grading will be provided based on examination. Attendance and quality of assigned reports, etc. are considered.

【Course Goals】 The aim of this course is to understand engineering problems and their mechanical background in the following points:

- Physical properties and mechanical characteristics of quaternary soft soil deposits and relevant engineering problems in terms of disaster prevention

- Fundamentals of unsaturated soil mechanics and engineering problems of earth structures in terms of disaster prevention

- Concepts of innovative underground foundations and structures and engineering problems during construction

【Course Topics】

Theme	Class number of times	Description
Outline of the course, introduction to quaternary deposits	1	Introduction to quaternary deposits. Types and mechanisms of geotechnical disasters relevant to quaternary deposits.
Geo-informatic database	1	Geo-informatic database and its application to modelling soft alluvial soils, liquefaction hazard map, etc.
Evaluation of subsurface structure based on GID	1	Scheme to evaluate subsurface structures using Geo-informatic database including boring logs, geophysical exploration, geological structures. Application to Kyoto basin is given.
Evaluation of liquefaction for near-surface sand deposits	1	Evaluation of liquefaction for near-surface sand deposits using Geo-informatic database is explained. Applications to the 1995 Hyogo-ken Nanbu Earthquake and the 2011 Off the Pacific Coast of Tohoku Earthquake are given, through which open questions are discussed.
Problems of soft clay deposits	1	Deformation characteristics and stability of soft clay deposits and their evaluation methods are explained, e.g., effectiveness and limitation of ground improvement, long term settlement problem, and case histories of large scale reclamation.
Concept of innovative underground structures	1	Citizen-participate-type renovation technique for unpaved roads using sandbags.
Concept of innovative underground structures	1	New construction method of embankments using consecutive precast arch culvert.
Concept of innovative underground structures	2	Technical problems of steel pipe sheet pile. Development of consecutive steel pipe sheet pile and its application.
Outline of earth structures, Unsaturated soil mechanics	2	Roles of earth structures as an infrastructure. Unsaturated soil mechanics.
Damage of earth structures caused by rainfall and earthquake	1	Case examples and their mechanisms of the damages of earth structures caused by rainfall and earthquake.
Methods to evaluate and improve stability of earth structures subjected to rainfall and earthquake	1	Design methods of earth structures and their problems are outlined.
Site visit	1	Visit construction site relevant to the issues of this course.
Evaluation and feedback	1	Evaluation of achievement by examination, and its feedback.

【Textbook】 Handout will be distributed.

【Textbook(supplemental)】 References are indicated in the handout.

【Prerequisite(s)】 Undergraduate courses in geology, geotechnical engineering, and soil mechanics.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Environmental Geotechnics

環境地盤工学

【Code】 10A055 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 1st

【Location】 C1-192 / Engineering Bldg.No.8 Kyodo No.1 (Yoshida Campus) 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese/English 【Instructor】 Takeshi Katsumi, Toru Inui,

【Course Description】 Several issues on environmental geotechnics including geoenvironmental contamination and countermeasure, waste containment and reuse are introduced to understand the contribution of geotechnical engineering to global and local environmental issues. Geoenvironmental issues due to the 2011 East Japan Earthquake and Tsunami are also introduced.

【Grading】 Continuous assessment including attendance, some assignments, and final report

【Course Goals】 Students should understand the geotechnics to solve the following geoenvironmental issues; soil & groundwater contamination, waste disposal and waste utilization, and extend this knowledge to the development of concepts and technologies for creating and preserving the geo-environment.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction to Environmental Geotechnics, including goals, outline and grading policy of the course
Waste geotechnics	3-4	Functions and structures of waste containment facilities Geotechnics on the liner system (Geosynthetics, clay liner, Leachate collection layer) Post-closure utilization of waste landfill
Remediation geotechnics	3-4	Behaviors of contaminants in subsurface Mechanisms of soil and groundwater contamination Remediation of soil and groundwater contamination Case histories
Geo-environmental issues related to construction works, global environmental issues, and natural disasters	2-3	Mechanisms and remediation of geoenvironmental problems and geo-disasters caused by construction works Geoenvironmental issues caused by the 2011 East Japan Earthquake and Tsunami
Reuse of wastes in geotechnical applications	3-4	Engineering properties of recycled materials in geotechnical applications (Incineration ashes, coal ash, surplus soils, dredged soils) Geoenvironmental impact assessment and control of waste utilization Case histories
Presentation and discussion	2-3	Student presentation, discussion, and summary on above topics

【Textbook】 Not specified.

Several technical papers related to the course will be distributed.

【Textbook(supplemental)】 Geoenvironmental Engineering (Kyoritsu Shuppan Publishing, ISBN: 9784320074293)

Handbook of Geoenvironmental Engineering (Asakura Publishing, ISBN: 9784254261523)

Introduction to Environmental Geotechnics (Japanese Geotechnical Society, ISBN: 9784886444196)

【Prerequisite(s)】 Having knowledge on soil mechanics and geotechnical engineering at bachelor level is preferable, but not requirement.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Disaster Prevention through Geotechnics

地盤防災工学

【Code】10F109 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Mon 2nd
 【Location】C1-117 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English
 【Instructor】Ryosuke Uzuoka and Kyohei Ueda

【Course Description】The lecture covers nonlinear continuum mechanics and dynamic three-phase analysis of ground and geotechnical structures. In particular, the lecture covers the geo-hazards mechanism and prediction of failure modes, and mitigation measure against geo-hazards. The lecture ranges from fundamental mechanics of granular materials to numerical simulation.

【Grading】Based on reports to exercises and attendance.

【Course Goals】Successful students will have the ability to initiate their own research work on geo-hazards based on the solid understanding of the mechanics of granular materials and numerical analysis.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction to the course (objectives, contents, and grading procedure) - Geo-hazards induced by heavy rain and earthquake - Application of numerical analysis to predict the geo-hazards
Nonlinear continuum mechanics 1	3	Nonlinear continuum mechanics 1 - Vector and tensor algebra - Kinematics (motion and strain tensors) - Concept of stress tensors
Nonlinear continuum mechanics 2	3	Nonlinear continuum mechanics 2 - Balance Principles - Objectivity and stress/strain rates - Constitutive laws
Fundamentals of numerical analysis for geo-hazards	4	Fundamentals of numerical analysis for geo-hazards - Balance equations - Constitutive equations - Numerical method
Applications of Numerical analysis for geo-hazards	4	Applications of Numerical analysis for geo-hazards - Liquefaction - Landslide

【Textbook】Handouts

【Textbook(supplemental)】Gerhard A. Holzapfel: Nonlinear Solid Mechanics: A Continuum Approach for Engineering, Wiley.

Javier Bonet, Antonio J. Gil, Richard D. Wood: Nonlinear Solid Mechanics for Finite Element Analysis: Statics, Cambridge University Press.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Public Finance

公共財政論

【Code】 10F203 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 4th

【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Kobayashi, Matsushima,

【Course Description】 The concept of public finance will be taught based upon the framework of Macro economics.

【Grading】 Final Exam: 60-70%

Mid-term Exam and Attendance: 30-40%

【Course Goals】 Understand the concept of public finance

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Explain the outline of this course
GDP and Circular flow model of macro economics	2	Explain about the circular flow model of macro economics and the definition of GDP
Input Output Table and General Equilibrium Model	2	Explain about the input-output table and its role on general equilibrium model
IS-LM Model	2	Explain about IS-LM model to analyze both goods market and money market
International Economics	2	Explain about the international account balance and IS-LM model with trade
AD-AS Model	2	Explain about AD-AS model which analyze the mid term
Economic Growth Model	2	Explain about economic growth model in which long term economic growth is analyzed
Summary	1	Summarize classes and check whether students could achieved its goal.
feedback	1	Accept feedback from students

【Textbook】

【Textbook(supplemental)】 Dornbusch et al., Macroeconomics 13rd edition, Mcgrow-hill, 2017
isbn9781259253409

【Prerequisite(s)】 Basic Microeconomics

【Independent Study Outside of Class】

【Web Sites】 will be notified in the first class.

【Additional Information】

Urban Environmental Policy

都市社会環境論

【Code】10F207 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 2nd

【Location】C1-173 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Ryoji Matsunaka

【Course Description】 This lecture aims to learn urban environmental policy and its fundamental theory and methodology to solve social and environmental problems that occur in urban area as well as to understand the structure of these problems.

【Grading】 evaluation by commitment, tests, reports and examination

【Course Goals】 to understand the structure of social and environmental problems in urban area and urban environmental policy, its fundamental theory and methodology to solve the problems

【Course Topics】

Theme	Class number of times	Description
Outline	1	
Structure of urban problems	3	Expansion of urban areas, Increase of Environmental impact, Making compact cities
Basic theory of transportation and environment	2	Downtown activation, Road space re-allocation, Pedestrianisation
Road traffic and Public transportation	2	Characteristics of traffic modes, Light Rail Transit, Bus Rapid Transit, Mobility Management
Fundamental theory for measurements of environmental values	3	Utility, Equivalent Surplus, Compensating Surplus
Methodology to measure environmental values	3	Travel Cost Method, Hedonic Approach, Contingent Valuation Method, Conjoint Analysis
Summary	1	

【Textbook】 No textbook

【Textbook(supplemental)】

【Prerequisite(s)】 basic knowledge of public economics is required

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantitative Methods for Behavioral Analysis

人間行動学

【Code】10F219 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 5th

【Location】C1-192 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Satoshi Fujii,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	3	
	3	
	3	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Intelligent Transportation Systems

交通情報工学

【Code】10F215 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Fri 2nd 【Location】C1-173

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】N. Uno and T. Yamada

【Course Description】 This class provides you with the outlines of engineering methodology with information and communication technology as its core element for improving the safety, efficiency and reliability of traffic and transportation systems and reducing the environmental burden. Concretely, we discuss the applicability of countermeasures, such as Travel Demand Management, modal-mix in transportation systems, traffic safety improvement schemes for relieving contemporary problems in traffic and transportation systems, in addition to brief introduction of innovative approaches to collect high-quality of real-time traffic data. Moreover, the methodology for policy evaluation and the related basic theory are explained.

【Grading】 Final report: 45%, Mid-term report: 45% and Mark given for class participation: 10%

【Course Goals】 Goal of this class is to cultivate basic and critical abilities of students for implementing effective traffic and transportation management using ITS (Intelligent Transportation System).

【Course Topics】

Theme	Class number of times	Description
Basics for Transportation Network Analysis	1	
Estimation of OD Traffic Volume using Observed Link Traffic Counts	1	
Analytical Approaches Based on Transportation Network Equilibrium	4	
Outlines of ITS	1	
Traffic Management for Enhancing Efficiency	2	
Innovative Approaches for Data Collection Using ICT	1	
Application of ITS for Enhancing Traffic safety	1	
Travel Demand Management and Congestion Charging	2	
Application of Traffic Simulation	2	
Feedback of evaluation of report examination to students	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Remote Sensing and Geographic Information Systems

リモートセンシングと地理情報システム

【Code】 10A805 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 2nd 【Location】 C1-117 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture & Exercise 【Language】 Japanese 【Instructor】 Nobuhiro Uno and Junichi Susaki

【Course Description】 Geoinformatics is the science and technologies dealing with spatially distributed data acquired with remote sensing, digital photogrammetry, global positioning system, etc. to address the problems in natural phenomena or human activities. This course particularly focuses on remote sensing by using LiDAR and geographic information system (GIS) and explains the theory and applications. Unlike traditional surveying, LiDAR technique can sequentially obtain the data in a wide area within a short time, and thus it is now widely used in construction and management of civil infrastructure. GIS is a technique to handle digital maps and related information, and it is popular in the fields of urban planning, environmental management and infrastructure management. This course provides an understanding of remote sensing and GIS via applications presented by the exercises of remote sensing and lectures of GIS.

【Grading】 Grading is based on the achievements in exercise and assignments.

【Course Goals】 Students understand the basic theory and acquire the basic techniques of remote sensing for observation and analysis of environmental changes, disaster effects and human activities in urban areas. And, they understand the basic theory and applications of GIS.

【Course Topics】

Theme	Class number of times	Description
Object extraction and landscape analysis from LiDAR data	1	The principle of Light detection and ranging (LiDAR) and the method to generate digital surface model (DSM) from point clouds are explained. As applications of LiDAR data, methods to extract objects by using geometric features and estimate landscape indices are introduced.
(Exercise) Field measurement by using LiDAR	2	Field measurement by using LiDAR is conducted in Katsura Campus.
(Exercise) Co-registration of LiDAR data and its assessment	1	LiDAR data are co-registered and its accuracy is assessed.
(Exercise) Vegetation extraction from LiDAR data and green space ratio estimation	1	Vegetation is extracted by using scattergram of point clouds. Green space ratio from an arbitrary viewpoint is calculated, and the vegetation landscape is assessed.
Satellite remote sensing	1	Basic terms on electromagnetic radiation including radiation and reflection are introduced, and calculation of surface reflectance and temperature is explained. In addition, principles and applications of visible and infrared sensors are introduced.
(Exercise) Vegetation coverage ratio estimation from satellite images	1	Vegetation index is calculated from an optical satellite image, and vegetation coverage ratio is estimated.
Introduction to GIS	1	Structure of GIS (Geographic Information System) and its utilization for spatial analysis are outlined.
GIS and Network Analysis	1	Basic idea of network structure, evaluation indices and methods of network analysis are explained.
GIS and Spatial Correlation Analysis	1	Focusing on spatial correlation analysis useful for developing spatial model, regression analysis and spatial auto correlation analysis are explained.
Classification Method of Spatial Attribute	1	Classification method of spatial attribute is explained in order to classify the target area using attribute information in GIS.
Transportation Big Data Collected by Mobile Objects Observation and Its Utilization	1	The changes in transportation observation led by progress of location identification technologies is stated. In addition, utilizations and issues of big data in transportation are explained.
Realization of Smart City and Big Data Utilization	1	The concept of Smart City and corresponding projects are introduced, and utilization and issues of big data for smart city are explained.
Analyses of Big Data	1	Analysis methods to utilize information of big data are explained. Especially, multivariate analysis and machine learning are outlined.
Assessment of understanding	1	Assess students' understanding levels

【Textbook】

【Textbook(supplemental)】 - Junichi Susaki and Michinori Hatayama, Geoinformatics, Corona Publisher, 2013

- W. G. Rees , Physical Principles of Remote Sensing 3rd ed., Cambridge University Press, 2013.

- J. A. Richards and X. Jia , Remote Sensing Digital Image Analysis: An Introduction, 5th ed., Springer-Verlag, 2013.

-M. Netler and H. Mitasova, Open Source GIS: A GRASS GIS Approach 3rd ed., The International Series in Engineering and Computer Science, 2008.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】 <http://www.gi.ce.t.kyoto-u.ac.jp/user/susaki/rsgis/index.html>

【Additional Information】 Students may be required to use their own laptop computer for exercise. Two exercises offered in the 1st and 2nd hour in a row are planned in April.

Civic and Landscape Design

景観デザイン論

【Code】 10A808 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Tue 3rd

【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture and practice

【Language】 Japanese 【Instructor】 Masashi Kawasaki, Keita Yamaguchi, Keiichiro Okabe

【Course Description】 Lecture for Landscape Design, Design of Urban infrastructure, and Landscape Architecture Practice

【Grading】 Reports (Kawasaki: 50%) and design practice (Okabe: 50%)

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Guidance. Landscape and image	1	Guidance, Lecture on landscape and image.
Architectural Design of city and urban facilities	3	Lecture on planning and designing about landscape design of urban facilities such as roads and plazas, parks, waterfront and waterfront and public space.
Landscape Design and Management	4	The history of landscape policy, the method of evaluating landscape, the case and method of landscape planning, examples and methods of urban design both in Japan and abroad
Landscape Architecture Practice	6	Designed for streets, parks
Feedback	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Risk Management Theory

リスクマネジメント論

【Code】 10F223 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Wed 3rd

【Location】 C1-173 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture and exercise 【Language】 English

【Instructor】 Muneta Yokomatsu, Cruz Ana Maria

【Course Description】 The aim of the class is to provide the basic knowledge of risk management methods for various types of risks such as natural disaster, environment and natural resources in urban and rural areas. Students will learn the decision making principle under risks in Economics and asset pricing methods in Financial Engineering as well as have exercises of application on public project problems.

【Grading】 20% of score is valued on attendance and discussion in classes, and 80% on reports.

【Course Goals】 It is targeted to understand 1) representative concepts of risk and risk management process, 2) expected utility theory and 3) foundation of Financial Engineering, and examine 4) public project problems by applying the above knowledge.

【Course Topics】

Theme	Class number of times	Description
Basic framework of risk management	2	1-1 Representative concept of risk 1-2 Risk management technologies
Decision making theory under risks	3	2-1 The Bayes' theorem 2-2 The Expected utility theory
Financial engineering	6	3-1 The Capital Asset Pricing Model 3-2 Option pricing theory 3-3 The arbitrage theorem 3-4 The Black-Scholes formula
Decision making methods for projects	3	4-1 The decision tree analysis 4-2 The real option approach
Comprehension check	1	5 Comprehension check

【Textbook】

【Textbook(supplemental)】 1.Ross, S.M.: An Elementary Introduction To Mathematical Finance, Cambridge University Press, 1999

2.Sullivan W.G.: Engineering Economy, Pearson, 2012

【Prerequisite(s)】 Fundamental understanding of probability

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Disaster Risk Management

災害リスク管理論

【Code】 10X333 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Wed 4th

【Location】 Research Bldg.5Main Lecture Rm 2F, Katsura C1-171 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture

【Language】 English 【Instructor】 TATANO Hirokazu, YOKOMATSU Muneta,, SAMADDAR SUBHAJYOTI

【Course Description】 Natural disasters have low frequencies but high impacts. It is very important to make an integrated risk management plan that consists of various countermeasures such as prevention, mitigation, transfer, and preparedness. This class will present economic approaches to natural disaster risk management and designing appropriate countermeasures.

【Grading】 Evaluate mainly by the presentations in the class as well as end-of-term report, taking active and constructive participation in the class into account.

【Course Goals】 Students are expected to understand fundamental ways of economic analyses of disaster prevention such as economic valuation of disaster losses, decision making principle under risks, derivation of benefits of risk management.

【Course Topics】

Theme	Class number of times	Description
Introduction to disaster risk management	1	Introduction and Explanation of Course Outline, The Global Trends of Natural Disasters
1. Decision making theory under uncertainty	1	Bayes' theorem, Expected utility function
Methods of disaster risk management	1	Risk control and risk finance
Economic valuation of catastrophic risk mitigation	1	Cost-Benefit analysis, conventional valuation method, catastrophic risks and economic valuation of disaster mitigation
Risk perception bias, land-use and risk communication	2	Risk perception bias, land-use model, risk communication
Disaster risk finance	2	Recent issues of risk finance market, reinsurance, CAT bond, roles of government, derivatives
Risk curve and risk assessment	1	Fragility curve and risk assessment
General equilibrium analysis under disaster risk	1	General equilibrium model under disaster risk
Macrodynamics under disaster risk	1	GDP, economic growth
Disaster accounting	1	Accounting systems
Exercise and presentation	2	Students' exercise and presentation
Confirmation of the learning achievement degree	1	Confirmation of the learning achievement degree

【Textbook】 Tatano,H., Takagi,A.(ed.):Economic Analysis of disaster prevention, Keiso pub.,2005 (in Japanese).

【Textbook(supplemental)】 Froot ,K.A.(ed) “ The Financing of Catastrophic Risk ” , the University of Chicago Press Kunreuther H. and Rose, A., “ The Economics of Natural Hazards ” , Vol.1 & 2, The International Library of Critical Writings in Economics 178, Edward Elgar publishers, 2004

Okuyama, Y., and Chang, S.T.,(eds.) “ Modeling Spatial and Economic Impacts of Disasters ” (Advances in Spatial Science), Springer, 2004.

【Prerequisite(s)】 Nothing

【Independent Study Outside of Class】

【Web Sites】 No web site

【Additional Information】

Disaster Information

防災情報特論

【Code】 10X714 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Wed 3rd 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Hirokazu Tatano(DPRI), Katsuya Yamori(DPRI), Michinori Hatayama(DPRI), Onishi.Masamitsu(DPRI),

【Course Description】 This lecture gives an outline of disaster prevention and reduction countermeasures both inside and outside Japan with special reference to disaster information related topics. Concrete examples of disaster information systems are introduced to show that psychological aspect of information users under critical social conditions is carefully taken into account in such current disaster information systems.

【Grading】 Submit every class reports and end-of-term report Every class reports:

“ Point out 3 discoveries for you and 1 request which you want to know more with reasons in this class.

Submit report via Email by the following rules

1. Address: disaster,nfo@imdr.dpri.kyoto-u.ac.jp
2. subject: “ Disaster Information Report [Date] Student ID, Name ”
3. Don ' t use attached file.
4. Dead line: Next Tuesday

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
What is disaster prevention?	1	
Information system in emergency	2	
Information system in emergency	1	
Case examples on introduction of disaster information system	1	
Information system for evacuation planning,	1	
Information system for rescue activity	1	
Social psychological study of disaster information	2	
Disaster information and evacuation behavior	2	
Gaming approach to disaster risk communication	3	
Test	1	

【Textbook】 Nothing

【Textbook(supplemental)】 Only Japanese Books

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Office Hours: After Class, Make an appointment immediately after.

Questions via Email: disaster,nfo@imdr.dpri.kyoto-u.ac.jp

Theory & Practice of Environmental Design Research

環境デザイン論

【Code】 10A845 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 2nd

【Location】 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 ,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	6	
	5	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Resources Development Systems

資源開発システム工学

【Code】 10A402 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 1st

【Location】 C1-172 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Sumihiko Murata, Assoc. Prof., Dept. of Urban Management

【Course Description】 Development of mineral resources and energy resources is essential to the sustainable development of our society. In this class, the exploration and development process of natural resources are reviewed including the environmental conservation and harmony. In addition, fundamentals of reservoir engineering for the evaluation of production behavior and reserves of oil and natural gas are lectured.

【Grading】 Evaluation is made by the average score of report problems. They are presented 2 or 3 times in the semester.

【Course Goals】 The goal of this class is to understand the natural resources development concerning environment and master the reservoir engineering needed for the exploration and development of oil and natural gas resources.

【Course Topics】

Theme	Class number of times	Description
From exploration to development of natural resources	1	The exploration and development processes of mineral and energy resources, which are essential to the sustainable development of our society, are reviewed including the environmental conservation and harmony.
Fundamentals of reservoir engineering	3	The properties of reservoir fluids and the material balance method to evaluate the reserve of oil and natural gas are explained.
Fluid flow in the reservoir	7	Basic equations of multi-phase fluid flow in the reservoir and analytical solution for the flow of oil and natural gas around a well are explained. Furthermore, the concept and the method of well test analysis are also explained.
Enhanced oil and natural gas recovery	4	The displacement processes of oil and gas in a reservoir are explained. Furthermore, methods of enhanced oil and gas recovery (EOGR) are overviewed, and the essentials of each EOGR method are explained.

【Textbook】 Handouts are delivered.

【Textbook(supplemental)】 L.P.Dake, Fundamentals of Reservoir Engineering, Developments in petroleum science Vol.8, Elsevir, ISBN 0-444-41830-X

【Prerequisite(s)】 It is desirable to have knowledge of calculus of undergraduate level.

【Independent Study Outside of Class】 Self study is required using supplemental book.

【Web Sites】 Web page of this class is not provided. Information is shown in the class when it is needed.

【Additional Information】 Office hours are set 10:30-12:00 and 14:30-16:00 on the same day of the class.

Applied Mathematics in Civil & Earth Resources Engineering

応用数理解析

【Code】10F053 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 3rd

【Location】C1-192 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	2	
	4	
	5	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Environmental Geosphere Engineering

地殻環境工学

【Code】10A405 【Course Year】Master Course 【Term】1st term 【Class day & Period】Wed 2nd 【Location】C1-171

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】Katsuaki KOIKE,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction of structure and content of this course	1	
Physics of Earth system	2	
Chemistry of Earth system	3	
Fundamentals of Geoinformatics (1): Spatical modeling techniques	2	
Fundamentals of Geoinformatics (2): Scaling of geological structure	1	
Fundamentals of Geoinformatics (3): Remote sensing	2	
Fundamentals of Geoinformatics (4): Earth survey and geochemical exploration	1	
Geosphere environments (1): Weathering process and geohazards	2	
Geosphere environments (2): CCS and HLW	1	
Mineral and energy resources	1.5	

【Textbook】Handouts will be distributed at each class.

【Textbook(supplemental)】References will be introduced in the handouts.

【Prerequisite(s)】Fundamental knowledges on geology, physics, and chemistry are required.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Applied Elasticity for Rock Mechanics

応用弾性学

【Code】10F071 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Fri 3rd
 【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
 【Instructor】Sumihiko Murata, Assoc. Prof., Dept. of Urban Management

【Course Description】Theory of elasticity relating to the deformation and failure of rock and rock mass and design of rock structures is explained. Specifically, two-dimensional analysis of elasticity using the basic equations, constitutive equations, and the complex stress function are explained. In addition, poroelasticity is explained. Several applications of this analysis to rock mechanics, rock engineering, and fracture mechanics are also explained.

【Grading】Evaluation is made by the score of two report problems or homeworks (25% each) and semester final examination (50%).

【Course Goals】The goal of this class is to master the theory of elasticity so as to solve the elastic problem in rock mechanics, rock engineering, and fracture mechanics.

【Course Topics】

Theme	Class number of times	Description
Airy ' s stress function and complex stress function	2	Airy ' s stress function used to solve a two-dimensional elastic problem is first explained, and then the complex stress functions that are the representation of Airy ' s stress function by the complex variables are explained.
Two-dimensional elastic analysis using the complex stress function	8	Analytical solutions of two-dimensional elastic problems in fracture mechanics and rock engineering are derived by using the complex stress functions. The mechanical behavior of rock material is also explained based on the derived solutions.
Application of two-dimensional elastic analysis	2	The theory of rock support, ground characteristic curve, theoretical equations used for the evaluation of rock stress, which are derived from the solution of two-dimensional elastic problem, are explained.
Poroelasticity	2	Basic equations and parameters of poroelasticity are explained. Futhrermore, the applications of poroelasticity are explained.
Summary and Achievement check	1	The contents of this class are summarized. In addition, the achievement of course goals is checked.

【Textbook】Handouts are delivered.

【Textbook(supplemental)】J.C. Jaeger, N.G.W. Cook, and R.W. Zimmerman: Fundamentals of Rock Mechanics -4th ed., Blackwell Publishing, 2007, ISBN-13: 978-0-632-05759-7

【Prerequisite(s)】The knowledge and calculation skill of calculus, vector analysis and complex analysis are required.

【Independent Study Outside of Class】Review of the each class is required.

【Web Sites】Web page of this lecture is not provided. When preparing it by need, the information is shown in the class.

【Additional Information】Office hour is set 10:30-12:00 and 14:30-1600 on the same day of the class.

Fundamental Theories in Geophysical Exploration

物理探査の基礎数理

【Code】10F073 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 3rd
 【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
 【Instructor】Hitosih Mikada, Junichi Takekawa

【Course Description】We are outlining various basic mathematical principles used for the analysis of the dynamic and kinematic earth-scientific problems in conjunction with wave propagation, mass transfer, etc. in the crust, and presenting examples of such analysis techniques in the area of earth sciences and earth resources engineering.

【Grading】Rating is performed by the combination of exams (40%) and the attendance to the class (60%).

【Course Goals】The aims of the class is to understand various signal-processing theories, the applied seismology, and the applied geo-electromagnetics with respect to exploration geophysics as application tools in seismology and in geo-electromagnetics.

【Course Topics】

Theme	Class number of times	Description
Introduction to exploration geophysics	1	General introduction to the lecture.
Seismic wave propagation and signal processing	8	Acquire knowledge on the propagation phenomena of elastic waves to learn the equivalency of 1D propagation with the theory of system function. The topics included would be, z-transform, Levinson recursion, Hilbert transform, etc.
Fundamentals of geo-electromagnetics and their application to exploration geophysics	5	Learn fundamental theories of magnetotellurics, instantaneous potential, spontaneous potential, and apparent resistivity methods, etc. that deal with geo-electromagnetic phenomena. Case studies are introduced to understand the advantages of geo-electromagnetic exploration schemes.
Wave propagation problem in seismic exploration	1	Discussing fundamental theories of elastic wave propagation, used in subsurface structural surveys, in terms of the actual utilization and the theories of wave phenomena.

【Textbook】

【Textbook(supplemental)】Claerbout, J.F. (1976): Fundamentals of Geophysical Data Processing (Available online URL: <http://sep.stanford.edu/oldreports/fgdp2/>)

【Prerequisite(s)】Students should understand exploration geophysics of undergraduate level.

【Independent Study Outside of Class】

【Web Sites】Could be specified by the lecturers if any.

【Additional Information】

Underground space and petrophysics

地下空間と地殻物性

【Code】10F076 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Tue 3rd

【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Professor Weiren Lin, Professor Tsuyoshi Ishida, Professor Toshihiro Sakaki, Part-time Lecture
Tatsuya Yokoyama

【Course Description】In this course, we will give lectures on the physical properties and mechanical properties of rocks under large depths, in-situ stress, stability of underground spaces such as radioactive waste disposal and traffic tunnels.

【Grading】

【Course Goals】Understand the representative physical properties of rocks under high temperature and high pressure, measurement methods of in-situ stress and their applications in radioactive waste disposal and traffic tunnels.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	Introduce the contents of the course.
Physical properties and strength of rocks	4	Physical properties (elastic wave velocity, resistivity, fluid flow and thermal properties) and mechanical properties (strength and deformation).
Rock stress and its measurements	2	Measurement methods of in-situ stress such as relief method, hydraulic method etc.
Underground stability and rock stress problems	2	Stability of large underground spaces (e.g., South Africa gold mines) and their relations with in-situ stress.
Radioactive waste repository	3	Concept and designs of radioactive waste repository for a long time scale
Tunnel	2	Survey, designs, construction and maintenance of traffic tunnels
Feedback	1	

【Textbook】No set text

【Textbook(supplemental)】Instructed in class

【Prerequisite(s)】Taking Underground Development Engineering and Rock Engineering (when undergraduate) are desirable.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Lecture on Exploration Geophysics

探査工学特論

【Code】 10A420 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Wed 4th

【Location】 C1-117 【Credits】 2

【Restriction】 The class of Fundamental theories of geophysical exploration is recommended to acquire.

【Lecture Form(s)】 Lecture 【Language】 English 【Instructor】 Hitosih Mikada, Junichi Takekawa

【Course Description】 Applied geophysical exploration technologies in disaster mitigation, civil engineering, and earth resources engineering is discussed in terms of seismological and of electromagnetic theories. Students may be asked to process data or design digital filters in the course.

【Grading】 Brief explanations on the grading will be given at the time of the lecture.

【Course Goals】 Understanding seismological and electromagnetic theories used in geophysical exploration and subsurface-imaging technologies.

【Course Topics】

Theme	Class number of times	Description
Electromagnetic signal processing	3	Principles of magnetotelluric methods, electromagnetic sources and noise reduction.
Modeling technologies in electromagnetic methods	3	Subsurface structure modeling in EM methods. The effects of surface weathered layers, the identification of spatial dimensions, and modeling methodologies are discussed.
Signal processing in seismics	4	Digital filtering in seismic data processing.
Reflection seismology	3	Fundamental theories of reflection seismic data processing. Seismic migration is the one to be briefly discussed.
Petrophysics	2	Fundamental petrophysics, and fundamental measurement theories in geophysical logging are discussed.

【Textbook】 Specified in the course.

【Textbook(supplemental)】 J.F.Claerbout, 1976, Fundamentals of Geophysical Data Processing, (OOP:photocopies to be specified)

【Prerequisite(s)】 The credits of Exploration Geophysics in undergraduate course and Fundamental Theories of Geophysical Exploration in graduate course are requested to obtain before the classes.

【Independent Study Outside of Class】

【Web Sites】 Would be specified by the lecturers.

【Additional Information】

Measurement in the earth's crust environment

地殻環境計測

【Code】10F085 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 3rd 【Location】C1-192

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English

【Instructor】Tsuyoshi ISHIDA, Yoshitaka NARA, Koji YAMAMOTO, Kiyoshi AMEMIYA

【Course Description】Information necessary to understand environment in the upper layer of the earth's crust will be explained for various engineering projects. Among them, measurements of rock stress and mechanical properties of rock will be focused in the relation to the projects of oil and gas exploitation, underground disposal of radio active waste, geological sequestration of CO₂, construction of underground power houses and hot dry rock geothermal power extraction.

【Grading】Grading will be made from scores of the followings; report for subjects, achievement tests and number of attendance to the classes.

【Course Goals】Goals of this course are the followings. 1) To understand effects of initial rock stress on stability of underground chambers for various purposes. 2) To understand a stress relief method as one of typical rock stress measurement. 3) To understand the principle of a least square method though learning a procedure to determine initial rock stress condition from released strains measured on a borehole wall. 4) To understand effects of rock stress for oil and gas exploitation through borehole breakout problems and others. 5) To understand purposes and latest technologies for long term monitoring up to 100,000 years. 6) To understand mechanical properties of rock (strength, permeability, fracturing, etc.) under different environmental condition with methodology of their measurements.

【Course Topics】

Theme	Class number of times	Description
Importance of rock stress condition in underground development (by ISHIDA)	3	Necessity of rock stress measurements and their applications for various engineering projects will be explained. Among the projects, underground disposal of radio active waste, geological sequestration of CO ₂ , construction of underground power houses and hot dry rock geothermal power extraction will be focused.
Stress relief methods to measure rock stress and application of least square method (by ISHIDA)	3	Actual field works of stress relief methods to measure initial rock stress condition will be explained. Though learning a procedure to determine an initial rock stress condition from released strains measured on a borehole wall, the principle of a least square method will be explained. The report subject will be shown in the last week.
Effect of rock stress on oil and gas exploitation	4	Estimation of rock stress condition by hydraulic fracturing and logging, which is conducted at various steps for oil and gas exploitation, will be explained. Importance of rock stress affecting on borehole stability will be explained as well.
Monitoring in Deep Underground Facility - to ensure the long term stability-	2	The purposes and latest technologies of monitoring are shown in this lecture, focusing on the methods of ensuring the long term (up to 100,000 years) safety assessment of radioactive waste disposal.
Measurement of mechanical properties of rock under various environment	2	Mechanical properties of rock (strength, permeability, fracturing, etc.) under different environmental condition are shown, as well as the methodology of measurements. In addition, the relationship between the rock properties and radioactive waste disposal is described.
Confirmation of understanding	1	Feedback through tests and others.

【Textbook】None. Handouts will be given in classes when needed.

【Textbook(supplemental)】1) Amadei, B. & Stephansson, O.: Rock Stress and Its Measurements, Capman & Hall, 1977.

2) Vutukuri, V. S. & Katsuyama, K.: Introduction to Rock Mechanics, Industrial Publishing & Consulting, Inc., Tokyo, 1994.

【Prerequisite(s)】Elasticity, Linear Algebra (Calculation of Matrices) and Computer Literacy (for example, Excel, Word and so on.)

【Independent Study Outside of Class】When you make a report, it is necessary to calculate matrixes by using a Microsoft Excel and others.

【Web Sites】

【Additional Information】This class is made by English.

Earth Resources Engineering

地球資源学

【Code】10F088 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 2nd 【Location】C1-171

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English 【Instructor】Katsuaki Koike

【Course Description】Securance and development harmonious with natural environments of the mineral and fossil energy resources, and utilization of storage function of geologic strata have become important issues for constructing sustainable society. This subject introduces comprehensively the present situation of uses of mineral and energy resources, crust structure and dynamics, economic geology for the genesis and geologic environments of deposits, physical and chemical exploration methods of marine deposits, mathematical geology for reserve assessment, engineering geology for resource development and geological repository, and problems and promise of natural energy such as geothermal, solar, wind, and tide.

【Grading】Integrated evaluation of report grades and attendance to the classes. The attendance includes answer to short quiz to make sure the understanding, etc. Weight of these two items is about 9:1.

【Course Goals】To find out directionality about the technologies required for constructing sustainable society by yourself with full understandings of genetic mechanism, biased distribution, and the present situation of demand and supply of the mineral and energy resources.

【Course Topics】

Theme	Class number of times	Description
Introduction of this course and resources	1	Definition of renewable and non-renewable resources. Interaction among Earth environment, human society, and natural resources. Existence pattern of natural resources in the crust.
1. Internal structure of Earth and geodynamics	2	Inner structure of the Earth, geodynamics, geologic composition, temperature structure, rock physics, and chemical composition of crust.
2. Present and future of energy resources	1	Classification of energy sources, recent trend on social demand of energy, physical characteristics of each energy resources, and sustainability.
3. Present and future of mineral resources	1	Classification of minerals used for resources, recent trend on social demand of mineral resources, industrial uses of each mineral, and sustainability.
4. Economic geology (1)	1	Classification of ore deposits, distribution of each type of ore deposit, generation mechanism of deposit.
4. Economic geology (2)	1	General structure and distribution of fuel deposits (coal, petroleum, and natural gas), generation mechanism of deposits, and geological process of formation.
5. Resource exploration (1): Terrestrial area	1	Physical and chemical exploration technologies for natural resources in terrestrial area. Representative methods are remote sensing, electric sounding, electromagnetic survey, and seismic prospecting.
6. Resource exploration (2): Sea area	1	Introduction of marine natural resources such as methane hydrate, cobalt-rich crust, and manganese nodule, and exploration technologies for the deposits in sea area.
7. Assessment of ore reserves and deposit characterization	2	Fundamentals of geostatistics, variography for spatial correlation structure, spatial modeling by kriging, geostatistical simulation, integration of hard and soft data, and feasibility study.
8. Resource development	1	Development and management technologies of energy resources related to coal, petroleum, and natural gas.
9. Engineering geology	1	Fundamentals of deep geological repository for high-level nuclear waste, CCS (carbon dioxide capture and storage), and underground storage of petroleum and gas.
10. Sustainability	1	Characteristics of natural energy related to geothermal, solar, wind, and tide, and assessment of natural energy resources. Co-existence of natural resource development with environment, low-carbon society, and problems for human sustainability.
Feedback	1	Based on evaluation of the reports, contents that are not well understood will be explained additionally using KLUSIS or by personal interview.

【Textbook】Printed materials on the class contents are distributed at each class.

【Textbook(supplemental)】References on each topic will be instructed in the classes.

【Prerequisite(s)】Elementary knowledge of engineering, mathematics, physics, and geology are required.

【Independent Study Outside of Class】Deepen the understanding by solving assignments.

【Web Sites】

【Additional Information】This course is opened every two years, and not opened in 2018.

Urban Infrastructure Management

都市基盤マネジメント論

【Code】 10X311 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 3rd

【Location】 C1-173 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 OHTSU Hiroyasu,

【Course Description】 This lecture aims to provide interdisciplinary knowledge associated with how urban infrastructure is comprehensively management, from viewpoints of not only economy but also “ human security engineering ” . In detail, the contents of lectures consist of following topics: Urban Infrastructure Asset Management, Urban Disaster Risk Mitigation Management, Urban Transport/Logistics Management and Urban Food/Water Supply Management.

【Grading】 Attendance(20), Report(80)

【Course Goals】 Aquisition of interdisciplinary knowledge associated with how urban infrastructure is comprehensively management, from viewpoint of not only economy but also human security engineering.

【Course Topics】

Theme	Class number of times	Description
Guidance, Introduction of Urban Infrastructure Asset Management	1	Guidance & Introduction to Urban Infrastructure Asset Management
Urban Infrastructure Asset Management	4	Urban Infrastructure Asset Management on Geotechnical structures and Bridge
Urban Disaster Risk Mitigation Management	3	Urban Disaster Risk Mitigation Management
Urban Food/Water Supply Management	3	Urban Food/Water Supply Management
Urban Transport/Logistics Management	2	Urban Transport/Logistics Management
Report	1	Report
Feed back	1	Feed back

【Textbook】

【Textbook(supplemental)】 Hand-out

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Additional information is available by visiting the following professors. Appointment shall be made in advance by e-mail.

ohtsu.hiroyasu.6n@kyoto-u.ac.jp

Global Survivability Studies

グローバル生存学

【Code】10F113 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Thu 5th

【Location】Yoshida, Higashi Ichijokan, Shishukan Hall 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】English 【Instructor】Kaoru Takara, Junji Kiyono, Satoshi Fujii, Takahiro Sayama, Mika Shimizu

【Course Description】Modern global society is facing risks or social unrests that are caused by huge natural hazards and disasters, man-made disasters and accidents, regional environmental change/degradation including infectious diseases, and food security. Introducing such examples at global and regional scales, this subject lectures how to cope with them at national, local and community levels for making the society sustainable/survivable. Future countermeasures are also discussed under the uncertain circumstances such as climate change, population growth, energy and socio-economic issues.

【Grading】Attendance to lectures (40%) and Presentation and discussion (60 %).

【Course Goals】The objectives of this class are to have basic knowledge about global issues threatening safety and security of the earth society such as catastrophic natural disasters, man-made disasters and accidents, regional environmental change (including infectious diseases) and food security, and to enhance student's ability to express his/her own ideas and discuss with professors and students from other study areas.

【Course Topics】

Theme	Class number of times	Description
Introduction of Global Survivability Studies	1	Introduction of Global Survivability Studies.
Earthquake disaster mitigation	1	Discuss on earthquake disaster mitigation focusing on lessons learnt from Tohoku EQ.
Mitigation of earthquake damage to historic structures	1	Discuss on the mitigation of earthquake damage to historic structures.
Why we need GSS?	1	Discuss on why we need Global Survivability Studies (GSS).
Global agendas for sustainable development and resilient societies	1	Discuss on global agendas for sustainable development and resilient societies.
Building national resilience in Japan	1	Discuss on building national resilience based on Japanese experiences.
Globalism as totalitarianism	1	Discuss on globalism as totalitarianism.
Public policy and systems approach for global changes in disaster risks	1	Lecture and group work on public policy and systems approach for global changes in disaster risks.
Disaster risk management and governance for global changes	1	Lecture and group work on disaster risk management and governance for global changes.
Water-related disaster risk management	1	Discuss on water-related disaster risk management: concept and recent experiences.
Water cycle and climate change	1	Discuss on water cycle and climate change.
Presentation by students & discussions	4	Presentation by students related to this lectures and discussions on the presented topics.

【Textbook】Nothing special.

【Textbook(supplemental)】Nothing special.

【Prerequisite(s)】Nothing special.

【Independent Study Outside of Class】If handouts (teaching materials) are distributed (or downloaded from the website), students should read them prior to the class. They may be distributed at the classroom (or put on the website). Students can make use of them after the class for reviewing lectures and preparing presentation materials and discussion sessions which will be organized in the latter half of the semester.

【Web Sites】

【Additional Information】This subject is compulsory for students enrolled in the Inter-Graduate School Program for Sustainable Development and Survivable Societies. Students other than ones in Graduate School of Engineering should submit a registration card for taking this class.

Emergency Management Systems

危機管理特論

【Code】10X715 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Mon 3rd

【Location】Faculty of Engineering Integrated Research Bldg. 213 【Credits】2 【Restriction】No Restriction

【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】Haruo HAYASHI, Norio MAKI, Shingo SUZUKI,

【Course Description】Damage from disasters is defined by two factors: scale of hazard and social vulnerability. Two strategies exist to reduce damage from disasters?namely, crisis management as a post-event countermeasure and risk management as a pre-event measure. This course introduces students to a system for effective emergency management, consisting of response, recovery, mitigation, and preparedness.

【Grading】Every after lecture, please submit short report writing following things 1) Three points you could learn in this lecture, and reason 2) What you would like to explain more? Please send your short report to following address by following formats 1.address: disaster.reporti2@drs.dpri.kyoto-u.ac.jp 2.subject: 「Emergency Management Report “ date ” “ ID ” “ Name ” 3.No attach file

【Course Goals】Learning about Techniques for Business Continuity Management consisted of Risk Assessment, Strategic Planning, Emergency Response, and Training.

【Course Topics】

Theme	Class number of times	Description
Business Continuity Management	3	What is emergency response, and business continuity management.
Risk Assessment	3	Techniques for Risk Identification, and Risk Assessment
Strategic Planning	3	Techniques for Strategic Planning and Evaluation
Emergency Response	3	Incident Command System, and Design of Emergency Operation Center
Training	3	Learning, drill, Exercises for Emergency Response

【Textbook】Haruo Hayashi et.al., Soshiki no Kikikanri Nyuumon, Maruzen, 2008// Kyodai, NTT Resilience Kennkyuu Group, Shinayakana Syakai no Souzou, Nikkei BP, 2009

【Textbook(supplemental)】Tom Demarco et.al, Waltzing With Bears: Managing Risk on Software Projects, Dorset House, 2003// Project Management Institute : A Guide to the Project Management Body of Knowledge 2000 Edition , Project Management Institute, Inc , 2000// R. Max Wideman : Risk Management - A guide to Managing Project Risk & Opportunities - , Project Management Institute, Inc , 2000// Memorial Conference in Kobe, 12 sai karano hisaisya gaku, NHK Press, 2005//

【Prerequisite(s)】

【Independent Study Outside of Class】Submit a short report about what they have learned in a lecture before next lecture.

【Web Sites】

【Additional Information】

Urban Transport Policy

都市交通政策フロンランナー講座

【Code】10Z001 【Course Year】Master and Doctor Course 【Term】1st term

【Class day & Period】see the handbook for course registration

【Location】conference room, TPU karasuma office (see the handbook for course registration) 【Credits】1

【Restriction】see the handbook for course registration 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】Ryoji Matsunaka, Tetsuharu Oba

【Course Description】 This class will provide lectures on the new transport policy carried out in domestic and foreign cities and to understand the difference between the conventional transport policy and the new urban transport policy. Also, it will cover a process to realize the new urban transport policy.

【Grading】 evaluation by attendance and class participation

【Course Goals】 to understand the difference between the conventional transport policy and the new urban transport policy

【Course Topics】

Theme	Class number of times	Description
Outline	1	
Front runner of urban transport policy in the world	2	Reallocation of road space, Pedestrianisation
Front runner of urban transport policy in Japan	1	Downtown activation, Strategies of sustainable transport for our cities, Climate change
Front runner of urban transport policy in Kyoto	2	Eco model city, Transport demand management, Public transport network
Discussion	2	

【Textbook】 No textbook

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】 <http://www.upl.kyoto-u.ac.jp/index.html>

【Additional Information】

Policy for Low-Carbon Society

低炭素都市圏政策論

【Code】 10Z002 【Course Year】 Master and Doctor Course 【Term】 1st term

【Class day & Period】 see the handbook for course registration

【Location】 conference room, TPU karasuma office (see the handbook for course registration) 【Credits】 1

【Restriction】see the handbook for course registration 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】 Ryoji Matsunaka, Masashi Kawasaki

【Course Description】 This class will provide lectures on the contents of policies and the methods to realize a low carbon society. Also, it will cover the knowledge and the technical skill to relate to urban activation, reduction of the environmental load, compact city planning, and so on.

【Grading】 evaluation by attendance and class participation

【Course Goals】 to understand the knowledge and the technical skill to relate to urban activation, reduction of the environmental load, compact city planning, and so on.

【Course Topics】

Theme	Class number of times	Description
Measures against global warming	1	Plan for measures against global warming, Eco model city
Urban policy management for low-carbon society	1	Eco model city, Guideline for low-carbon city construction
Landscape & environmental planning	1	Landscape design in public space, View structure
Urban policy for low-carbon society and change of urban structure	1	Public transport, Pedestrianisation
Roles and issues of urban transport policy	1	Transport and urban policy, Transport policy in EU, Railways, Light Rial Transit
Discussion	3	

【Textbook】 No textbook

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】 <http://www.upl.kyoto-u.ac.jp/index.html>

【Additional Information】

Urban Transport Management

都市交通政策マネジメント

【Code】 10Z003 【Course Year】 Master and Doctor Course 【Term】 1st term

【Class day & Period】 see the handbook for course registration

【Location】 conference room, TPU karasuma office (see the handbook for course registration) 【Credits】 1

【Restriction】see the handbook for course registration 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】 Ryoji Matsunaka, Satoshi Fujii, Nobuhiro Uno

【Course Description】 This class will provide lectures on characteristics and problems of transport modes such as car, public transport, and foot. Also, it will cover the technical skill to analyze present urban traffic problems quantitatively.

【Grading】 evaluation by attendance and class participation

【Course Goals】 to understand characteristics and problems of transport modes such as car, public transport, and foot.

【Course Topics】

Theme	Class number of times	Description
Plan and practice of public transport	2	City activation and attractiveness, Public transport, Light rail transit, Bus
Basic concept of mobility management	1	Mobility management, Activation of the public transport, Downtown activation
Investigation, interpretation, and evaluation on urban traffic phenomenon	2	Person trip survey, Transportation demand management, Cost-benefit analysis
Exercise and discussion	3	

【Textbook】 No textbook

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】 <http://www.upl.kyoto-u.ac.jp/index.html>

【Additional Information】

Engineering Seminar for Disaster Resilience in ASEAN countries

強靱な国づくりのためのエンジニアリングセミナー

【Code】10F380 【Course Year】Master 1st 【Term】Late August 【Class day & Period】Late August

【Location】School of Engineering, Kasetsart University, Bangkok, Thailand 【Credits】2

【Restriction】Due to the capacity, students attending “ Study Area of Approaches for Disaster Resilience ” have priority.

【Lecture Form(s)】Intensive Lecture 【Language】English

【Instructor】Prof. Hiroyasu Ohtsu, Related lecturers in ASEAN collaborative universities,

【Course Description】The purpose of this course is to provide practical lessons in ASEAN countries associated with disaster risk mitigation such as early warning and evacuation program, and disaster recovery/restoration from viewpoints of problems-finding/problem-solving through short term intensive lecture and field work. By taking the applied practical programs of shared major classes under the instructions of teachers in charge, the students can improve the ability of resolving issues on practical projects. Topics taught in this seminar are earthquake, flood, landslide, land subsidence, and geo-risk engineering.

【Grading】40% for course work assignments and reports, 60% for final exam.

【Course Goals】Course aims to foster international leaders who are able to solve and manage problems concerned about natural disaster, disaster mitigation, health and environmental issues, especially about case studies in ASEAN countries.

【Course Topics】

Theme	Class number of times	Description
Introduction:		
Engineering for Disaster Resilience	1	
Earthquake Disaster	2	
Landslide Disaster	2	
Geo-Risk Engineering	2	
Flood Disaster	2	
Land Subsidence	2	
Site Visit	5	
Evaluation of understanding	1	

【Textbook】Lecture notes provided by the instructors.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】Consortium for International Human Resource Development for Disaster-Resilient Countries, Kyoto University <http://www.drc.t.kyoto-u.ac.jp/rsdc/eng/>

【Additional Information】Those who want to take this course have to apply for Study area of Approaches for Disaster Resilience. Refer the website above.

Disaster and Health Risk Management for Liveable City

安寧の都市のための災害及び健康リスクマネジメント

【Code】 10F382 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Intensive course (2 weeks)

【Location】 Meeting room at Research Bldg. No.5 【Credits】 2 【Restriction】 30 students, priority for DRC course students

【Lecture Form(s)】 Relay Lecture 【Language】 English 【Instructor】 Kiyono, Koyama, Kikuchi, Mitani, Fujii, Kawasaki, Ando, Teo,

【Course Description】 Various types of disasters constantly attack to Asian countries, and those countries sometimes are very vulnerable to the natural disasters and health risk. The interdisciplinary approach of engineering and medical science is indispensable to construct disaster-resilient countries. The 2011 Tohoku earthquake was one of the worst disasters in recent Japanese history.

However many lessons to mitigate and manage the disaster are learnt from the event. In order to solve the related issues, the course provides selected topics about natural disaster, disaster-induced human casualty, emergency response, urban search and rescue, emergency medical service, principle of behavior based on neuroscience, urban search and rescue, reconstruction and rehabilitation policy, social impact of disaster, transportation management, logistics during earthquake disaster and so on.

【Grading】 Course work assignments and reports

【Course Goals】 Course aims to foster international leaders who are able to solve and manage problems concerned about natural disaster, disaster mitigation, health and environmental issues, logistics and amenity for constructing liveable city.

【Course Topics】

Theme	Class number of times	Description
Guidance and Group Work	2	
ORT	3	
Earthquake disaster and human casualty	1	
Earthquake protection and emergency responses	1	
Human brain function and behavior	1	
Disaster medicine and epidemiology	1	
Resilient society	1	
Transition of the design for amenity in the river-front	1	
Concern that elderly people in rural area have over health and mobility	1	
Differences in logistics and humanitarian logistics	1	
Unique challenges of humanitarian logistics	1	
Advancement on humanitarian logistics	1	
Achievement evaluation	1	

【Textbook】 Textbook for the course is provided by the instructor on the first day.

【Textbook(supplemental)】 Some literatures would be introduced by professors.

【Prerequisite(s)】 No special knowledge and techniques are necessary.

【Independent Study Outside of Class】

【Web Sites】 Consortium for International Human Resource Development for Disaster-Resilient Countries, Kyoto University

<http://www.drc.t.kyoto-u.ac.jp/>

【Additional Information】 Contact person: Prof.Kiyono <kiyono@quake.kuciv.kyoto-u.ac.jp

エネルギービジネス展開論

【Code】 10X752 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Tue 5th

【Location】 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	9	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Project Management in Engineering

エンジニアリングプロジェクトマネジメント

【Code】 10i049 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 4th 【Location】 A2-308 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu

Assoc.Prof. Lintuluoto, J. Assoc. Prof. Tanaka

【Course Description】 This course provides a basic knowledge required for the project management in various engineering fields such as process design, plant design, construction, and R&D projects. Also, visiting lecturers from industry and public works provide management insights of actual engineering projects.

【Grading】 Evaluated by assignments (project report exercise) and class contribution

【Course Goals】 This course will help students gain a fundamental knowledge of what project management in engineering is. Throughout the course, students will learn various tools applied in project management. Students will also understand the importance of costs and money, risks, leadership, and environmental assessment in managing engineering projects. This course is followed with the course Seminar on Project Management in Engineering. in the second semester.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	4/13 (Matsumoto) Course guidance
Special lecture by extramural instructor 1	1	4/20 (Inaoka(JICA))@A2-306 Project management in the case of Japanese ODA
Introduction to project management	1	4/27 (Maeda) Introduction to project management Project phases
Tools for project management I	1	5/11 (Lintuluoto) Tools for project management, cost, and cash flows I
Tools for project management II	1	5/18 (Lintuluoto) Tools for project management, cost, and cash flows II
Tools for project management III	1	5/25 (Lintuluoto) Tools for project management, cost, and cash flows III
Project scheduling I	1	6/1 (Ashida) Project scheduling I
Project scheduling II	1	6/8 (Ashida) Project scheduling II
Leadership I	1	6/15 (Tanaka) Leadership I
Leadership II	1	6/22 (Tanaka) Leadership II
Risk management I	1	6/29 (Matsumoto) Risk management I
Risk management II	1	7/6 (Matsumoto) Risk management II
Environmental Impact Assessment	1	7/13 (Yorozu) Environmental Impact Assessment
Special lecture by extramural instructor 2	1	7/20 (Kumagai(JGC CORPORATION)) To be announced
Feedback	1	7/27 (Matsumoto) Feedback

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 1. Lock, Dennis. Project Management. 10th edition. Gower Publishing Ltd.

2. Cleland, David L., and Lewis R. Ireland. Project Management. 5th edition. McGraw-Hill Professional

3. Roger Miller and Donald R. Lessard. The strategic management of large engineering projects, Shaping Institutions, Risks, and Governance, The MIT Press

【Prerequisite(s)】 No pre-requisite

【Independent Study Outside of Class】

【Web Sites】 The web-site is opened in the home page of the GL education center.

【Additional Information】

Exercise on Project Management in Engineering

エンジニアリングプロジェクトマネジメント演習

【Code】 10i059 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day & Period】 Friday 4th period and 5th period 【Location】 B-Cluster 2F Seminar Room 【Credits】 2

【Restriction】 Student number will be limited. 【Lecture Form(s)】 Seminar 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu
Assoc.Prof. Lintuluoto

【Course Description】 In this course, students will apply the engineering know-how and the skills of management, and group leadership which they learned in the course of Project Management in Engineering to build and carry out a virtual inter-engineering project. This course provides a forum where students' team-plan based on ideas and theories, decision making, and leadership should produce realistic engineering project outcomes. The course consists of intensive group work, presentations, and a few intermediate discussions. A written report will be required.

【Grading】 Report, class activity, presentation

【Course Goals】 This course prepares engineering students to work with other engineers within a large international engineering project. In particular this course will focus on leadership and management of projects along with applied engineering skills where the students learn various compromises, co-operation, responsibility, and ethics.

【Course Topics】

Theme	Class number of times	Description
	10/5	
Guidance	1	Introduction to Exercise on Project Management in Engineering Lecture on tools for the Project management in engineering Practice
Teamwork	7	Each project team may freely schedule the group works within given time frame. The course instructors are available if any need is required.
Mid-term presentation	1	Each project team will have a mid-term presentation.
Lecture & Teamwork	2	Some lectures will be provided, such as Leadership structuring, Risk Management, and Environmental Impact Assessment, depending on projects you propose.
Presentation	1	Each project team will have a presentation based on its proposed project.

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 Fundamental skills about group leading and communication, scientific presentation.

【Independent Study Outside of Class】

【Web Sites】 The web-site will be opened in the home page of the GL education center.

【Additional Information】 The number of students may be restricted. Students are requested to check in advance whether the credit from this course will be accepted as a graduation requirement for their department.

Environmental Risk Analysis

環境リスク学

- 【Code】10F439 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 4th
 【Location】C1-192 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English
 【Instructor】Yoneda, Takano, Matsuda, Shimada, Matsui,
 【Course Description】Paying attention to the environment of children in particular, students themselves study, make presentation, and debate about the environmental risk. Students learn the background, the actual situation, and the theory for quantitative risk analysis through practice of investigation and discussion by themselves.
 【Grading】Grading based on the participation and performance in presentation and discussion.
 【Course Goals】To understand or master the necessity of environmental risk analysis, its practical examples, framework for solving problems concerning to risk evaluation, technical and basic knowledge for environmental risk analysis, and the way of thinking for risk analysis
 【Course Topics】

Theme	Class number of times	Description
Introduction		
Framework of risk analysis	2	Introduction of lecture and grading. Framework of risk analysis for children of WHO.
Children and health risk	1	1) Why children 2) Children are not little adults
Children and environmental change	1	3) The paediatric environmental and health history 4) Global change and children
Air pollution	1	5) Outdoor air pollution 6) Indoor air pollution
Lead and pesticide	1	7) Pesticides 8) Lead
Heavy metal	1	9) Mercury 10) Other heavy metals
Various risk	1	11) Noise 12) Water 13) Food safety
Chemicals	1	14) Children and chemicals 15) Persistent Organic Pollutants
Tobacco and natural toxin	1	16) Second-hand tobacco smoke 17) Mycotoxins, plants, fungi and derivates
Occupational risk and radiation	1	18) Injuries 19) Ionizing and non-ionizing radiations 20) Occupational risks
Respiratory diseases and cancer	1	21) Respiratory diseases 22) Childhood cancer
Innume disorders and neural system	1	23) Immune disorders 24) Neurobehavioral and neurodevelopmental disorders
Endocrine system and environmental monitoring	1	25) Endocrine disorders 26) Bio-monitoring and environmental monitoring
D evelopmental toxicity and indicators	1	27) Early developmental and environmental origins of disease 28) Indicators

- 【Textbook】Necessary files are supplied.
 【Textbook(supplemental)】To be introduced if necessary.
 【Prerequisite(s)】Not necessary in particular.
 【Independent Study Outside of Class】
 【Web Sites】
 【Additional Information】The contents may be changed according to the progress of lecture.

Urban Metabolism Engineering

都市代謝工学

【Code】 10A632 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 3rd

【Location】 C1-173 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 English / Japanese 【Instructor】 Masaki Takaoka, Kazuyuki Oshita, Takashi Fujimori

【Course Description】 Much energy and resources are consumed to maintain various activities in urban city. As the result, various environmental loads such as exhaust gas, wastewater and waste generate and should be reduced to levels natural environment can accept. To establish sustainable urban metabolism, concept, elements, control, optimization and management of urban metabolism are explained.

【Grading】 Small tests and reports are evaluated.

【Course Goals】 To understand technological measures by learning about current trend and issue of urban metabolism and related engineering principles.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Concept of urban metabolism and its system are explained
Elements of urban metabolic system	9	Planning and selection of urban metabolic system, Transportation & collection, Engineering principles on Recycling, Thermal recovery, Engineering principles on flue gas treatment and Landfill management are explained.
Management of hazardous waste	2	Treatment, disposal and management of hazardous waste are explained.
Design of sewage treatment system in urban area	2	Properties and chemical compositions of sewage and sludge. Introduction and developing trend of sewage treatment system. Elemental and heat balance analysis of sedimentation, aeration tank, anaerobic fermentation and incineration.
Feedback and summary	1	Feedback of small tests and summary

【Textbook】 Recent paper and/or books will be used.

【Textbook(supplemental)】

【Prerequisite(s)】 Environmental plant engineering

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Systems Approach on Sound Material Cycles Society

循環型社会システム論

【Code】 10F454 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 3rd 【Location】 C1-192

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese/English

【Instructor】 Shinichi Sakai, Yasuhiro Hirai,

【Course Description】 It has become a major political/ social issue to establish a Sound Material-Cycle Society in order to save the earth resources and energy and to preserve environmental conservation. This course mainly covers the following topics: 1) History, current status, and future prospect of waste issues and establishment of a sound material-cycles society. 2) Basic concepts and current conditions/ challenges of the following items: The Basic Law for Establishing the Material Cycles Society and the Basic Plan for accomplishing it; Containers and Packaging Recycling Law; Home Appliance Recycling Law; End-of-Life Vehicle Recycling Law and others. 3) Basic concept and application of material flow analysis and life cycle assessment; these tools are important to grasp the whole flow of each recycling, resource use, product consumption, recycle and disposal of waste electrical and electronic equipment, for which it is required to take Clean Cycle & Control concepts in relation to chemical substances. Along with above topics, source origin, behavior, and decomposition of persistent organic pollutants, which should be inevitably linked to the realization of a Sound Material-Cycle Society, will also be discussed in the class.

【Grading】 Evaluation will be done based on the test scores and learning attitude in class.

【Course Goals】 The goal of this class is to help students understand the systems and technologies for establishing a Sound Material Cycles Society; students learn how to think about material flow analysis and life cycle assessment in order to develop deep understanding of the whole system of material flow (i.e., resource use, product consumption, cycles and disposal of waste).

【Course Topics】

Theme	Class number of times	Description
The Basic Law for Establishing the Material Cycles Society and the Basic Plan for Material Cycles	1	Learn the frame work and three indices of this basic plan in detail, and examine recent globally developed " 3R Initiative " activities and status of material cycles in Asian countries.
Development of Each Recycling System	3	Learn the following items separately designated as effective measures under The Basic Law for Establishing the Material Cycles Society: 1) Containers and packaging 2) Home Appliance 3) End-of-Life Vehicle 4) Construction Material 5) Food Material
Each Recycling System and Clean, Cycles & Control Concepts	3	Examine application of the following strategic concepts for waste electrical and electronic equipment, end-of-life vehicles, and battery waste. 1) Clean: Avoid the use of hazardous waste and chemical substances. 2) Cycle: Apply cycle concept when use effects are expected but no alternatives are available.
Basic concept and application of material flow and life cycle analyses	5	Learn about basic concept of Material Flow Analysis (MFA) and Life Cycle Assessment (LCA). Examine food waste recycling using these analyses as a case study.
Environmental Transport Model and Behavior of Persistent Organic Pollutants (POPs)	2	Learn basic concept and application of the model. Examine case studies of global mobility of POPs and behavior of PCB on regional and global scales.
Confirmation of Attainment	1	Confirm students ' levels of understanding on the course topics, and make sure of the points of MFA, LCA, and systems and techniques for establishing a sound material-cycle society.

【Textbook】 Not specified. Materials and references will be distributed when needed.

【Textbook(supplemental)】 Introduced in class when necessary.

【Prerequisite(s)】 Solid Waste Management

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Water Quality Engineering

水環境工学

【Code】10F441 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 2nd

【Location】C1-171 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Hiroaki TANAKA,Fumitake NISHIMURA,Hidaka Taira,Nakada Norihide,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	5	
	5	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Water Sanitary Engineering

水質衛生工学

【Code】 10F234 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 2nd

【Location】 C1-192 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 English/Japanese 【Instructor】 Sadahiko Itoh, Koji Kosaka

【Course Description】 The ultimate goal of this course is to understand Sanitary Engineering quantitatively. Students will learn methods to quantify chemical and microbial risk in drinking water and realize concept and methods of risk management and control.

【Grading】 Evaluated by assignments.

【Course Goals】 To quantify chemical and microbial risk in drinking water and to realize methodologies of risk management and control.

【Course Topics】

Theme	Class number of times	Description
Environmental risk and quantification	1	Introduction and goal of the class. Concept of Sanitation. Environmental risk and quantification. Safety of drinking water and acceptable risk level.
Quantitative microbial risk assessment and management	5	Coexistence and competition between human and microbes. Quantitative microbial risk assessment (QMRA). Comparison of the risk assessment and management methods between chemicals and microbes. Disability adjusted life years (DALYs).
Risk assessment and control of hazardous chemicals	3	Risk assessment of hazardous chemicals. Drinking water quality standards. Derivation of drinking water quality standards. The benchmark dose method.
Perspectives of water treatment technology	5	Development of advanced water treatment processes. Water supply technology and its prospects. Water reuse and health risk. Access to safe drinking water in developing countries and global burden of disease.
Feedback and summary	1	Feedback of assignments and summary.

【Textbook】 Class handouts

【Textbook(supplemental)】 Itoh, S., Echigo, S.: Disinfection By-products in Water, GIHOUDOU SHUPPAN Co., Ltd., 2008 (in Japanese).

【Prerequisite(s)】 General understanding of water quality and water treatment process

【Independent Study Outside of Class】

【Web Sites】 Data for assignments will be at <http://www.urban.env.kyoto-u.ac.jp>

【Additional Information】

Nuclear Environmental Engineering, Adv.

原子力環境工学

【Code】 10F461 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Thu 2nd 【Location】 C1-192 【Credits】 2
 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 Japanese 【Instructor】 Yoko Fujikawa, Satoshi Fukutani, Maiko Ikegami
 【Course Description】 Various wastes are generated from the use of nuclear energy, one of the key technologies to overcome the global warming, and the associated industrial activity. This course is intended to understand the type and origin of radioactive wastes, as well as the management, treatment, and final disposal of these wastes, from the viewpoint of environmental engineering.

【Grading】 Attendance to the lecture plus report

【Course Goals】 By providing the students with the knowledge on various radioactive wastes generated by the use of nuclear energy as well as the radiological risk of such wastes, the course will enable the students to consider the future of nuclear industries based on their own judgement.

【Course Topics】

Theme	Class number of times	Description
Course Introduction	1	Course Introduction
Nuclear disaster action program	1	Nuclear disaster action program
Nuclear reactors	1	Nuclear reactors
Treatment of liquid radioactive waste	1	Treatment of liquid radioactive waste
Treatment of gaseous and solid radioactive waste	1	Treatment of gaseous and solid radioactive waste
Legislation of radioactive wastes	1	Legislation of radioactive wastes
Decommissioning and clearance	1	Decommissioning and clearance
Radiological risk	1	The risk of radiation exposure, history of radiation dose limit set by international organizations, and dose limit under different situations are discussed
Fukushima Daiichi Nuclear Power Plant (F1) accident and nuclear disaster prevention	1	Discuss the relation between the events in F1 and the radiation dose in the environment as well as pollution of environment. The evacuation activity conducted in Fukushima and the related lessons are summarized.
Problems of designated waste	1	In the aftermath of the F1 accident, municipal solid waste contaminated with radioactive cesium has been produced in 12 Prefectures, some of these wastes were classified as designated wastes (DSW). The concept of DSW is compared with that of conventional radioactive wastes.
Geological disposal of high level radioactive wastes (HLW) and the safety assessment	1	Inventory, the method of disposal (critical path and nuclides), philosophy of radiological protection, etc. are discussed.
Behavior of radionuclides in the environment and mathematical modeling of nuclide migration	1	Behavior of radionuclides in the geosphere has governing effect on the safety of geological disposal of HLW. The behavior based on the chemical characteristics of each nuclides and mathematical modeling of their behavior are discussed.
Behavior and qualitative/ quantitative analysis of radionuclides in the environment	1	Behavior and qualitative/ quantitative analysis of radioactive Cs, Co, Sr, I, Se, U, Pu and Ra in the environment, and events of radioactive pollution of the environment in the past, are introduced.
The risk of radiation and the society	1	After the F1 accident, the risk of radiation has drawn intense attention from citizens. The risk communication methodology to facilitate the understanding of radiation is discussed.
Discussion with /between students	1	Discussion on issues such as lifestyle in the contaminated environment (under existing exposure situation), whether residents should return to the contaminated areas, and how to deal with siting problems of final disposal of HLW, etc..

【Textbook】 Related papers etc. will be distributed in each lecture.

【Textbook(supplemental)】 Related literature will be notified in each lecture.

【Prerequisite(s)】 Basic knowledge on health physics, chemistry and earth science.

【Independent Study Outside of Class】 NOT specified.

【Web Sites】 None

【Additional Information】 None

Atmospheric and Global Environmental Engineering, Adv.

大気・地球環境工学特論

【Code】10F446 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 2nd 【Location】C1-172

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lectures and presentations 【Language】Japanese/English

【Instructor】Shinichiro, FUJIMORI

【Course Description】The contents of the lecture are as follows. (1) History of Global Warming problem, Radiative forcing, Green house gas emission, Carbon cycle, Mechanism of Climate Change, Mitigation measures, Social and Natural impact of Climate change (2) Mechanism of formation of Photochemical oxidant and Acid rain, Global scale transportation of atmospheric pollutants, Deposition and its impact of air pollutants, control measure of air pollution. Also, students make presentation and discussion on the related papers.

【Grading】Points are allocated for the quiz at every lectures, the presentation and discussion, report.

【Course Goals】By the end of the course, students will be able to understand the mechanisms of climate change and air pollution, and learn to solve the problems by themselves.

【Course Topics】

Theme	Class number of times	Description
Guidance, IPCC, Observation of a climate change	1	
Carbon cycle and response of climate	1	
Impact of Climate Change	1	
Climate change mitigation (1)	1	
Climate change mitigation(2)	1	
Climate change mitigation and possible side effects	1	
Urban air pollution, transboundary transport of air pollution, and international measures	1	
Literature review presentation	1	
Literature review presentation(1)	1	
Literature review presentation(2)	1	
Literature review presentation(3)	1	
Literature review presentation(4)	1	
Literature review presentation(5)	1	
Literature review presentation(6)	1	
Achievement test	1	

【Textbook】Handout

【Textbook(supplemental)】

【Prerequisite(s)】None

【Independent Study Outside of Class】The students are required to prepare for the presentation with sufficient time.

【Web Sites】

【Additional Information】Language of presentation and Q/A: English

Advanced Seminar on Urban and Environmental Engineering A

都市環境工学特別セミナー A

【Code】 10U401 【Course Year】 Doctor Course 【Term】 1st+2nd term

【Class day & Period】 First: Thu 3rd and 4th, Second: Wed 1st and 2nd 【Location】 C1-226 【Credits】 4

【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	9	
	1	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Seminar on Urban and Environmental Engineering B

都市環境工学特別セミナー B

【Code】10U403 【Course Year】Doctor Course 【Term】1st+2nd term

【Class day & Period】First: Fri 3rd and 4th, Second Thu 3rd and 4th 【Location】C1-226 【Credits】4 【Restriction】

【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	9	
	1	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Environmental Microbiology, Adv.

環境微生物学特論

【Code】10A643 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Mon 1st

【Location】C1-172 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Hiroaki TANAKA, Fumitake NISHIMURA, Taira HIDAHA, Masaru IHARA

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	2	
	2	
	1	
	1	
	1	
	1	
	3	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Environmental Health

環境衛生学特論

【Code】10A626 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 4th
 【Location】C1-171 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】Japanese
 【Instructor】Hirohisa Takano, Kayo Ueda,

【Course Description】Environmental factors and genetic factors are responsible for our health and diseases. This seminar has the lecture on the relationships between environmental factors and our health. Also, Students make presentation and discussion on the previous and recent environmental problems, with special emphasis on their relation with health concerns.

【Grading】Points are allocated for the activities on the presentation and discussion.

【Course Goals】Students learn about the fundamentals of environmental health and make use of the knowledge for the development of related areas.

【Course Topics】

Theme	<small>Class number of times</small>	Description
Environment and health	2	Lecture on the relationships between environmental factors and our health
Seminar on the previous and recent environmental problems	13	Presentation and discussion on the previous and recent environmental problems, with special emphasis on their relation with health concerns

【Textbook】on demand

【Textbook(supplemental)】on demand

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Environmental-friendly Technology for Sound Material Cycle

環境資源循環技術

【Code】 10H424 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 3rd

【Location】 C1-192 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 ,,,,,,

【Course Description】 Global warming, ecosystem crisis, and depletion of natural resources are of great concern today. To solve these problems, we have to build the sustainable society where low carbon dioxide emission, low environmental burdens, and the reduction of wastes by recycling are realized. It is possible to utilize municipal wastes, wastewaters, and unused biomass as resources instead of the natural resources used at present.

Recycling-oriented technologies that enable sustainable utilization of those wastes and the concept to develop those technologies are introduced.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Lecture on Environmental Management Leader

環境リスク管理リーダー論

【Code】10X321 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Thu 5th 【Location】C1-171 【Credits】2 【Restriction】

【Lecture Form(s)】Relay Lecture 【Language】English 【Instructor】TANAKA Hiroaki,SHIMIZU Yoshihisa,FUJII Shigeo,

【Course Description】In this class, we ' ll give lectures on theory of risk analysis, risk identification, risk assessment, risk evaluation, and risk reduction and avoidance in the field of urban human security including human health risk and ecological risk. The main purpose of this lecture is to provide students basic viewpoint and knowledge required for environmental leaders who can practically solve environmental issues occurring in developing countries, showing several international environmental projects as practical case works.

【Grading】Participation, Oral and Poster Presentation, and Report

【Course Goals】The main purpose of this lecture is to provide students with the basic viewpoint and knowledge required for environmental leaders able to practically solve environmental issues occurring in developing countries, focusing on several international environmental projects as practical case works.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	In this introductory lecture, the current situation and problems of the environment in Asian developing countries are explained, and basic ideas for their improvement measures are given together with fundamental terminologies.
Energy and Environment	1	
View point and commitment to rural environmental issues	1	
Disaster Risk Management and Grass-roots International Cooperation	1	
Environmental Risk Assessment and Risk Communication	1	
Water, Sanitation and Solid Waste Management for Developing Countries	1	
Presentations and Discussions	2	
Japan's Lessens on Economy & Development	1	
Solid Waste Management	1	
Ensuring Sustainability in Water Supply and Sewerage Sector	1	
Water Supply and Human Security	1	
Impending Issues in Lake Biwa-Yodo River Water Management and the Basin Governance	1	
Environment & Sanitary Engineering Research International Session	1	
Poster Presentation in Environment & Sanitary Engineering Research Symposium	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】To be announced at class about poster presentation in Environment & Sanitary Engineering Research Symposium.

New Environmental Engineering I, Advanced

新環境工学特論 I

【Code】 10F456 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 5th

【Location】 Reserch Bldg.No.5-Lecture Room(2nd floor)/C1-171 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Relay Lecture 【Language】 English 【Instructor】 Y. Shimizu (Prof), H. Tanaka (Prof), and S. Fujii (Prof),

【Course Description】 This course provides various kinds of engineering issues related to the water environment in English, which cover fundamental knowledge, the latest technologies and regional application examples. These lectures, English presentations by students, and discussions enhance English capability and internationality of students.

The course is conducted in simultaneous distance-learning from Kyoto University, or from remote lecture stations in University of Malaya, and Tsinghua University of China. For the distance-learning, a hybrid system is used, which consists of prerecorded lecture VIDEO, VCS (Video conference system) and SS (slide sharing system).

【Grading】 Evaluated by class attendance, Q&A and presentation.

【Course Goals】 Each student is requested to give a short presentation in English in the end of the course. The students will understand the present circumstance of environments in the world, and the students may improve their English skill and international senses through these lectures, presentations, and discussions.

【Course Topics】

Theme	Class number of times	Description
Wastewater Treatment in Japan	1.4	Guidance & Self Introduction of Students & Lecturer on “ Wastewater Treatment Plants Case Study in Japan (Fujii)
Ecological Sanitation	1.4	From Ecotoilets to Ecotowns (Shimizu)
Wastewater Treatment in China and Nutrient Removal	1.4	Wastewater Treatment Plant: Case Study in China, Biological Nutrient Removal (BNR) (Prof. Wen, Tsinghua University)
Wastewater Reuse & Disinfection	1.3	Wastewater Reuse & Disinfection (Tanaka)
Wastewater Treatment in Malaysia	1.4	Governance of Water and Wastewater in Malaysia (Prof. Ghufuran, University of Malaya) Case studies of Wastewater Treatment Plants Design & Operation (Prof. Nuruol, University of Malaya)
Membrane Technology	1.3	Treatment Technologies (Practical & Advanced Technology I): Membrane Technology (MT) (Prof. Huang, Tsinghua University)
Anaerobic Treatment	1.3	Anaerobic Biological Treatment Technologies (Prof. Shaliza, University of Malaya)
Advanced Oxidation Processes	1.3	Advanced Oxidation Processes (Prof. Zhang, Tsinghua University)
Student Presentation	1.4	Student Presentations /Discussions I (all)
Student Presentation	1.4	Student Presentations /Discussions II (all)
Student Presentation	1.4	Student Presentations /Discussions III (all)

【Textbook】 Class handouts

【Textbook(supplemental)】 Introduced in the classes

【Prerequisite(s)】 General understanding of water environmental issues

【Independent Study Outside of Class】 The students should study the PPT file used in the lectures. Students also need to enough literature review and related prior to their presentation.

【Web Sites】

【Additional Information】 PowerPoint slides are main teaching materials in the lectures, and their hard copies are distributed to the students. In addition, a list of technical terms and difficult English words is given to the students with their explanation and Japanese translation.

New Environmental Engineering II, Advanced

新環境工学特論 II

【Code】10F458 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Mon 5th

【Location】Reserch Bldg.No.5-Lecture Room(2nd floor)/C1-171 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】English

【Instructor】Prof. Shimidzu, Prof. Takaoka, Associate Prof. Oshita, Associate Prof. Ueda, Associate Prof. Fujimori, Prof. Fujii,

【Course Description】This course provides various kinds of engineering issues related to atmospheric environment and solid wastes management in English, which cover fundamental knowledge, the latest technologies and regional application examples. These lectures, English presentations by students, and discussions enhance English capability and internationality of students. The course is conducted in simultaneous distance-learning from Kyoto University, or from remote lecture stations in University of Malaya, and Tsinghua University. For the distance-learning, a hybrid system is used, which consists of prerecorded lecture VIDEO, VCS (Video conference system) and SS (slide sharing system). The students are requested to give a short presentation in English in the end of the lecture course. This course may improve students' English skill and international senses through these lectures, presentations, and discussions.

【Grading】Evaluate by class attendance, Q&A and presentation.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Global warming and Low carbon society	1.4	Global warming and Low carbon society(Prof. Fujimori, Kyoto University)
Atmospheric diffusion and modeling	1.4	Atmospheric diffusion and modeling (Prof. S Wang, Tsinghua University)
Air Pollution, Its Historical Perspective from Asian Countries (II), Malaysia	1.4	Air Pollution, Its Historical Perspective from Asian Countries (II), Malaysia (Prof. Nasrin Aghamohammadi, University of Malaya)
Air Pollution, Its Historical Perspective from Asian Countries (III), Japan	1.4	Air Pollution, Its Historical Perspective from Asian Countries (III), Japan (Prof. Ueda, Kyoto University)
Student Presentations /Discussions I	1.4	Student Presentations /Discussions I (all)
Introduction to Municipal Solid Waste (MSW) Management in Malaysia	1.4	Introduction to Municipal Solid Waste (MSW) Management in Malaysia (Prof. Fauziah Shahuk Hamid, University of Malaya)
Solid Waste Management, Case Study in China	1.4	Solid Waste Management, Case Study in China (Prof. Lu Wenjing, Tsinghua University)
Solid Waste Management, Case Study in Japan	1.4	Solid Waste Management, Case Study in Japan (Prof. Takaoka, Kyoto University)
Solid Waste Management, Case Study in Malaysia	1.4	Solid Waste Management, Case Study in Malaysia (Prof. Noor Zalina Mahamood, University of Malaya)
Student Presentations /Discussions II	1.4	Student Presentations /Discussions II (all)
Student Presentations /Discussions III	1.4	Student Presentations /Discussions III(all)

【Textbook】Class handouts

【Textbook(supplemental)】Introduce in the lecture classes

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Either of this course or “ New Environmental Engineering I, advanced ” can be dealt as “ Asian Environmental Enigneering ” . PowerPoint slides are main teaching materials in the lectures, and their hard copies are distributed to the students. In addition, a list of technical terms and difficult English words is given to the students with their explanation and Japanese translation.

Environmental Organic Micropollutants Analysis Lab.

環境微量分析演習

【Code】 10F468 【Course Year】 Master and Doctor Course 【Term】 Intensive course (25,27,28th Sep.)

【Class day & Period】 9:00 am- 6:00 pm

【Location】 Seminar Room, Research Center for Environmental Quality Management 【Credits】 2

【Restriction】 around 10 students 【Lecture Form(s)】 Intensive Lecture 【Language】 Japanese

【Instructor】 Shimizu, Yoshihisa, Matsuda, Tomonari,

【Course Description】 There is increasing concern about proper risk evaluation and management of hazardous chemicals such as dioxins and endocrine disruptors. To manage this problem, it is necessary to understand analytical methods and toxicity of those hazardous chemicals. In this class, lectures and experiments will be carried out about chromatography, bioassays and mass spectrometry.

【Grading】 It is required to attend all 3 days for lectures and experiments. Attendance and reports are considered for grading.

【Course Goals】 Understand about principle and practical techniques of chromatography. Understand about principle of several bioassays.

【Course Topics】

Theme	Class number of times	Description
HPLC -How to separate it- Fractionation and	3	Learn about principle and practice of HPLC separation. How do you choose columns, solvents and detectors? How to improve peak separation?
Purification by using HPLC	3	Learn about practical techniques of fractionation and purification using HPLC.
LC/MS/MS	5	Learn about principle and practice of LC/MS/MS analysis. Understand about 3 different scan modes, full scan, daughter scan and MRM. How to make an analytical method in a refined way for substances of your interest.
Bioassays	4	Lecture about several bioassays which are used for evaluation of environmental toxicity, and discuss about how to identify toxic compounds in environment by using HPLC in combination with bioassays.

【Textbook】 Handouts are distributed.

【Textbook(supplemental)】 Daniel C. Harris: Quantitative Chemical Analysis ISBN-13: 978-1-4292-3989-9

【Prerequisite(s)】

【Independent Study Outside of Class】 We hope active participation of students. It is welcome that participants additionally try to analyze the sample their own interest.

【Web Sites】

【Additional Information】 This intensive course is useful especially for students who usually use or intend to use HPLC and LC/MS/MS for their research.

Advanced Environmental Engineering Lab.

環境工学先端実験演習

【Code】 10F470 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day & Period】 Monday 3,4 【Location】 C1-173 【Credits】 2 【Restriction】 less than 10 students

【Lecture Form(s)】 Seminar and Exercise 【Language】 English / Japanese

【Instructor】 Sadahiko Itoh, Minoru Yoneda, Yoshihisa Shimizu, Masaki Takaoka, Koji Kosaka, Makoto Yasojima

【Course Description】 Analytical methods to characterize environmental samples are learnt through practical training including site visit to other research institute or analytical company. Also, integration of environmental information using GIS is also mastered.

【Grading】 Attendance at the class (50%) and report subjects(50%) are evaluated.

【Course Goals】 To promote your own research by learning each research method with wide vision

【Course Topics】

Theme	Class number of times	Description
Guidance and Safety Education	1	The content of subject and safety education for the following experiment are explained.
Quantitative analysis of elements	2	The principle of multielement analysis is explained and practical training of ICP-AES or ICP-MS machine is conducted.
Qualitative analysis of elements	2	The principle of X-ray based methods is explained and practical training of one or two X-ray based machine is conducted.
Qualitative analysis of organic compounds and bioassay	6	Qualitative analysis of organic compounds such as mass spectrometry, NMR, ESR and IR and bioassay are explained and practical training of GC-MS etc. is conducted.
GIS	2	The way to use GIS is learnt.
Site visit	2	Site visit to research institute or analytical company

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminer on Practical Issues in Urban and Environmental Engineering

環境工学実践セミナー

【Code】10F472 【Course Year】Master Course 【Term】1st+2nd term 【Class day & Period】Fri 4th

【Location】C1-192 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	5	
	1	
	1	
	5	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Exercises in Urban and Environmental Engineering A

都市環境工学演習 A

【Code】10F449 【Course Year】Master Course 【Term】1st+2nd term 【Class day & Period】Fri 5th 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	2	
	10	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

ORT on Urban and Environmental Engineering

都市環境工学 ORT

【Code】 10F475 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 【Language】 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	1	
	13	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (6H course)

現代科学技術の巨人セミナー「知のひらめき」(6Hコース)

【Code】10i051 【Course Year】Doctor Course 【Term】First term, intensive

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】0.5

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 6H course, students have to select two classes and will earn 0.5 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (12H course)

現代科学技術の巨人セミナー「知のひらめき」(12Hコース)

【Code】10i052 【Course Year】Doctor Course 【Term】First term/Spring term

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】1

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 12H course, students have to complete all four classes and will earn 1 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later
Topic 3	2	Detail will be announced later
Topic 4	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Exercise in Practical Scientific English

実践的科学英語演習

【Code】 10i045 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Thu 4th or 5th 【Location】 A2-304

【Credits】 1 【Restriction】 Up to 20 students for each class 【Lecture Form(s)】 Seminar 【Language】 English (Japanese)

【Instructor】 M. Nishikawa, R. Matsumoto, R. Ashida, M. Maeda,

【Course Description】 This course is open to all master and doctoral engineering students. It is designed to help students understand how to write a research paper step by step. In this course, the students will write a short research paper (i.e. Extended Research Abstract for Proceeding, approx. 1000 -1500 words) on a topic drawn from assigned readings.

【Grading】 Evaluation based on 30% participation, 40% reports, 30% final paper *More than twice unexcused absence can result in course failure

【Course Goals】 The primary goal of this course is to deepen an understanding of the main features of each part of a scientific paper (IMRaD). Throughout the course, students will develop the core competencies required for language, grammar, and style to produce a research manuscript in English.

【Course Topics】

Theme	Class number of times	Description
Unit 1: Course Overview	1	Course Overview: Introduction to writing scientific research articles
Unit 2: Introduction	1	Raising awareness of the register of science research articles (genre, audience, purpose)
Unit 3: Preparing to Write	1	Writing a proposal for a research paper, using corpus-based approach (Exercise: Creating own Corpus)
Unit 4: Preparing to Write	1	Paraphrasing ideas from source texts, using citations and references in formal writing
Unit 5: Writing Processes	1	Identifying the “ moves ” for an Abstract section by hint expressions
Unit 6: Writing Processes	1	Writing an Abstract (Title) & peer feedback
Unit 7: Writing Processes	1	Identifying the “ moves ” for an Introduction section by hint expressions
Unit 8: Writing Processes	1	Writing an Introduction section & peer feedback
Unit 9: Writing Processes	1	Writing a Method section & peer feedback
Unit 10: Writing Processes	1	Writing a Result section & peer feedback
Unit 11: Writing Processes	1	Writing a Discussion and a Conclusion section
Unit 12: Writing Processes	1	Writing a cover letter to reviewers and how to respond to reviewers
Unit 13: Monitoring and Revising	1	Online feedback
Unit 14: Monitoring and Revising	1	Revising a paper based on peer feedback
Unit 15: Submission	1	Final Paper Due, August 6.

【Textbook】 Handout materials will be supplied by the instructor.

【Textbook(supplemental)】 ALESS (2012). Active English for Science- 英語で科学する - レポート、論文、プレゼンテーション . The University of Tokyo Press. Cargill, M., & O'Connor, P. (2013). Writing scientific research articles: Strategy and steps. John Wiley & Sons. Cowell, R., & She, L. (2015). Mastering the Basics of Technical English 『技術英語の基礎』 . 2nd Ed., Corona Publishing. 野口ジュディー・深山晶子・岡本真由美 . (2007) . 『理系英語のライティング』 . アルク

【Prerequisite(s)】 Students who intend to join this course must attend the first class.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 We may restrict the class size to enhance students ’ learning. Students who intend to join the course are required to attend the first-day guidance. Office Hours: (by appointment) nishikawa.mikako7w@kyoto-u.ac.jp (Ext. 2052)

Project Management in Engineering

エンジニアリングプロジェクトマネジメント

【Code】 10i049 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 4th 【Location】 A2-308 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu

Assoc.Prof. Lintuluoto, J. Assoc. Prof. Tanaka

【Course Description】 This course provides a basic knowledge required for the project management in various engineering fields such as process design, plant design, construction, and R&D projects. Also, visiting lecturers from industry and public works provide management insights of actual engineering projects.

【Grading】 Evaluated by assignments (project report exercise) and class contribution

【Course Goals】 This course will help students gain a fundamental knowledge of what project management in engineering is. Throughout the course, students will learn various tools applied in project management. Students will also understand the importance of costs and money, risks, leadership, and environmental assessment in managing engineering projects. This course is followed with the course Seminar on Project Management in Engineering. in the second semester.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	4/13 (Matsumoto) Course guidance
Special lecture by extramural instructor 1	1	4/20 (Inaoka(JICA))@A2-306 Project management in the case of Japanese ODA
Introduction to project management	1	4/27 (Maeda) Introduction to project management Project phases
Tools for project management I	1	5/11 (Lintuluoto) Tools for project management, cost, and cash flows I
Tools for project management II	1	5/18 (Lintuluoto) Tools for project management, cost, and cash flows II
Tools for project management III	1	5/25 (Lintuluoto) Tools for project management, cost, and cash flows III
Project scheduling I	1	6/1 (Ashida) Project scheduling I
Project scheduling II	1	6/8 (Ashida) Project scheduling II
Leadership I	1	6/15 (Tanaka) Leadership I
Leadership II	1	6/22 (Tanaka) Leadership II
Risk management I	1	6/29 (Matsumoto) Risk management I
Risk management II	1	7/6 (Matsumoto) Risk management II
Environmental Impact Assessment	1	7/13 (Yorozu) Environmental Impact Assessment
Special lecture by extramural instructor 2	1	7/20 (Kumagai(JGC CORPORATION)) To be announced
Feedback	1	7/27 (Matsumoto) Feedback

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 1. Lock, Dennis. Project Management. 10th edition. Gower Publishing Ltd.

2. Cleland, David L., and Lewis R. Ireland. Project Management. 5th edition. McGraw-Hill Professional

3. Roger Miller and Donald R. Lessard. The strategic management of large engineering projects, Shaping Institutions, Risks, and Governance, The MIT Press

【Prerequisite(s)】 No pre-requisite

【Independent Study Outside of Class】

【Web Sites】 The web-site is opened in the home page of the GL education center.

【Additional Information】

Exercise on Project Management in Engineering

エンジニアリングプロジェクトマネジメント演習

【Code】 10i059 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day & Period】 Friday 4th period and 5th period 【Location】 B-Cluster 2F Seminar Room 【Credits】 2

【Restriction】 Student number will be limited. 【Lecture Form(s)】 Seminar 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu
Assoc.Prof. Lintuluoto

【Course Description】 In this course, students will apply the engineering know-how and the skills of management, and group leadership which they learned in the course of Project Management in Engineering to build and carry out a virtual inter-engineering project. This course provides a forum where students' team-plan based on ideas and theories, decision making, and leadership should produce realistic engineering project outcomes. The course consists of intensive group work, presentations, and a few intermediate discussions. A written report will be required.

【Grading】 Report, class activity, presentation

【Course Goals】 This course prepares engineering students to work with other engineers within a large international engineering project. In particular this course will focus on leadership and management of projects along with applied engineering skills where the students learn various compromises, co-operation, responsibility, and ethics.

【Course Topics】

Theme	Class number of times	Description
		10/5
Guidance	1	Introduction to Exercise on Project Management in Engineering Lecture on tools for the Project management in engineering Practice
Teamwork	7	Each project team may freely schedule the group works within given time frame. The course instructors are available if any need is required.
Mid-term presentation	1	Each project team will have a mid-term presentation.
Lecture & Teamwork	2	Some lectures will be provided, such as Leadership structuring, Risk Management, and Environmental Impact Assessment, depending on projects you propose.
Presentation	1	Each project team will have a presentation based on its proposed project.

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 Fundamental skills about group leading and communication, scientific presentation.

【Independent Study Outside of Class】

【Web Sites】 The web-site will be opened in the home page of the GL education center.

【Additional Information】 The number of students may be restricted. Students are requested to check in advance whether the credit from this course will be accepted as a graduation requirement for their department.

Advanced Theory of Architecture and Architectural Engineering I

先端建築学特論

【Code】 10Q021 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Mon 3rd

【Location】 C2-213 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture

【Language】 Japanese

【Instructor】 Monnai, Kishi, Katoh, Takada, Yamagishi, Kanki, Hokoi, Takahashi, Harada, Maki,

【Course Description】 Each professor gives a lecture for one or two hours.

【Grading】 Each professor assigns one report at the end of his/her lecture. Students choose three of ten assignments and submit reports (about 1200 words per report). Evaluation will be done as follows: Regular students: Evaluation is done only by reports. But students must attend at least half of lectures. Working students: Evaluation is done by either (1) reports (80%) and attendance (20%), or (2) reports only (100%). In case (2), student must submit four reports. In any case, students can submit reports for the lectures they attended.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】 none

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】 none

【Additional Information】

Advanced Theory of Architecture and Architectural Engineering II

先端建築学特論

【Code】10Q022 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】Faculties of structural engineering

【Course Description】 Study the earthquake safety of building structures and the performance of structural materials. The main topics are the structural design of buildings, the structural analysis method and the evaluation of performances of advanced structural materials. The structural experiments are also discussed.

【Grading】 Grade based on the result of student effort.

【Course Goals】 Acquire the ability to write original articles on advanced theme on structural engineering

【Course Topics】

Theme	Class number of times	Description
15	15	Presentation and discussion on advanced theme on structural engineering

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Architectural Design and Planning I

建築設計・計画学セミナー

【Code】 10Q005 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Architectural Design and Planning II

建築設計・計画学セミナー

【Code】 10Q006 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Architectural Design and Planning III

建築設計・計画学セミナー

【Code】 10Q017 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Architectural Design and Planning IV

建築設計・計画学セミナー

【Code】 10Q018 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Structural Engineering of Buildings I

建築構造学セミナー

【Code】10Q008 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Structural Engineering of Buildings II

建築構造学セミナー

【Code】 10Q009 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Structural Engineering of Buildings III

建築構造学セミナー

【Code】10Q015 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Structural Engineering of Buildings IV

建築構造学セミナー

【Code】 10Q016 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Environmental Engineering I

建築環境工学セミナー

【Code】 10Q011 【Course Year】 Doctor Course 【Term】 1st term

【Class day & Period】 To be determined among participants and instructors

【Location】 To be determined among participants and instructors 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 Instructors in Architectural Environmental Lab's

【Course Description】 Seminar topics are selected among heat transfer, human comfort on thermal, lighting, sound sensation, building systems such as HVAC, water supply, sanitation and electricity. Through discussions, the participants are encouraged to understand deeply the subject and to develop ability to think themselves. To increase the progress of doctoral study, presentation and report are obligatory in order to receive instructions by professors and to join discussion among participants.

【Grading】 Presentation of research contents of his/her own and discussions among other participants and professors are necessary. The degree of understanding, the ability of conducting research by his/her own intension, the skills of presentation will be evaluated. In addition, the interest to broader range of research area, the ability of finding and solving problems are judged.

【Course Goals】 The course intends to summarize the development of his/her own research, to develop skills to convey his/her ideas to the researchers in other areas and to join discussions in multiple viewpoints properly.

【Course Topics】

Theme	Class number of times	Description
Research presentations and discussion	15	Participants shall make presentations on the research of his/her own and make discussions among other participants and instructors.

【Textbook】 None specified.

【Textbook(supplemental)】 Supplemental textbooks will be specified during the course if necessary.

【Prerequisite(s)】 As a general rule, students belonging to laboratories on the architectural environmental engineering are permitted to attend.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This seminar shall not be registered in parallel with Seminar on Environmental Engineering III.

Seminar on Environmental Engineering II

建築環境工学セミナー

【Code】10Q012 【Course Year】Doctor Course 【Term】2nd term

【Class day & Period】To be determined among participants and instructors

【Location】To be determined among participants and instructors 【Credits】2 【Restriction】No Restriction

【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】Instructors in Architectural Environmental Lab's

【Course Description】Seminar topics are selected among heat transfer, human comfort on thermal, lighting, sound sensation, building systems such as HVAC, water supply, sanitation and electricity. Through discussions, the participants are encouraged to understand deeply the subject and to develop ability to think themselves. To increase the progress of doctoral study, presentation and report are obligatory in order to receive instructions by professors and to join discussion among participants.

【Grading】Presentation of research contents of his/her own and discussions among other participants and professors are necessary. The degree of understanding, the ability of conducting research by his/her own intension, the skills of presentation will be evaluated. In addition, the interest to broader range of research area, the ability of finding and solving problems are judged.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Research presentations and discussion	15	Participants shall make presentations on the research of his/her own and make discussions among other participants and instructors.

【Textbook】None specified.

【Textbook(supplemental)】Supplemental textbooks will be specified during the course if necessary.

【Prerequisite(s)】As a general rule, students belonging to laboratories on the architectural environmental engineering are permitted to attend.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】This seminar shall not be registered in parallel with Seminar on Environmental Engineering IV.

Seminar on Environmental Engineering III

建築環境工学セミナー

【Code】 10Q013 【Course Year】 Doctor Course 【Term】 1st term

【Class day & Period】 To be determined among participants and instructors

【Location】 To be determined among participants and instructors 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 Instructors in Architectural Environmental Lab's

【Course Description】 Seminar topics are selected among heat transfer, human comfort on thermal, lighting, sound sensation, building systems such as HVAC, water supply, sanitation and electricity. Through discussions, the participants are encouraged to understand deeply the subject and to develop ability to think themselves. To increase the progress of doctoral study, presentation and report are obligatory in order to receive instructions by professors and to join discussion among participants.

【Grading】 Presentation of research contents of his/her own and discussions among other participants and professors are necessary. The degree of understanding, the ability of conducting research by his/her own intension, the skills of presentation will be evaluated. In addition, the interest to broader range of research area, the ability of finding and solving problems are judged.

【Course Goals】 The course intends to summarize the development of his/her own research, to develop skills to convey his/her ideas to the researchers in other areas and to join discussions in multiple viewpoints properly.

【Course Topics】

Theme	Class number of times	Description
Research presentations and discussion	15	Participants shall make presentations on the research of his/her own and make discussions among other participants and instructors.

【Textbook】 None specified.

【Textbook(supplemental)】 Supplemental textbooks will be specified during the course if necessary.

【Prerequisite(s)】 As a general rule, students belonging to laboratories on the architectural environmental engineering are permitted to attend.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This seminar shall not be registered in parallel with Seminar on Environmental Engineering I.

Seminar on Environmental Engineering IV

建築環境工学セミナー

【Code】10Q014 【Course Year】Doctor Course 【Term】2nd term

【Class day & Period】To be determined among participants and instructors

【Location】To be determined among participants and instructors 【Credits】2 【Restriction】No Restriction

【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】Instructors in Architectural Environmental Lab's

【Course Description】Seminar topics are selected among heat transfer, human comfort on thermal, lighting, sound sensation, building systems such as HVAC, water supply, sanitation and electricity. Through discussions, the participants are encouraged to understand deeply the subject and to develop ability to think themselves. To increase the progress of doctoral study, presentation and report are obligatory in order to receive instructions by professors and to join discussion among participants.

【Grading】Presentation of research contents of his/her own and discussions among other participants and professors are necessary. The degree of understanding, the ability of conducting research by his/her own intension, the skills of presentation will be evaluated. In addition, the interest to broader range of research area, the ability of finding and solving problems are judged.

【Course Goals】The course intends to summarize the development of his/her own research, to develop skills to convey his/her ideas to the researchers in other areas and to join discussions in multiple viewpoints properly.

【Course Topics】

Theme	Class number of times	Description
Research presentations and discussion	15	Participants shall make presentations on the research of his/her own and make discussions among other participants and instructors.

【Textbook】None specified.

【Textbook(supplemental)】Supplemental textbooks will be specified during the course if necessary.

【Prerequisite(s)】As a general rule, students belonging to laboratories on the architectural environmental engineering are permitted to attend.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】This seminar shall not be registered in parallel with Seminar on Environmental Engineering II.

Frontiers in Modern Science and Technology (6H course)

現代科学技術の巨人セミナー「知のひらめき」(6Hコース)

【Code】10i051 【Course Year】Doctor Course 【Term】First term, intensive

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】0.5

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 6H course, students have to select two classes and will earn 0.5 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (12H course)

現代科学技術の巨人セミナー「知のひらめき」(12Hコース)

【Code】10i052 【Course Year】Doctor Course 【Term】First term/Spring term

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】1

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 12H course, students have to complete all four classes and will earn 1 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later
Topic 3	2	Detail will be announced later
Topic 4	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Exercise in Practical Scientific English

実践的科学英語演習

【Code】 10i045 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Thu 4th or 5th 【Location】 A2-304

【Credits】 1 【Restriction】 Up to 20 students for each class 【Lecture Form(s)】 Seminar 【Language】 English (Japanese)

【Instructor】 M. Nishikawa, R. Matsumoto, R. Ashida, M. Maeda,

【Course Description】 This course is open to all master and doctoral engineering students. It is designed to help students understand how to write a research paper step by step. In this course, the students will write a short research paper (i.e. Extended Research Abstract for Proceeding, approx. 1000 -1500 words) on a topic drawn from assigned readings.

【Grading】 Evaluation based on 30% participation, 40% reports, 30% final paper *More than twice unexcused absence can result in course failure

【Course Goals】 The primary goal of this course is to deepen an understanding of the main features of each part of a scientific paper (IMRaD). Throughout the course, students will develop the core competencies required for language, grammar, and style to produce a research manuscript in English.

【Course Topics】

Theme	Class number of times	Description
Unit 1: Course Overview	1	Course Overview: Introduction to writing scientific research articles
Unit 2: Introduction	1	Raising awareness of the register of science research articles (genre, audience, purpose)
Unit 3: Preparing to Write	1	Writing a proposal for a research paper, using corpus-based approach (Exercise: Creating own Corpus)
Unit 4: Preparing to Write	1	Paraphrasing ideas from source texts, using citations and references in formal writing
Unit 5: Writing Processes	1	Identifying the “ moves ” for an Abstract section by hint expressions
Unit 6: Writing Processes	1	Writing an Abstract (Title) & peer feedback
Unit 7: Writing Processes	1	Identifying the “ moves ” for an Introduction section by hint expressions
Unit 8: Writing Processes	1	Writing an Introduction section & peer feedback
Unit 9: Writing Processes	1	Writing a Method section & peer feedback
Unit 10: Writing Processes	1	Writing a Result section & peer feedback
Unit 11: Writing Processes	1	Writing a Discussion and a Conclusion section
Unit 12: Writing Processes	1	Writing a cover letter to reviewers and how to respond to reviewers
Unit 13: Monitoring and Revising	1	Online feedback
Unit 14: Monitoring and Revising	1	Revising a paper based on peer feedback
Unit 15: Submission	1	Final Paper Due, August 6.

【Textbook】 Handout materials will be supplied by the instructor.

【Textbook(supplemental)】 ALESS (2012). Active English for Science- 英語で科学する - レポート、論文、プレゼンテーション . The University of Tokyo Press. Cargill, M., & O'Connor, P. (2013). Writing scientific research articles: Strategy and steps. John Wiley & Sons. Cowell, R., & She, L. (2015). Mastering the Basics of Technical English 『技術英語の基礎』 . 2nd Ed., Corona Publishing. 野口ジュディー・深山晶子・岡本真由美 . (2007) . 『理系英語のライティング』 . アルク

【Prerequisite(s)】 Students who intend to join this course must attend the first class.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 We may restrict the class size to enhance students ' learning. Students who intend to join the course are required to attend the first-day guidance. Office Hours: (by appointment) nishikawa.mikako7w@kyoto-u.ac.jp (Ext. 2052)

Professional Scientific Presentation Exercises (English lecture)

科学技術者のためのプレゼンテーション演習 (英語科目)

【Code】 10i041 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Thu 5th

【Location】 B-Cluster 2F Seminar Room 【Credits】 1

【Restriction】 The number of students might be limited if too many students will get enrolled.

【Lecture Form(s)】 Seminar 【Language】 English

【Instructor】 Juha Lintuluoto, Associate Professor, Department of Synthetic Chemistry and Biological Chemistry

【Course Description】 It is imperative for future engineers to be able to communicate and deliver effectively scientific information to large variety of audiences. This skill enables engineers to share and absorb information to more extended audiences, and facilitates success in selling ideas and products, publishing and team working. The purpose of this course is to teach the basic rules needed for successful professional scientific presentation, both orally and written. The course also prepares students to deliver scientific information presentations to wide audiences. The course is consisted of excessive exercises, of which the student should complete seven (7) tasks. The course holds 3-4 tasks for oral presentation exercises, and 3-4 tasks for professional scientific writing exercises. The exact number of both exercises is adjusted for each student ' s needs. The course is aimed for doctor course (DC) students, both Japanese and Foreign nationals

【Grading】 Reports, class activity, presentation

【Course Goals】 This course is aimed to foster engineering students ' scientific presentation skills. The successfully course completed students will be able to express and present complicated and specific scientific information at more generally understandable level. The students will also be able to pose relevant questions and effectively answer to the wide variety of questions.

【Course Topics】

Theme	Class number of times	Description
	1	Guidance and Professional presentation rules and etiquette
	3	Oral presentations & questioning I, Written report I
	3	Oral presentations & questioning I, Written report I
	3	Oral presentations & questioning II, Written report II
	3	Oral presentations & questioning II, Written report II
	2	Oral presentations & questioning III, Written report III
		Oral presentations & questioning III, Written report III
		Oral presentations & questioning IV, Written report IV
		Oral presentations & questioning IV, Written report IV I
		Course summary and discussion

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 -Fundamental skills about scientific presentation

-Advanced English skills

-Sufficient personal research results

【Independent Study Outside of Class】

【Web Sites】 The web-site is listed in the home page of the GL education center.

【Additional Information】 Students are requested to check in advance whether the credit of this course is counted as the unit for graduation requirement at department level. Course starts at April 12th, and the 1st lesson is repeated on April 19th. The course schedule is irregular. Most classes are biweekly, the detailed schedule is provided at the 1st lecture.

Advanced Engineering and Economy (English lecture)

工学と経済 (上級)(英語科目)

【Code】 10i042 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Tue 5th 【Location】 B-Cluster 2F Seminar Room

【Credits】 2 【Restriction】 The number of students might be limited if too many students will get enrolled. 【Lecture Form(s)】 Lectures, Group works&tasks

【Language】 English 【Instructor】 Juha Lintuluoto, Associate Professor, Department of Synthetic Chemistry and Biological Chemistry

【Course Description】 Engineering economics plays central role in any industrial engineering project. For an engineer, it is important to apply the engineering know-how with the economic analysis skills to obtain the best available materials, methods, devices, etc. in the most economical way. This course is aimed to teach engineering students the basic economic methods to manage economically an engineering project. In addition, the report writing on various engineering economic issues prepares to write reports in a professional form. The lab sessions are meant for the verbal skills improvement as well as improvement of analytical thinking. The topics are of current relevant topics Small-group brain-storming method is used. The exercise sessions cover the use of Ms-Excel for various quantitative economic analyses.

【Grading】 Final test, reports, class activity

【Course Goals】 This course is aimed to strengthen engineering students' skills in economics. The course concept is to teach students selectively those subjects which serve as major tools to solve economic tasks in engineering environment. The reports and lab sessions provide students stimulating and analytical thinking requiring tasks, and presentation skills training is an important part of this course.

【Course Topics】

Theme	Class number of times	Description
Student orientation and Introduction to engineering economy	1	Course contents, goals
Cost concepts and design economics	1	Cost terminology and classification
Cost estimation techniques	1	WBS for cost estimation, estimation techniques (indexes, unit, factor, power-sizing, learning curve, CER, top down, bottom up), target costing
The time value of money	1	Simple interest, compound interest, economic equivalence concept, cash-flow diagrams, PW, FW, AW
Evaluating a single project	1	MARR, present worth method, bond value, capitalized worth, internal rate of return, external rate of return, payback method
Comparison and selection among alternatives	1	Investment and cost alternatives, study period, equal and unequal useful lives, rate-of-return method, imputed market value
Depreciation and income taxes	1	SL and DB depreciation methods, book value, after-tax MARR, marginal income tax rate, gain(loss) on asset disposal, after-tax economic analysis general procedure, EVA,
Price changes and exchange rates	1	Actual dollars, real dollars, inflation, fixed and responsive annuities, exchange rates, purchasing power
Replacement analysis	1	Determining economic life of challenger, determining economic life of defender, abandonment, after-tax replacement study
Evaluating projects with the benefit-cost ratio method	1	Benefits, costs, dis-benefits, self-liquidating projects, multi-purpose projects, interest rate vs. public project, conventional B-C ratio PW and AW method, modified B-C ratio PW and AW method
Breakeven and sensitivity analysis	1	Breakeven analysis, sensitivity analysis, spider plot
Probabilistic risk analysis	1	Sources of uncertainty, discrete and continuous variables, probability trees, Monte Carlo simulation example, decision trees, real options analysis
The capital budgeting process	1	Capital financing and allocation, equity capital and CAPM, WACC, WACC relation to MARR, opportunity cost
Decision making considering multiattributes	1	Non-compensatory models (dominance, satisficing, disjunctive resolution, lexicography), compensatory models (non-dimensional scaling, additive weight)
Final test	1	90 minutes, concept questions, calculation task (option of choice)

Additionally, students will submit three reports during the course on given engineering economy subjects. Also, required are the five lab participations (ca.60 min/each) for each student. Additionally, three exercise sessions (ca.60 min/each), where use of Ms-Excel will be practiced for solving various engineering economy tasks, should be completed

【Textbook】 Engineering Economy 15th ed. William G. Sullivan (2011)

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 -This course is highly recommended for those who attend " Project Management in Engineering course , Small group working method

【Independent Study Outside of Class】

【Web Sites】 The web-site is listed in the home page of the GL education center.

【Additional Information】 Students are requested to check in advance whether the credits of this course are counted as the units for graduation requirement at department level. The course starts on Oct.2nd.

International Internship in Engineering 1

工学研究科国際インターンシップ 1

【Code】 10i010 **【Course Year】** Master and Doctor Course **【Term】** 1st+2nd term**【Class day & Period】** Intensive course **【Location】** **【Credits】** 1 **【Restriction】** Defined by each internship program**【Lecture Form(s)】** Exercise **【Language】** English**【Instructor】** Faculty members in charge of educational affairs of the Global Leadership Engineering Education Center and of the department the registrant belongs to.**【Course Description】** Acquisition of international skills with the training of foreign language through the internship programs hosted by the University, the Graduate School of Engineering, or The Department the registrant belongs to.**【Grading】** Merit rating is performed based on the presentation or the report(s) after the participation in each internship program. Each department is responsible to identify the number of credits to be granted to the student of the department, if the credits are included in the mandatory ones. The Global Leadership Engineering Education Center takes the role to evaluate the credits if the department the student belongs to deals the credits as optional ones. The number of credits to be earned is 1 and 2, respectively to the subjects International Internship in Engineering 1 and 2 depending on the period and the contents of the internship program the students has participated in.**【Course Goals】** Acquisition of international skills with the training of foreign language.**【Course Topics】**

Theme	Class number of times	Description
Overseas Internship	1	The contents to be acquired should be described in the brochure of each internship program.
Final Presentation	1	A presentation by the student is required followed by discussion among participants.

【Textbook】 Not Applicable**【Textbook(supplemental)】** Not Applicable**【Prerequisite(s)】** Described in the application booklet for each internship program. The registrant is requested to have enough language skills for the participation.**【Independent Study Outside of Class】** Not Applicable**【Web Sites】** Not Applicable**【Additional Information】** It is required for students to check if the internship program to participate in could be evaluated as part of mandatory credits or not and could earn how many credits before the participation to the department or educational program the student in enrolled. If the credit could not be treated as mandatory ones, get in touch with the Global Leadership Engineering Education Center.

International Internship in Engineering 2

工学研究科国際インターンシップ 2

【Code】 10i011 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day & Period】 Intensive course 【Location】 【Credits】 2 【Restriction】 Defined by each internship program

【Lecture Form(s)】 Exercise 【Language】 English

【Instructor】 Faculty members in charge of educational affairs of the Global Leadership Engineering Education Center and of the department the registrant belongs to.

【Course Description】 Acquisition of international skills with the training of foreign language through the internship programs hosted by the University, the Graduate School of Engineering, or The Department the registrant belongs to.

【Grading】 Merit rating is performed based on the presentation or the report(s) after the participation in each internship program. Each department is responsible to identify the number of credits to be granted to the student of the department, if the credits are included in the mandatory ones. The Global Leadership Engineering Education Center takes the role to evaluate the credits if the department the student belongs to deals the credits as optional ones. The number of credits to be earned is 1 and 2, respectively to the subjects International Internship in Engineering 1 and 2 depending on the period and the contents of the internship program the students has participated in.

【Course Goals】 Acquisition of international skills with the training of foreign language. Detailed objectives should be described in each program.

【Course Topics】

Theme	Class number of times	Description
Overseas Internship	1	The contents to be acquired should be described in the brochure of each internship program.
Final Presentation	1	A presentation by the student is required followed by discussion among participants.

【Textbook】 Not Applicable.

【Textbook(supplemental)】 Not Applicable.

【Prerequisite(s)】 Described in the application booklet for each internship program. The registrant is requested to have enough language skills for the participation.

【Independent Study Outside of Class】 Not Applicable.

【Web Sites】 Not Applicable.

【Additional Information】 It is required for students to check if the internship program to participate in could be evaluated as part of mandatory credits or not and could earn how many credits before the participation to the department or educational program the student in enrolled. If the credit could not be treated as mandatory ones, get in touch with the Global Leadership Engineering Education Center.

Project Management in Engineering

エンジニアリングプロジェクトマネジメント

【Code】 10i049 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 4th 【Location】 A2-308 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu

Assoc.Prof. Lintuluoto, J. Assoc. Prof. Tanaka

【Course Description】 This course provides a basic knowledge required for the project management in various engineering fields such as process design, plant design, construction, and R&D projects. Also, visiting lecturers from industry and public works provide management insights of actual engineering projects.

【Grading】 Evaluated by assignments (project report exercise) and class contribution

【Course Goals】 This course will help students gain a fundamental knowledge of what project management in engineering is. Throughout the course, students will learn various tools applied in project management. Students will also understand the importance of costs and money, risks, leadership, and environmental assessment in managing engineering projects. This course is followed with the course Seminar on Project Management in Engineering. in the second semester.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	4/13 (Matsumoto) Course guidance
Special lecture by extramural instructor 1	1	4/20 (Inaoka(JICA))@A2-306 Project management in the case of Japanese ODA
Introduction to project management	1	4/27 (Maeda) Introduction to project management Project phases
Tools for project management I	1	5/11 (Lintuluoto) Tools for project management, cost, and cash flows I
Tools for project management II	1	5/18 (Lintuluoto) Tools for project management, cost, and cash flows II
Tools for project management III	1	5/25 (Lintuluoto) Tools for project management, cost, and cash flows III
Project scheduling I	1	6/1 (Ashida) Project scheduling I
Project scheduling II	1	6/8 (Ashida) Project scheduling II
Leadership I	1	6/15 (Tanaka) Leadership I
Leadership II	1	6/22 (Tanaka) Leadership II
Risk management I	1	6/29 (Matsumoto) Risk management I
Risk management II	1	7/6 (Matsumoto) Risk management II
Environmental Impact Assessment	1	7/13 (Yorozu) Environmental Impact Assessment
Special lecture by extramural instructor 2	1	7/20 (Kumagai(JGC CORPORATION)) To be announced
Feedback	1	7/27 (Matsumoto) Feedback

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 1. Lock, Dennis. Project Management. 10th edition. Gower Publishing Ltd.

2. Cleland, David L., and Lewis R. Ireland. Project Management. 5th edition. McGraw-Hill Professional

3. Roger Miller and Donald R. Lessard. The strategic management of large engineering projects, Shaping Institutions, Risks, and Governance, The MIT Press

【Prerequisite(s)】 No pre-requisite

【Independent Study Outside of Class】

【Web Sites】 The web-site is opened in the home page of the GL education center.

【Additional Information】

Exercise on Project Management in Engineering

エンジニアリングプロジェクトマネジメント演習

【Code】 10i059 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day & Period】 Friday 4th period and 5th period 【Location】 B-Cluster 2F Seminar Room 【Credits】 2

【Restriction】 Student number will be limited. 【Lecture Form(s)】 Seminar 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu
Assoc.Prof. Lintuluoto

【Course Description】 In this course, students will apply the engineering know-how and the skills of management, and group leadership which they learned in the course of Project Management in Engineering to build and carry out a virtual inter-engineering project. This course provides a forum where students' team-plan based on ideas and theories, decision making, and leadership should produce realistic engineering project outcomes. The course consists of intensive group work, presentations, and a few intermediate discussions. A written report will be required.

【Grading】 Report, class activity, presentation

【Course Goals】 This course prepares engineering students to work with other engineers within a large international engineering project. In particular this course will focus on leadership and management of projects along with applied engineering skills where the students learn various compromises, co-operation, responsibility, and ethics.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	10/5 Introduction to Exercise on Project Management in Engineering Lecture on tools for the Project management in engineering Practice
Teamwork	7	Each project team may freely schedule the group works within given time frame. The course instructors are available if any need is required.
Mid-term presentation	1	Each project team will have a mid-term presentation.
Lecture & Teamwork	2	Some lectures will be provided, such as Leadership structuring, Risk Management, and Environmental Impact Assessment, depending on projects you propose.
Presentation	1	Each project team will have a presentation based on its proposed project.

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 Fundamental skills about group leading and communication, scientific presentation.

【Independent Study Outside of Class】

【Web Sites】 The web-site will be opened in the home page of the GL education center.

【Additional Information】 The number of students may be restricted. Students are requested to check in advance whether the credit from this course will be accepted as a graduation requirement for their department.

Advanced Modern Science and Technology (4 times course) (English lecture)

現代科学技術特論 (4回コース) (英語科目)

【Code】 10i055 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 5th

【Location】 A2-306 【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 ER Center, J. Assoc. Prof., Ashida
ER Center, J. Assoc. Prof., Matsumoto
ER Center, J. Assoc. Prof., Maeda
ER Center, J. Assoc. Prof., Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '4 times course' should select one of the topics and attend the lectures. (Students who take '8 times course' should attend the lectures of the both topics.) Attend a course orientation held before the first lecture (Nov. 1) even if you take only the second topic.

Advanced Modern Science and Technology (8 times course) (English lecture)

現代科学技術特論 (8 回コース) (英語科目)

【Code】 10i056 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 5th

【Location】 A2-306 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 ER Center, J. Assoc. Prof., Ashida
ER Center, J. Assoc. Prof., Matsumoto
ER Center, J. Assoc. Prof., Maeda
ER Center, J. Assoc. Prof., Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '8 times course' should attend the lectures of the both topics. (Students who take '4 times course' should select one of the topics and attend the lectures.)

Applied Numerical Methods

応用数値計算法

【Code】 10G001 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Mon 1st

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Toshiyuki Tsuchiya

【Course Description】 Numerical techniques, such as the finite element method and numerical control method, are indispensable in mechanical engineering. In this lecture, basics of numerical techniques which are required to study advanced methods for graduated students will be explained. The lecture will cover the linear system solution ($Ax=b$), eigenvalue analysis, interpolation approximation method, solutions of ordinary differential equation and partial differential equation. The programming exercise is included in this lecture.

【Grading】 Home works (four home works will be assigned) and examination.

【Course Goals】 Understandings of mathematical theories and programming implementations of the numerical methods.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction of this class
		Numerical representations and errors
		Macro programming using spread sheet applications
Linear system	1	Matrix
		Norms
		Singular value decomposition
Linear simultaneous equation 1	2	Solution of simultaneous linear equations direct method, iteration method
Eigenvalue analysis	2	Eigenvalue problems
Interpolation	2	Interpolation and its errors
Numerical integra 1	2	Numerical integration methods
Normal differential equation and numerical integral	1	explicit method, implicit method initial value problem, boundary value problem
Partial differential equation	3	Differential expression of partial differential Diffusion equation, wave equation Poisson equation, Laplace equation
Examination	1	Feedback for homework and examination

【Textbook】 Lecture note will be distributed through the course website.

【Textbook(supplemental)】 Golub, G. H. and Loan, C. F. V., Matrix Computations, John Hopkins University Press
R.D.Richtmyer and K.W.Morton, Difference Methods for Initial-Value Problems, Second Edition, John Wiley & Sons 1967

【Prerequisite(s)】 Basic mathematics for undergraduates

Basic macro programming

【Independent Study Outside of Class】 Problems are based on macro on Microsoft Excel or LibreOffice.

【Web Sites】 Lecture notes, home works, and other info will be distributed through Panda:

<https://panda.ecs.kyoto-u.ac.jp>

【Additional Information】 Have a PC with Microsoft Excel with VBA or LibreOffice (<https://ja.libreoffice.org/>).

Solid Mechanics, Adv.

固体力学特論

【Code】10G003 【Course Year】Master Course 【Term】1st term 【Class day & Period】Thu 1st

【Location】C3-Lecture Room 1 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】H. Hirakata, T. Shimada

【Course Description】 This course provides fundamental concepts of solid mechanics such as stress, strain, and constitutive laws, and methods for analyzing stress/strain fields and deformation of solids and structures on the basis of the concepts. In particular, the course lectures theories of nonlinear problems such as plasticity and creep, and their numerical solutions, or finite element methods, which are important for design and development of mechanical structures.

【Grading】 Grading is based on the examination, possibly with considerations of the homework reports.

【Course Goals】 Students will be able to:

understand solid mechanics deeply and acquire basic knowledge to design mechanical structures.

analyze problems of plasticity and creep by finite element methods.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Overview of solid mechanics
Stress	1	Cauchy stress tensor, Equilibrium equation, Invariants
Deformation	2	Material description and spatial description, Displacement, Deformation gradient, Lagrange-Green strain and Euler-Almansi strain, Infinitesimal strain, Material time derivative
Constitutive equation: linear elasticity	1	Linear elastic stress-strain response, Hooke ' s law
Principle of virtual work and principle of minimum potential energy	1	Principle of virtual work, Principle of minimum potential energy
Finite element method for linear elasticity	3	Basis of finite element method, Finite element equilibrium equations, Elements, Numerical integration
Plasticity problems	3	Plasticity theory (uniaxial and multiaxial problems, yield criteria, flow rule, hardening rule, constitutive equations), Finite element method for elasto-plastic problems
Creep problems	2	Creep theory (uniaxial and multiaxial constitutive equations), Finite element method for creep problems
Summary	1	Discussions and reports

【Textbook】 Lecture materials are distributed in the classroom.

【Textbook(supplemental)】 T. Kyoya, Continuum Mechanics, Morikita (2008) (in Japanese)

Y. Tomita, “ Foundation and Application of Elastoplasticity ” Morikita (1995) (in Japanese)

E. Neto et al., “ Computational Methods for Plasticity, ” John Wiley & Sons (2008).

【Prerequisite(s)】 This course requires basic knowledge of mechanics of materials and solid mechanics.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Thermal Science and Engineering

熱物理工学

【Code】 10G005 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Mon 3rd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 H. Yoshida & M. Matsumoto

【Course Description】 Several topics in advanced thermal physics are discussed. From microscopic view points, basics of stochastic process and related topics are given. From macroscopic ones, after the concept of entropy is revisited, applications in global environments and hydrogen energy are described.

【Grading】 Reports, essays, and/or written examinations.

【Course Goals】 Microscopic Viewpoints: Ability of multi-scale modelling

Macroscopic Viewpoints: Ability of global environment modelling

【Course Topics】

Theme	Class number of times	Description
(M) Brownian Motion	1	
(M) Transport Phenomena and Correlation Functions	1	
(M) Spectral Analysis and Fractal Analysis	2	
(M) Stochastic Process and Its Applications	3	
(Y) Science of Atmosphere and Ocean	5	
(Y) Science of Hydrogen Energy	1	
(Y) Science of Nuclear Energy	1	
Check and feedback	1	

【Textbook】 Not specified.

【Textbook(supplemental)】

【Prerequisite(s)】 Elementary thermodynamics, Statistical physics, Heat transfer engineering, Numerical analysis etc.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 (2018)

Matsumoto: April 9 ~ May 28

Yoshida: June 4 ~ July 17

Introduction to Advanced Fluid Dynamics

基盤流体力学

【Code】 10G007 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Fri 1st

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	5	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantum Condensed Matter Physics

量子物性物理学

【Code】 10G009 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Thu 2nd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	4	
	1	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Design and Manufacturing Engineering

設計生産論

【Code】 10G011 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Fri 2nd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	3	
	2	
	3	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Dynamic Systems Control Theory

動的システム制御論

【Code】 10G013 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Tue 2nd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	5	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Engineering Ethics and Management of Technology

技術者倫理と技術経営

【Code】 10G057 【Course Year】 Master 1st 【Term】 1st term 【Class day & Period】 Thu 3rd

【Location】Butsurikei-Kousya 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lectures and Exercise

【Language】 Japanese 【Instructor】 Sawaragi, Nishiwaki, Tomita, M. Komori, Tsuchiya, Noda, Sato, Iseda,

【Course Description】 Basic knowledge of Engineering Ethics and Management of Technology needed for future project leaders in companies and society is taught. Students have to make group work after-class hours as well as presentations of wrapping-up the discussions. Engineering ethics is the field of applied ethics and system of moral principles that apply to the practice of engineering. The field examines and sets the obligations by engineers to society, to their clients, and to the profession. Management of Technology is a set of management disciplines that allows organizations to manage their technological fundamentals to create competitive advantage. This course consists of lectures, exercises, discussions and oral presentations under supervision of professional faculties and extramural lecturers.

【Grading】 Submission of reports and presentations

【Course Goals】 To cultivate a spirit of self-sufficiency needed for engineers

【Course Topics】

Theme	Class number of times	Description
Engineering Ethics	9	1. Introduction to Engineering Ethics (EE) 2. Medical Engineering Ethics 3. EE by Institution of Professional Engineers, Japan and abroad 4. Product Safety and Product Liability 5. Comprehensive Manufacturing and EE (1) 6. Comprehensive Manufacturing and EE (2) 7. Group Discussions 8. History and Philosophy of EE 9. Presentation on exercise of EE
Management of Technology	5	1. Product Portfolio, Strategy for Competition 2. Business Domain and MOT for Marketing 3. Organizational Strategy for Corporates' R & D 4. Management Theory for R & D 5. Presentation on exercise of MOT
Summary	1	

【Textbook】 No textbook

【Textbook(supplemental)】 Nothing

【Prerequisite(s)】 Nothing particular

【Independent Study Outside of Class】

【Web Sites】 No Web Site

【Additional Information】 Nothing particular

Fracture Mechanics

破壊力学

【Code】10G017 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Fri 1st

【Location】C3-Lecture Room 3 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Takayuki Kitamura,

【Course Description】The basics of the fracture mechanics will be lectured.

Elastic problem, Stress function of a crack, Stress field around a crack tip, Stress intensity factors, Energy release rate, J-integral, Elastic plastic fracture mechanics, Interfacial fracture mechanics etc.

Fracture toughness, Crackings in fatigue, environmental fatigue and creep-fatigue etc.

【Grading】Mini-reports will be evaluated.

【Course Goals】The objective of this lecture is to master the basic knowledge of the fracture mechanics, and to be able to discuss about material strength on the basis of the knowledge.

【Course Topics】

Theme	Class number of times	Description
Introduction	2	Introduction
		Examples of fracture in real components
		Deformation and fracture
		Stress concentration and singular stress field
		Basics of solid mechanics
Linear fracture mechanics	3	Mechanics of cracked body under linear elasticity
		Singular stress field near a crack tip, Stress intensity factor, Energy release rate, J-integral, Small scale yielding
		Interfacial fracture mechanics in dissimilar materials, Stress field near an interface edge, Stress field near an interfacial crack
Nonlinear fracture mechanics	2	Fracture mechanics in non-linear elastic solid
		HRR singular field, J-integral, creep
		Stress field near an interface edge
Fracture phenomenon and mechanics	3	Application of fracture mechanics to fracture toughness
		Application of fracture mechanics to fatigue cracking
		Application of fracture mechanics to environmental cracking
		Application of fracture mechanics to fatigue cracking at high temperatures
Fracture mechanics on growth of small cracks	1	Growth of physical small crack
		Growth of microstructurally small crack
Crack growth and cavity in creep	1	Cavity growth by diffusion creep
		Difference of stress field between crack and cavity
Fracture nanomechanics	1	Research works on fracture mechanics in nanometer scale
Fracture in atomic scale	1	Research works on fracture in atomic scale
Summary	1	Discussion and report

【Textbook】The teacher provide articles for this lecture.

【Textbook(supplemental)】

【Prerequisite(s)】The traditional material strength and the linear elastic mechanics should be learned before taking this lecture.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Physics of Neutron Scattering

中性子物理学

【Code】10B628 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Mon 4th

【Location】C3-Lecture Room 3 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】K. Mori, Y. Onodera

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Robotics

ロボティクス

【Code】 10B407 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 Mon 2nd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Fumitoshi Matsuno,

【Course Description】 Understanding of intelligent behaviors of living things is very interesting. And realization of their intelligent motion by a robot is also attractive for mechanical engineering. In this lecture, we consider basic understanding of beautiful human skill “ manipulation ” on the point of view of dynamics and control. First modeling methodologies for a rigid multibody system and a general dynamic model of a manipulator are provided. Next, a typical nonlinear control law is introduced and some problems for applying the controller are shown. Based on nature of the dynamics of the manipulator, a very simple and robust controller can be derived by designing energy of the system. This lecture provides modeling methodologies and controller design strategies of the rigid multibody system and we analyze a beautiful human skill of the manipulation.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	1	
	3	
	3	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Mechanical Functional Device Engineering

メカ機能デバイス工学

【Code】 10G025 【Course Year】 Master 1st 【Term】 2nd term 【Class day & Period】 Wed 3rd

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Masaharu Komori

【Course Description】 For any machines, prime movers and powertrains are necessary to realize the required functions. In automobiles, an engine is the prime mover and a transmission, a clutch, and a shaft are parts of the powertrain. In machine tools, a motor is used as the prime mover and the powertrain uses feed screws. In this lecture, the prime mover is taken up. Types, characteristics, principles, advantages and disadvantages of the prime mover are explained. In addition, examples of the powertrains are shown using mechanism models.

【Grading】 Evaluate comprehensively by participation in class, tests, reports, etc.

【Course Goals】 Understand the principles and basic characteristics of the prime movers and powertrains taken up in the lecture.

【Course Topics】

Theme	Class number of times	Description
Outline	1	Outline of mechanical functional device engineering, composition of mechanical device, examples of prime movers, working parts, and powertrains, examples of actuators and mechanisms
Electromagnetic force	3	Principle used for actuators, type of electromagnetic motor, principle and characteristics of synchronous motor, generating method of rotating magnetic field, induction motor, reluctance motor, DC motor, stepping motor
Electrostatic force	1	Usage as actuator, explanation of principle and characteristics
Piezoelectric	1	Piezoelectric effect, characteristics of piezoelectric effect, piezoelectric material, polarization, displacement and force, hysteresis, type and basic structure, application
Fluid pressure	1	Fluid pressure actuator
Ultrasonic	1	Ultrasonic motor
Shape memory alloy	1	Shape memory effect, shape resilience
Mechanism	5	Introduction of mechanism using mechanism model
Feedback class	1	Answer questions

【Textbook】 Instruct as necessary.

【Textbook(supplemental)】 Instruct as necessary.

【Prerequisite(s)】 Nothing.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Schedule of lecture may be changed according to circumstances. Supplement in English as necessary.

Basic Seminar on Mechanical Engineering and Science A

機械理工学基礎セミナー A

【Code】10G036 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	10	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Basic Seminar on Mechanical Engineering and Science B

機械理工学基礎セミナー B

【Code】10G037 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	10	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Mechanical Engineering and Science A

機械理工学セミナー A

【Code】 10G031 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	5	
	5	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Mechanical Engineering and Science B

機械理工学セミナー B

【Code】10G032 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】 【Location】 【Credits】

【Restriction】 No Restriction 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	5	
	5	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Finite Element Methods

有限要素法特論

【Code】10G041 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 1st
 【Location】C3-Lecture Room 2 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture and Practice
 【Language】English 【Instructor】Kotera and Nishiwaki,

【Course Description】 This course presents the basic concept and mathematical theory of the Finite Element Method (FEM), and explains how the FEM is applied in engineering problems. We also address important topics such as the physical meaning of geometrical non-linearity, material non-linearity, and non-linearity of boundary conditions, and we explore numerical methods to deal with these nonlinearities. Also, we guide students in class in the use of software to solve several numerical problems, to develop practical skill in applying the FEM to engineering problems.

【Grading】 Grading is based the quality of two or three reports and the final exam.

【Course Goals】 The course goals are for students to understand the mathematical theory of the FEM and the numerical methods for analyzing non-linear problems based on the FEM.

【Course Topics】

Theme	Class number of times	Description
Basic knowledge of the FEM	3	What is the FEM? The history of the FEM, classifications of partial differential equations, linear problems and non-linear problems, mathematical descriptions of structural problems (stress and strain, strong form and weak form, the principle of energy).
Mathematical background of the FEM	2	Variational calculus and the norm space, the convergence of the solutions.
FEM formulations	3	FEM approximations for linear problems, formulations of iso-parametric elements, numerical instability problems such as shear locking, formulations of reduced integration elements, non-conforming elements, the mixed approach, and assumed-stress elements.
Classifications of nonlinearities and their formulations	4	Classifications of nonlinearities and numerical methods to deal with these nonlinearities.
Numerical practice	2	Numerical practice using COMSOL.
Evaluation of student achievements	1	

【Textbook】

【Textbook(supplemental)】 Bath, K.-J., Finite Element Procedures, Prentice Hall

Belytschko, T., Liu, W. K., and Moran, B., Nonlinear Finite Elements for Continua and Structures, Wiley

【Prerequisite(s)】 Solid Mechanics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Strength of Advanced Materials

先進材料強度論

【Code】 10B418 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 2nd

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 M. Hojo and M. Nishikawa,

【Course Description】 The mechanism underlying mechanical and functional properties are lectured for advanced materials used and developed in advanced fields of current engineering. In particular, advanced composite materials, used for aircraft structure etc., are introduced, with a detailed description of the relationship between microscopic constituent materials and macroscopic properties from the perspective of multiscale mechanics; also the anisotropy of their properties, their fatigue and fracture properties are described in the basic discipline for strength of materials. The latest applications are introduced in the field of various transportation systems including airplanes.

【Grading】 Grading is based on the reports. The assignments will be given around three times.

【Course Goals】 The course goal is to understand basic concepts of composite materials and the underlying mechanism of their mechanical properties from multiscale viewpoints, while the physical understanding of composites is developed based on multiple disciplines.

【Course Topics】

Theme	Class number of times	Description
Concept of composite materials	2	The concept and definition of composite materials, their constituent materials and manufacturing methods are illustrated. Their application to aircraft structures etc. are also introduced.
Mechanical properties of microscopic constituent materials	2	Resin for matrix and various fiber types are explained including their structure and mechanical properties. The weakest link model and Weibull distribution are described as a basis of the statistic nature of strength.
Basic mechanical properties	4	The specific strength, the specific stiffness, and the rule of mixture for elastic modulus and strength are lectured. In particular, the detailed explanation is made to the anisotropy of elastic modulus, independent elastic constants in the generalized Hookean law, the anisotropic failure criteria, and laminate theory. The relationship between the mechanical properties of microscopic constituent materials and macroscopic properties of composite materials is also illustrated.
Micromechanics	2	The mechanism of transverse fracture is illustrated. The mechanical models are described for short fiber reinforced composites and particle dispersed composites. The micromechanical analyses based on finite element method is also illustrated for the physical understanding of the strength of composite materials.
Fracture mechanics properties	2	Fracture mechanics of anisotropic materials are described. The interlaminar fracture toughness and interlaminar fatigue crack propagation, the critical issues in the application of composite structures, are explained including their underlying mechanism.
Superconducting materials	1	High-temperature superconducting materials are the composite materials consisting of metals and fibrous superconducting materials made of oxides. The mechanism are explained for understanding that their mechanical properties so much control their electric properties.
Process and mechanical properties of composite materials	1	The molding and machining process of composite materials is explained to relate it to their mechanical properties. Fiber preform, the selection of resin, intermediate materials, machining and assembly and inspection methods are overviewed from the academic viewpoints.
Academic achievement test	1	Academic achievements is assessed.

【Textbook】 Supplementary handouts will be distributed in the class.

【Textbook(supplemental)】 D.Hull and T.W.Clyne, An Introduction to Composite Materials, Cambridge University Press.

【Prerequisite(s)】 Mechanics of Materials, Continuum Mechanics, Fundamentals of Materials, Solid Mechanics, Adv.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 The order and the item in the course are possibly subject to change.

Thermophysics for Thermal Engineering

熱物性論

【Code】 10B622 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 1st

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 M. Matsumoto

【Course Description】 Based on elementary thermodynamics and statistical physics, I will describe non-equilibrium thermodynamics and advanced statistical physics, including phase transition, pattern formation, and entropy production.

【Grading】 Paper assignments

【Course Goals】 Understanding the principle mechanisms of phase transition, cooperation phenomena, pattern formation, and relaxation phenomena, in terms of advanced statistical mechanics and non-equilibrium thermodynamics.

【Course Topics】

Theme	Class number of times	Description
Elementary statistical physics: review	1	Review of equilibrium statistical mechanics
Phase transition as a cooperative phenomenon	3	Statistical mechanics of interacting particle system - Exact calculation - Monte Carlo simulation - Mean field approximation
Pattern formation of non-equilibrium systems	3	After a time dependent Ginzburg-Landau (TDGL) model is introduced, formation of spatial patterns is discussed from various viewpoints.
Equilibrium thermodynamics: review	2	Review of elementary thermodynamics
Non-equilibrium thermodynamics: Basics	5	System stability and the principle of irreversible process are discussed in terms of thermodynamics.
Non-equilibrium thermodynamics: Applications	3	- Entropy production - Linear response theory - Onsager's reciprocal relation
Check and Feedback	1	

【Textbook】 Lecture note will be prepared.

【Textbook(supplemental)】 will be listed in the class.

【Prerequisite(s)】 Undergraduate level of Thermophysics, Heat transfer phenomena, and Statistical physics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Transport Phenomena

熱物質移動論

【Code】 10G039 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 3rd
 【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese
 【Instructor】 Nakabe, Kazuyoshi, Tatsumi, Kazuya,

【Course Description】 The important learning objective of this class is to understand the fundamental mechanisms of momentum, heat, and mass transfer phenomena, the knowledge of which will be markedly required for the thermal energy control technologies to further practice conservations of natural resources and energies for sustainable development. Heat and mass transfer processes consisting of conduction and forced/natural convection will be highlighted in detail, referring to the similarity characteristics of flow velocity, fluid temperature, and species concentration. Some topics on Reynolds stress, turbulent heat flux, and phase change will be introduced, expanding to their numerical models, together with some recent trends of high-tech heat and energy devices.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Surrounding Examples of Transport Phenomena	1	
Governing Equations and Non-Dimensional Parameters	3 ~ 4	
Boundary Layer Flows	2 ~ 3	
External and Internal Flows	1 ~ 2	
Turbulent Phenomena	2 ~ 3	
Topics of Flow and Heat Transfer Mechanism	2 ~ 3	
Estimation on Study Achievement	1	

【Textbook】

【Textbook(supplemental)】 Example: Transport Phenomena (Bird, R.B. et al.)

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Engineering Optics and Spectroscopy

光物理工学

【Code】 10G021 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Tue 2nd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Masahiro Hasuo, Taiichi Shikama

【Course Description】 Optics are widely used in many areas of modern science and technology. Students will learn the physical properties of light and light-matter interactions, and their applications. Topics such as light propagation in dielectric media, crystal optics, quantum optics, and lasers will be explored. Interactions of light with atoms, molecules and solids as examples will be also explored with introduction of the fundamentals of spectroscopy and their applications.

【Grading】 Grade evaluation will be based on report examination.

【Course Goals】 Understand the principles of optical engineering and spectroscopy.

Develop application abilities based on the principle understanding.

【Course Topics】

Theme	Class number of times	Description
Dispersion of light	6	propagation of light in dielectric media (Lorentz model), crystal optics, nonlinear optics
Quantum optics	1	quantum theory of light, principles of lasers
Light-matter interactions	5	light-induced transition, quantum states of atoms, molecules, and solids, and rules governing the transitions (selection rules)
Selection rules and group theory	2	introduction to group theory and its application to the selection rules
Confirmation of the achievement	1	

【Textbook】 Recommended books will be discussed in class.

【Textbook(supplemental)】 Lecture notes will be distributed.

【Prerequisite(s)】 Undergraduate-level electromagnetism and quantum mechanics.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Optimum System Design Engineering

最適システム設計論

【Code】 10G403 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 2nd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	2	
	5	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

High Energy Radiation Effects in Solid

高エネルギー材料工学

【Code】 10B631 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 3rd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 A. Kinomura, Q. Xu, A. Yabuuchi

【Course Description】 Selection, fabrication and deterioration of materials are important factors for mechanical system design. It is necessary to understand conditions under which selected materials are actually used. In particular, special design policies are required for the materials used under irradiation of high-energy particles and radiation. On the other hand, it is possible to intentionally make use of property changes of materials by high-energy particle irradiation.

Irradiation of high-energy particles such as accelerated neutrons, ions and electrons deposits very high energies at local regions. Such irradiated regions undergo extreme conditions which cannot be realized by other methods. As a result, the irradiation leads to significant structural and stoichiometric changes in materials. This lecture gives general description of materials irradiation effects, irradiation effects on materials related to nuclear power plants, and academic/industrial applications of materials fabrication/analysis by using high-energy particles.

【Grading】 Grading is based on small quizzes and report submission (if necessary) on the lecture.

【Course Goals】 To understand reactions and property changes of materials under radiation and high-energy particle irradiation.

【Course Topics】

Theme	Class number of times	Description
		(1) Introduction
		(2) Scattering of high-energy particles with atoms in solids
		(3) Displacement of atoms in solids by high-energy particles
		(4) Motion and behaviors of point defects
		(5) Rate equation of point defects and secondary-defect formation
		(6) The influence of irradiation on material properties
		(7) Activation of materials
	15	(8) High-energy particle sources
		(9) Ion beam fabrication
		(10) Ion beam analysis
		(11) Electron beam applications
		(12) Materials irradiation studies
		(13) Neutron irradiation effects and nuclear materials
		(14) Positron analysis

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 Basic knowledge on materials engineering and mechanics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Experimental Techniques and Analysis in Engineering Physics

先端物理工学実験法

【Code】 10B634 【Course Year】 Master and Doctor Course 【Term】 (intensively; in summer vacation)

【Class day & Period】 【Location】 Research Reactor Institute 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
-------	-----------------------	-------------

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Theory for Design Systems Engineering

デザインシステム学

【Code】 10Q807 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 2nd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Tetsuo Sawaragi and Hiroaki Nakanishi,

【Course Description】 The lecture focuses on the human design activity; designing artifacts (things, events and systems) based on human intuitions, and designing human-machine systems in which the relations between human and objects are of importance.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	3	
	3	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

High Precision Engineering

超精密工学

【Code】10B828 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】

【Location】C3-Lecture Room 2 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese+English 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction to High Precision Analysis Using Synchrotron Radiations
High precision Measurement	2	Synchrotron Radiation and X-ray Fluorescence Spectroscopy
High precision Measurement	3	Micro Imaging and Quantitative XRF micro Analysis
High precision Measurement	4	Fine Structure Spectroscopy
High precision Measurement	5	Fine Structure Spectroscopy
High precision Measurement	6	Synchrotron Radiation Measurement
Applications in bio-nano technology	7	Elemental Images of Single Neurons by Using SR-XRF I
Applications in bio-nano technology	8	Elemental Images of Single Neurons by Using SR-XRF II
Applications in bio-nano technology	9	Elemental Imaging of Mouse ES Cells(Application)
Applications in bio-nano technology	10	Application of Synchrotron Radiation in the Investigation of process of neuronal differentiation
Applications in bio-nano technology	11	Chemical State Imaging for Investigations of Neurodegenerative Disorders (Parkinsonism-Dementia Complex)
Applications in bio-nano technology	12	Chemical State Imaging for Investigations of Neurodegenerative Disorders: Chemical State of Iron in Parkinsonism Dementia Complex (PDC)
Applications in bio-nano technology	13	Comparison with other techniques
Applications in bio-nano technology	14	Comparison with other techniques
	15	

【Textbook】

【Textbook(supplemental)】Application of Synchrotron Radiation, Arid Ide-Ektessabi, Sp ringer 2007

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】<http://ocw.kyoto-u.ac.jp/graduate-school-of-engineering-jp/ultra-high-precision-analysis/schedule>

【Additional Information】

Biomechanics

バイオメカニクス

【Code】10V003 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 2nd

【Location】 【Credits】2 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】Taiji Adachi,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction	1	
	2	
	4	
	4	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Biomedical Engineering

医工学基礎

【Code】10W603 【Course Year】Master and Doctor Course 【Term】1st term

【Class day & Period】Intensive lecture using 3 days on Saturdays since mid-June 【Location】Katsura

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】,,,

【Course Description】Understand basic concepts related to clinical medicine and medical engineering . And expand the range of research by exchange each engineering knowledge and experience.

【Grading】Participate to the workshops submit a report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction to medicine for engineering students	3	
Introduction to Medical Engineeri	4	
Cross-field workshop	8	

【Textbook】no

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Environmental Fluid Dynamics

環境流体力学

【Code】10B440 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 2nd

【Location】C3-Lecture Room 5 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	6	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Turbulence Dynamics

乱流力学

【Code】 10Q402 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Tue 3rd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Hanazaki,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	4	
	2	
	2	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Crystallography of Metals

金属結晶学

【Code】 10G055 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 3rd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese
【Instructor】 ,

【Course Description】 Metallic crystal structure and deformation behavior are lectured on the basis of metal physics and dislocation theory. Especially, mechanical properties of dislocation and its substructure, which is changed in association with deformation, are introduced, and the effect of grain boundary and free surface on dislocation motion is explained.

【Grading】 Reporting assignment

【Course Goals】 The objective of this lecture is to deepen a further understanding of crystal growth methods, the dislocation theory and industrial problems.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction
		Ideal strength and slip deformation
		Concept of dislocation
		Simulation
Basis of crystallography	1	Typical crystallographic structure
		Allotropic transformation
		Stereographic projection of crystal
High temperature and vacuum techniques	1	Furnace
		Vacuum pump
Crystal breeding	2	Single- and bi-crystal growth
		Crystal growth
		Vapor deposition and thin film
Dislocation theory	3	Plastic deformation of crystal
		Definition and type of dislocation
		Strain field around dislocation
		Dislocation reaction
Mechanical properties of single- and bi-crystals	1	Dislocation substructure
		Grain boundary structure
		Reaction between dislocation and grain boundary
		Deformation of micro- and nano- materials
Fatigue	3	Fatigue of single crystal
		Fatigue dislocation substructure
		Fatigue cracking mechanism
		Fatigue of micro- and nano- materials
Observation and analysis techniques	2	Introduction of electron microscope and observation case
Summary	1	Discussion and report

【Textbook】 The teacher provide articles for this lecture.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar: Dynamics of Atomic Systems

原子系の動力学セミナー

【Code】10Q610 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 5th
 【Location】C3-Lecture Room 1 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture + Exercise
 【Language】Japanese and English

【Instructor】M. Matsumoto, M. Nishikawa, R. Matsumoto, T. Shimada, Y. Inoue

【Course Description】Particle simulations are a tool of analyzing microscopic phenomena, and widely used in various fields of science and engineering. After providing the basics of particle simulation methods through lectures and exercises, we show various practical applications in thermofluids, solid materials, biophysics, and quantum systems.

【Grading】Reports, presentation/discussion

【Course Goals】- Understanding the basics of particle simulations - Mastering data analysis techniques

【Course Topics】

Theme	<small>Class number of times</small>	Description
Basics of MD simulations (M.Matsumoto)	6	- Numerical simulation of equations of motion - Model potentials - Data analysis - Equilibrium vs. non-equilibrium
Application: Thermofluidal systems (M. Matsumoto)	2	- Lennard-Jones fluids - Interface, phase change, energy transport, etc.
Application: Polymeric materials (Nishikawa)	2	- Fundamentals on mechanical (viscoelastic) properties of polymer materials - Application of molecular dynamics method of polymer materials
Application: Biosystems (Inoue)	1	- MD simulation of biomolecular systems - Recent examples
Application: Solid systems (R. Matsumoto)	1	- Deformation and destruction - Alternative methods
Application: Quantum systems (Shimada)	2	- First principle MD - Mechanical and electronic properties on nanoscale
Check and Feedback	1	

【Textbook】**【Textbook(supplemental)】****【Prerequisite(s)】** Elementary Level of

Analytical mechanics, Quantum mechanics, Material science, Thermodynamics, Statistical physics, Numerical analysis

【Independent Study Outside of Class】**【Web Sites】****【Additional Information】**

Neutron Science Seminar 1

中性子材料工学セミナー

【Code】 10V007 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】

【Location】 Research Reactor Institute 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	2	
	2-3	
	2-3	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Neutron Science Seminar II

中性子材料工学セミナー

【Code】 10V008 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】

【Location】 Research Reactor Institute 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 K. Mori

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	2	
	9	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Mechanical Engineering

先端機械システム学通論

【Code】 10K013 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day & Period】 Tue 5th and Thu 4th 【Location】 C3-Lecture Room 5 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Faculty members from several fields

【Course Description】 Lectures on recent topics in various fields of mechanical engineering will be given in English. This is mainly for foreign students (MC/DC), but Japanese students are also welcome.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Mechanics	2	Detailed schedule will be announced later.
Materials	2	
Thermodynamics	2	
Fluid dynamics	2	
Control	2	
Design	2	
Microengineering	2	
Examination/Feedback	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This class will be given every two years; Not given in 2017.

Advanced Modern Science and Technology (8 times course) (English lecture)

現代科学技術特論（8回コース）（英語科目）

【Code】10i056 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 5th

【Location】A2-306 【Credits】1 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】English

【Instructor】	ER	Center,	J.	Assoc.	Prof.,	Ashida
	ER	Center,	J.	Assoc.	Prof.,	Matsumoto
	ER	Center,	J.	Assoc.	Prof.,	Maeda
	ER	Center,	J.	Assoc.	Prof.,	Yorozu

Related professors

【Course Description】Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】There are two topics, each of which consists of four lectures. Students who take '8 times course' should attend the lectures of the both topics. (Students who take '4 times course' should select one of the topics and attend the lectures.)

Design of Complex Mechanical Systems

複雑系機械システムのデザイン

【Code】 10X411 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 3rd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	2	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Theory for Designing Artifacts

アーティファクトデザイン論

【Code】 10X402 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Wed 5th 【Location】 C3-Lecture Room 4a 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English 【Instructor】 Tetsuo Sawaragi, Kumiyo Nakakoji

【Course Description】 The activity of design is fundamentally similar across a wide variety of domains. I use artifact in a broad and atypical sense to describe any product of intentional creation, including physical goods, services, information systems, buildings, landscapes, organizations, and societies. The central theme of this lecture is that a unifying framework informs the human activity of design across all domains. Especially, understanding user needs is a key element of problem definition, and that understanding is usually best developed with interactive and immersive methods. In this lecture, a variety of methodologies for participatory systems approach and an idea of user-experience are provided, and its contributions to the design process are discussed.

【Grading】 Students will be evaluated based on the following criteria, in the order listed. (1) Exercises assigned in class: approx. 20% (2) Final exam: approx. 60% (3) Contributions to classwork (e.g., asking good questions): approx. 20%

【Course Goals】 This course is aimed at developing the ability to apply methods for identifying problems and interactively analyzing/evaluating systems, based on understanding of the principles of artifact design and on systematic thinking.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	We will shed light on the concept of artifacts as something to be put on equal footing with natural objects and examine the history of artifacts in terms of how they were viewed in different ages?namely, artifacts as modes of representation in the ancient world, artifacts as necessities for survival in the middle ages, artifacts as forms of convenience in modern times, and artifacts as a means of perpetuation in the current era.
Artifact function and purpose	3	The effects that artifacts have on the outside world?i.e., other things?are " functions. " Function is the concept of questioning the existence of an artifact, and design is the formulation of functions for achieving an intended purpose. We will discuss the categorization of artifacts in terms of how the " purpose " of artifacts relates to the context in which they are used, and look at the origins of artifacts from the perspective of semiosis.
Artifact design principles	2	To understand an artifact is to know how its internal structure acts on the outside world to realize its function. Today, cybernetics?which has explored the interaction between the physical world and the world of information?is expanding into a concept that encompasses society as well (second-order cybernetics), and concepts have been put forward for actively rethinking how human cognition and decision-making interact with the outside world (ecological approaches, socially distributed cognition, naturalistic decision-making). We will examine artifact design principles based on theories related human activity at the boundary of these externalities.
Artifact design representation and evaluation	3	Design must fulfill its role of enhancing the quality of life through the creation of not only individual artifacts, but also environments and social systems that encompass groups of artifacts and natural objects. We will discuss the path toward expanding the scope of design from physical objects to environments and social systems that include intangible services, including with regard to problem development/representation methods, how to set purposes of design, how to eliminate the ambiguities and conflicts among various goals, searching for alternative design strategies, design evaluation, and principles and methods of consensus-forming among different stakeholders.
User-centered artifact design	2	The quality of designs is something to be evaluated by the user, and hence there must be collaboration between users and designers/producers. Moreover, complex design challenges cannot be resolved by experts of only one discipline; they must be tackled by pooling the design-related knowledge of different domains. We will discuss the concept of user-centered design, design rationale, and international standards of design processes for achieving design that is grounded in the user ' s needs/perspective.
Participatory systems approach	2	In order to deal with the design of large-scale, complex artifacts, one must take the approach of systemically structuring problems and basing design on diverse perspectives. We will broadly examine: interactive processes among system designers, users, and computers; methods of structurally modeling problems through repeated dialogue between experts in relative disciplines and computers; and ways of supporting the perceptions, interpretations, and decision-making of designers and users. We will also consider the utility of the participatory systems approach in smooth, effective implementation of system design.
Exercise in participatory systems approach	2	Students will apply the participatory systems approach to a real-world artifact design challenge, and report the results of this exercise.

【Textbook】 Lecture notes used in class will be distributed as needed. Refer to " Textbook (supplemental) " below.

【Textbook(supplemental)】 1. 吉川弘之 [2007] 人工物観, 横幹, 1(2), 59-65 2. Suh, N.P. [1990] The Principles of Design, Oxford University Press (邦訳: スー (翻訳: 畑村洋太郎) 「設計の原理?創造的機械設計論」, 朝倉書店, 1992.) 3. 吉川弘之 [1979] 一般設計学序説, 精密機械 45 (8) 20?26, 1979. 4. Vladimir Hubka and W. Ernst Eder [1995] Design Science, Springer 5. Simon, H. [1996] The Sciences of the Artificial Third edition 秋葉元吉、吉原英樹訳 [1999] 『システムの科学』 パーソナルメディア 6. H・A・サイモン [1979] 稲葉元吉・倉井武夫訳, 『意思決定の科学』, 産業能率大学出版部 7. Hutchins, Edwin [1995] Cognition in the Wild. MIT Press 8. Klein, G., Orasanu, J., Calderwood, R., and Zsombok, C.E. [1993] Decision Making in Action: Models and Methods. Ablex Publishing Co., Norwood, NJ. 9. D・ノーマン [1986] The Design of Everyday Things, 野島久雄訳 『誰のためのデザイン?: 認知科学者のデザイン原論』, 新曜社 10. 榎木、河村 [1981]: 参加型システムズ・アプローチ 手法と応用、日刊工業新聞社ほか

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Office hours will be held for one hour before and after each class period (preferably 5th period on Tuesdays, but also 3rd period on Wednesdays). Appointments for other times can be requested by e-mail.

Theory of Symbiotic Systems

統合動的システム論

【Code】 10X716 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 Mon 4th

【Location】 Integrated Research Bldg.-213 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,,,

【Course Description】 Various theories on developing and maintaining harmonious symbiosis among humans, artifacts, and environments are lectured and discussed. Topics include typical forms of harmonious coexistence such as in ecological systems, caring and artistic nature of communication and interactions, philosophical discussions on deep-ecology, and methodologies for designing symbiotic systems.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	2	
	1	
	2	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Control Theory for Mechanical Systems

機械システム制御論

【Code】 10X717 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Mon 2nd

【Location】 Engineering Science Depts Bldg.-315 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Toshiharu Sugie (School of Informatics)

【Course Description】 In this lecture, some basic components of advanced control theory for mechanical systems are described, which include coprime factorization, two-degree-of-freedom control, and robust controller design which takes account of model uncertainties.

【Grading】 It is evaluated by the raw score of the formal test in July. The students must submit the reports and the small exam papers which are requested in the class. The students should attend the class (with no late) more than 90 percent.

【Course Goals】 The course goals are (a) to understand the basic concepts of coprime factorization and algebraic control theory, (b) to be able to handle numerical examples, and (c) to understand the basic concepts of the robust control theory.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The purpose and the back ground of this lecture are described.
Coprime factorization	3-4	How to calculate the coprime factorization and its relation to stabilization are described.
Parametrization of stabilizing controllers	2-3	The class of all stabilizing controllers are given.
2 DOF control systems	3-4	The merits of 2 degree-of-freedom systems are described, and a systematic controller design method is given.
H-infinity control	3-4	Some basics of H- infinity control theory are described.

【Textbook】 none

【Textbook(supplemental)】 T.Sugie and M.Fujita, Introduction to Feedback Control, Corona Publishing Co., Ltd.

【Prerequisite(s)】 Classical Control Theory should be learned in advance.

【Independent Study Outside of Class】 Each student must confirm the numerical examples given in the lecture shown by himself/herself.

【Web Sites】 none

【Additional Information】 Office hour: Monday 15:00?17:00 at Room 409 of Research Building No. 10

Theory of Human-Machine Systems

ヒューマン・マシンシステム論

【Code】10X718 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Mon 3rd 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】..

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	3	
	2	
	3	
	3	
	1-2	
	1-2	
	1-2	
	1-2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Dynamical Systems,Advanced

力学系理論特論

【Code】10X719 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 4th

【Location】Reserch Bldg.No8 Lecture Room4 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】Kazuyuki Yagasaki(Graduate School of Infomatics)

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	2	
	2	
	2	
	2	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Heat Engine Systems

熱機関学

【Code】10X748 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Tue 3rd 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	2	
	2	
	1	
	1	
	2-3	
	2-3	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Combustion Science and Engineering

燃焼理工学

【Code】10X749 【Course Year】Master Course 【Term】1st term 【Class day & Period】Tue 1st 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1-2	
	1-2	
	1-2	
	1-2	
	1-2	
	1-2	
	1-2	
	1-2	
	1-2	
	1-2	
	1-2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Exercise in Mechanical Engineering and ScienceA

機械理工学特別演習 A

【Code】 10V012 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	10	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Exercise in Mechanical Engineering and ScienceB

機械理工学特別演習 B

【Code】 10V013 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	10	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Exercise in Mechanical Engineering and ScienceC

機械理工学特別演習 C

【Code】 10V014 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	10	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Exercise in Mechanical Engineering and ScienceD

機械理工学特別演習D

【Code】 10V015 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	10	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Exercise in Mechanical Engineering and ScienceE

機械理工学特別演習 E

【Code】 10V016 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	10	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Exercise in Mechanical Engineering and ScienceF

機械理工学特別演習 F

【Code】 10V017 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	10	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Internship M

インターンシップ M (機械工学群)

【Code】 10G049 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Exercise 【Language】 Japanese

【Instructor】 Tabata, Hasuo

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Orientation	1	
Internship	13	
Presentation	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Internship DS

インターンシップ DS (機械工学群)

【Code】 10V019 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 Tabata, Hasuo

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Orientation	1	
Internship	28	
Presentation	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Internship DL

インターンシップ DL (機械工学群)

【Code】 10V020 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 6 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 Tabata, Hasuo

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	1	
Internship	43	
Presentation	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar of Complex Mechanical Engineering,A

複雑系機械工学セミナー A

【Code】 10V025 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Tue 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at
cme-seminar@me.kyoto-u.ac.jp

Seminar of Complex Mechanical Engineering,B

複雑系機械工学セミナー B

【Code】 10V027 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at
cme-seminar@me.kyoto-u.ac.jp

Seminar of Complex Mechanical Engineering,C

複雑系機械工学セミナー C

【Code】 10V029 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Tue 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at
cme-seminar@me.kyoto-u.ac.jp

Seminar of Complex Mechanical Engineering,D

複雑系機械工学セミナー D

【Code】 10V031 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at
cme-seminar@me.kyoto-u.ac.jp

Seminar of Complex Mechanical Engineering,E

複雑系機械工学セミナー E

【Code】 10V033 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Tue 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at
cme-seminar@me.kyoto-u.ac.jp

Seminar of Complex Mechanical Engineering,F

複雑系機械工学セミナー F

【Code】 10V035 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Experiments on Mechanical Engineering and Science, Adv. I

機械理工学特別実験及び演習第一

【Code】 10G051 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	9	
	10	
	10	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Experiments on Mechanical Engineering and Science, Adv. II

機械理工学特別実験及び演習第二

【Code】 10G053 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	9	
	10	
	10	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Applied Numerical Methods

応用数値計算法

【Code】 10G001 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Mon 1st

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Toshiyuki Tsuchiya

【Course Description】 Numerical techniques, such as the finite element method and numerical control method, are indispensable in mechanical engineering. In this lecture, basics of numerical techniques which are required to study advanced methods for graduated students will be explained. The lecture will cover the linear system solution ($Ax=b$), eigenvalue analysis, interpolation approximation method, solutions of ordinary differential equation and partial differential equation. The programming exercise is included in this lecture.

【Grading】 Home works (four home works will be assigned) and examination.

【Course Goals】 Understandings of mathematical theories and programming implementations of the numerical methods.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction of this class
		Numerical representations and errors
		Macro programming using spread sheet applications
Linear system	1	Matrix
		Norms
		Singular value decomposition
Linear simultaneous equation 1	2	Solution of simultaneous linear equations direct method, iteration method
Eigenvalue analysis	2	Eigenvalue problems
Interpolation	2	Interpolation and its errors
Numerical integra 1	2	Numerical integration methods
Normal differential equation and numerical integral	1	explicit method, implicit method initial value problem, boundary value problem
Partial differential equation	3	Differential expression of partial differential Diffusion equation, wave equation Poisson equation, Laplace equation
Examination	1	Feedback for homework and examination

【Textbook】 Lecture note will be distributed through the course website.

【Textbook(supplemental)】 Golub, G. H. and Loan, C. F. V., Matrix Computations, John Hopkins University Press
R.D.Richtmyer and K.W.Morton, Difference Methods for Initial-Value Problems, Second Edition, John Wiley & Sons 1967

【Prerequisite(s)】 Basic mathematics for undergraduates

Basic macro programming

【Independent Study Outside of Class】 Problems are based on macro on Microsoft Excel or LibreOffice.

【Web Sites】 Lecture notes, home works, and other info will be distributed through Panda:

<https://panda.ecs.kyoto-u.ac.jp>

【Additional Information】 Have a PC with Microsoft Excel with VBA or LibreOffice (<https://ja.libreoffice.org/>).

Solid Mechanics, Adv.

固体力学特論

【Code】10G003 【Course Year】Master Course 【Term】1st term 【Class day & Period】Thu 1st

【Location】C3-Lecture Room 1 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】H. Hirakata, T. Shimada

【Course Description】 This course provides fundamental concepts of solid mechanics such as stress, strain, and constitutive laws, and methods for analyzing stress/strain fields and deformation of solids and structures on the basis of the concepts. In particular, the course lectures theories of nonlinear problems such as plasticity and creep, and their numerical solutions, or finite element methods, which are important for design and development of mechanical structures.

【Grading】 Grading is based on the examination, possibly with considerations of the homework reports.

【Course Goals】 Students will be able to:

understand solid mechanics deeply and acquire basic knowledge to design mechanical structures.

analyze problems of plasticity and creep by finite element methods.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Overview of solid mechanics
Stress	1	Cauchy stress tensor, Equilibrium equation, Invariants
Deformation	2	Material description and spatial description, Displacement, Deformation gradient, Lagrange-Green strain and Euler-Almansi strain, Infinitesimal strain, Material time derivative
Constitutive equation: linear elasticity	1	Linear elastic stress-strain response, Hooke ' s law
Principle of virtual work and principle of minimum potential energy	1	Principle of virtual work, Principle of minimum potential energy
Finite element method for linear elasticity	3	Basis of finite element method, Finite element equilibrium equations, Elements, Numerical integration
Plasticity problems	3	Plasticity theory (uniaxial and multiaxial problems, yield criteria, flow rule, hardening rule, constitutive equations), Finite element method for elasto-plastic problems
Creep problems	2	Creep theory (uniaxial and multiaxial constitutive equations), Finite element method for creep problems
Summary	1	Discussions and reports

【Textbook】 Lecture materials are distributed in the classroom.

【Textbook(supplemental)】 T. Kyoya, Continuum Mechanics, Morikita (2008) (in Japanese)

Y. Tomita, “ Foundation and Application of Elastoplasticity ” Morikita (1995) (in Japanese)

E. Neto et al., “ Computational Methods for Plasticity, ” John Wiley & Sons (2008).

【Prerequisite(s)】 This course requires basic knowledge of mechanics of materials and solid mechanics.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Thermal Science and Engineering

熱物理工学

【Code】 10G005 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Mon 3rd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 H. Yoshida & M. Matsumoto

【Course Description】 Several topics in advanced thermal physics are discussed. From microscopic view points, basics of stochastic process and related topics are given. From macroscopic ones, after the concept of entropy is revisited, applications in global environments and hydrogen energy are described.

【Grading】 Reports, essays, and/or written examinations.

【Course Goals】 Microscopic Viewpoints: Ability of multi-scale modelling

Macroscopic Viewpoints: Ability of global environment modelling

【Course Topics】

Theme	Class number of times	Description
(M) Brownian Motion	1	
(M) Transport Phenomena and Correlation Functions	1	
(M) Spectral Analysis and Fractal Analysis	2	
(M) Stochastic Process and Its Applications	3	
(Y) Science of Atmosphere and Ocean	5	
(Y) Science of Hydrogen Energy	1	
(Y) Science of Nuclear Energy	1	
Check and feedback	1	

【Textbook】 Not specified.

【Textbook(supplemental)】

【Prerequisite(s)】 Elementary thermodynamics, Statistical physics, Heat transfer engineering, Numerical analysis etc.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 (2018)

Matsumoto: April 9 ~ May 28

Yoshida: June 4 ~ July 17

Introduction to Advanced Fluid Dynamics

基盤流体力学

【Code】 10G007 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Fri 1st

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	5	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantum Condensed Matter Physics

量子物性物理学

【Code】 10G009 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Thu 2nd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	4	
	1	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Design and Manufacturing Engineering

設計生産論

【Code】10G011 【Course Year】Master Course 【Term】1st term 【Class day & Period】Fri 2nd

【Location】C3-Lecture Room 1 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	3	
	2	
	3	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Dynamic Systems Control Theory

動的システム制御論

【Code】 10G013 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Tue 2nd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	5	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Engineering Ethics and Management of Technology

技術者倫理と技術経営

【Code】 10G057 【Course Year】 Master 1st 【Term】 1st term 【Class day & Period】 Thu 3rd

【Location】Butsurikei-Kousya 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lectures and Exercise

【Language】 Japanese 【Instructor】 Sawaragi, Nishiwaki, Tomita, M. Komori, Tsuchiya, Noda, Sato, Iseda,

【Course Description】 Basic knowledge of Engineering Ethics and Management of Technology needed for future project leaders in companies and society is taught. Students have to make group work after-class hours as well as presentations of wrapping-up the discussions. Engineering ethics is the field of applied ethics and system of moral principles that apply to the practice of engineering. The field examines and sets the obligations by engineers to society, to their clients, and to the profession. Management of Technology is a set of management disciplines that allows organizations to manage their technological fundamentals to create competitive advantage. This course consists of lectures, exercises, discussions and oral presentations under supervision of professional faculties and extramural lecturers.

【Grading】 Submission of reports and presentations

【Course Goals】 To cultivate a spirit of self-sufficiency needed for engineers

【Course Topics】

Theme	Class number of times	Description
Engineering Ethics	9	1. Introduction to Engineering Ethics (EE) 2. Medical Engineering Ethics 3. EE by Institution of Professional Engineers, Japan and abroad 4. Product Safety and Product Liability 5. Comprehensive Manufacturing and EE (1) 6. Comprehensive Manufacturing and EE (2) 7. Group Discussions 8. History and Philosophy of EE 9. Presentation on exercise of EE
Management of Technology	5	1. Product Portfolio, Strategy for Competition 2. Business Domain and MOT for Marketing 3. Organizational Strategy for Corporates' R & D 4. Management Theory for R & D 5. Presentation on exercise of MOT
Summary	1	

【Textbook】 No textbook

【Textbook(supplemental)】 Nothing

【Prerequisite(s)】 Nothing particular

【Independent Study Outside of Class】

【Web Sites】 No Web Site

【Additional Information】 Nothing particular

Micro Process and Material Engineering

マイクロプロセス・材料工学

【Code】 10G203 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Mon 4th

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 O. Tabata, K. Eriguchi, R. Yokokawa, T. Tsuchiya

【Course Description】 Micro/nano fabrication processes and materials used to realize micro/nano systems are described. Topics will be photolithography, dry-etching, thin-film deposition, which includes bulk micro machining, surface micro machining and further advanced polymer processing.

【Grading】 Evaluated by homework. All report must be submitted to obtain credits.

【Course Goals】 To obtain fundamental knowledge about design and fabrication of micro/nano systems and to be familiar with recent fabrication technologies and micro/nano systems.

【Course Topics】

Theme	Class number of times	Description
Semiconductor microfabrication	3	Describe about the semiconductor microfabrication techniques.
Thin-film process and evaluation	3	Describe about the thin-film process and evaluation techniques.
Silicon micromachining	3	Describe about the silicon micromachining techniques.
3D lithography	3	Describe about the 3D lithography techniques.
Soft-micromachining	2	Describe about the soft-micromachining techniques.
Feedback	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Students unfamiliar with Japanese may enroll in this course. Their lessons will be supplemented with presentation slides, homework, and other additional course materials in English.

Microsystem Engineering

マイクロシステム工学

【Code】 10G205 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 Fri 4th 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 O. Tabata, T. Tsuchiya, R. Yokokawa

【Course Description】 Microsystem covers not only technologies related to individual physical or chemical phenomenon in micro scale, but also complex phenomena which are evolved from their interaction. In this course, the physics and chemistry in micro and nanoscale will be lectured in contrast to those in macro scale. The various kinds of application devices (ex. physical (pressure, flow, force) sensors, chemical sensors, biosensors, actuators (piezoelectric, electrostatic, and shape memory) and their system are discussed.

【Grading】 The evaluation will be based on the reports given in each lecture.

【Course Goals】 Understand the theory of sensing and actuating in microsystem. Acquire basic knowledge to handle various kinds of phenomena in microscale.

【Course Topics】

Theme	Class number of times	Description
MEMS modeling	2	Multi-physics modeling in microscale. Electro-mechanical coupling analysis.
MEMS simulation	2	System level simulation in MEMS.
Electrostatic microsystem	3	Electrostatic sensors and actuators. Theory and application devices.
Physical sensors	4	Physical sensors as a fundamental application in microsystem. Accelerometer, vibrating gyroscope, pressure sensors.
Micro total analysis system	4	Chemical analysis system and bio-sensing device using microsystem.

【Textbook】 Provided in the lecture.

【Textbook(supplemental)】 Provided in the lecture.

【Prerequisite(s)】 Students are required to take the 10G203 course Micro Process and Material Engineering.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 The student can register only to this class 10G205, but it is required to be able to take consecutive classes at Friday 4th and 5th. Those students who want to take this course has to contact Prof. Tabata (tabata@me.kyoto-u.ac.jp) by the end of 1st term. The student of this class is strongly recommended to take a course 10V201 Introduction to the Design and Implementation of Micro-Systems(10V201), which is a practice for designing microsystem. Those who want to take 10V201 have to take training course for CAD in advance.

Multi physics Numerical Analysis

マルチフィジクス数値解析力学

【Code】 10G209 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 1st

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	2	
	2	
	5	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantum Theory of Condensed Matter

量子物性学

【Code】 10B619 【Course Year】 Master Course 【Term】 【Class day & Period】 【Location】 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Akitomo TACHIBANA

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	3	
	3	
	6	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Solid State Physics 1

物性物理学 1

【Code】 10G211 【Course Year】 Master 1st 【Term】 2nd term 【Class day & Period】 Wed 1st

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1-2	
	1	
	1	
	1 -2	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1-2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Basic Seminar on Micro Engineering A

マイクロエンジニアリング基礎セミナーA

【Code】10G223 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	10	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Basic Seminar on Micro Engineering B

マイクロエンジニアリング基礎セミナー B

【Code】10G224 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	10	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Micro Engineering A

マイクロエンジニアリングセミナー A

【Code】 10G216 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	-	
	-	
	-	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Micro Engineering B

マイクロエンジニアリングセミナー B

【Code】 10G217 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	-	
	-	
	-	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Strength of Advanced Materials

先進材料強度論

【Code】 10B418 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 2nd

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 M. Hojo and M. Nishikawa,

【Course Description】 The mechanism underlying mechanical and functional properties are lectured for advanced materials used and developed in advanced fields of current engineering. In particular, advanced composite materials, used for aircraft structure etc., are introduced, with a detailed description of the relationship between microscopic constituent materials and macroscopic properties from the perspective of multiscale mechanics; also the anisotropy of their properties, their fatigue and fracture properties are described in the basic discipline for strength of materials. The latest applications are introduced in the field of various transportation systems including airplanes.

【Grading】 Grading is based on the reports. The assignments will be given around three times.

【Course Goals】 The course goal is to understand basic concepts of composite materials and the underlying mechanism of their mechanical properties from multiscale viewpoints, while the physical understanding of composites is developed based on multiple disciplines.

【Course Topics】

Theme	Class number of times	Description
Concept of composite materials	2	The concept and definition of composite materials, their constituent materials and manufacturing methods are illustrated. Their application to aircraft structures etc. are also introduced.
Mechanical properties of microscopic constituent materials	2	Resin for matrix and various fiber types are explained including their structure and mechanical properties. The weakest link model and Weibull distribution are described as a basis of the statistic nature of strength.
Basic mechanical properties	4	The specific strength, the specific stiffness, and the rule of mixture for elastic modulus and strength are lectured. In particular, the detailed explanation is made to the anisotropy of elastic modulus, independent elastic constants in the generalized Hookean law, the anisotropic failure criteria, and laminate theory. The relationship between the mechanical properties of microscopic constituent materials and macroscopic properties of composite materials is also illustrated.
Micromechanics	2	The mechanism of transverse fracture is illustrated. The mechanical models are described for short fiber reinforced composites and particle dispersed composites. The micromechanical analyses based on finite element method is also illustrated for the physical understanding of the strength of composite materials.
Fracture mechanics properties	2	Fracture mechanics of anisotropic materials are described. The interlaminar fracture toughness and interlaminar fatigue crack propagation, the critical issues in the application of composite structures, are explained including their underlying mechanism.
Superconducting materials	1	High-temperature superconducting materials are the composite materials consisting of metals and fibrous superconducting materials made of oxides. The mechanism are explained for understanding that their mechanical properties so much control their electric properties.
Process and mechanical properties of composite materials	1	The molding and machining process of composite materials is explained to relate it to their mechanical properties. Fiber preform, the selection of resin, intermediate materials, machining and assembly and inspection methods are overviewed from the academic viewpoints.
Academic achievement test	1	Academic achievements is assessed.

【Textbook】 Supplementary handouts will be distributed in the class.

【Textbook(supplemental)】 D.Hull and T.W.Clyne, An Introduction to Composite Materials, Cambridge University Press.

【Prerequisite(s)】 Mechanics of Materials, Continuum Mechanics, Fundamentals of Materials, Solid Mechanics, Adv.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 The order and the item in the course are possibly subject to change.

Precision Measurement and Machining

精密計測加工学

【Code】10G214 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Fri 2nd

【Location】C3 seminar room c1 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】

【Instructor】A. Matsubara and S. Ibaraki,

【Course Description】 This course gives the principles of precision measurement and machining process for the meso-micro-nano metric fabrication. The optical measurement technologies (e.g. laser interferometer, optical encoders) and cutting technologies (e.g. cutting mechanics, tool, machine) are shown.

【Grading】 Small exams in the term and the final exam

【Course Goals】 Understand the basic principles of precision measurement and machining associated with the applications

【Course Topics】

Theme	Class number of times	Description
Basics of measurement and machining	1	Concept of accuracy, precision, Relation of measurement, machining, and control
Basics of precision measurement	2	
Optical measurement	4	
	3	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Biomechanics

バイオメカニクス

【Code】10V003 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 2nd

【Location】 【Credits】2 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】Taiji Adachi,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Introduction	1	
	2	
	4	
	4	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to the Design and Implementation of Micro-Systems

微小電気機械システム創製学

【Code】 10V201 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 5th

【Location】 C3-Lecture room 1 or 3 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture and Pactice 【Language】 English 【Instructor】 O. Tabata,T. Tsuchiya,R. Yokokawa

【Course Description】 This is a joint lecture with Hong Kong University of Science and Technology (HKUST). A team consists of two students from each University work together to fullfill the assignment (design a microsystem) through paper survey, analysis,design, and presentation. A student can acquire not only the basic knowledge of a microsystem, but also comprehensive ability of English such as technical knowledge in English, skill for team work, and communication.

【Grading】 Presentation, Assignments, and Achievement

【Course Goals】 Acquire the knowledge and skill to design and analyze a microsystem.

【Course Topics】

Theme	Class number of times	Description
Tutorial on microsystem CAD software	3	Master CAD program for microsystem design and analysis which will be utilized to accomplish an assignment.
Lecture and Task Introduction	2	Learn basic knowledge necessary to design a microsystem/MEMS(Micro Electromechanical Systems) utilizing microfabrication technology.
Design and analysis work	3	Analyze and design a microsystem by communicating with a team member of HKUST.
Presentation I	2	The designed device and its analyzed results is presented in detail by team in English.
Evaluation of device	3	Evaluate the fabricated microsystem.
Presentation II	2	The measured results and comparison between the analyzed results of the fabricated microsystem is presented by team in English.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 Students are required to take the 10G203 course Micro Process and Material Engineering provided in 1st term.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 The student of this class is required to register to the course 10G205 Microsystem Engineering provided at Friday 4th so as to be able to take consecutive classes at Friday 4th and 5th. Those who want to take this course have to take training course for CAD in advance. Those students who want to take this course has to contact Prof. Tabata (tabata@me.kyoto-u.ac.jp) by the end of 1st term.

Advanced Finite Element Methods

有限要素法特論

【Code】10G041 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 1st
 【Location】C3-Lecture Room 2 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture and Practice
 【Language】English 【Instructor】Kotera and Nishiwaki,

【Course Description】 This course presents the basic concept and mathematical theory of the Finite Element Method (FEM), and explains how the FEM is applied in engineering problems. We also address important topics such as the physical meaning of geometrical non-linearity, material non-linearity, and non-linearity of boundary conditions, and we explore numerical methods to deal with these nonlinearities. Also, we guide students in class in the use of software to solve several numerical problems, to develop practical skill in applying the FEM to engineering problems.

【Grading】 Grading is based the quality of two or three reports and the final exam.

【Course Goals】 The course goals are for students to understand the mathematical theory of the FEM and the numerical methods for analyzing non-linear problems based on the FEM.

【Course Topics】

Theme	Class number of times	Description
Basic knowledge of the FEM	3	What is the FEM? The history of the FEM, classifications of partial differential equations, linear problems and non-linear problems, mathematical descriptions of structural problems (stress and strain, strong form and weak form, the principle of energy).
Mathematical background of the FEM	2	Variational calculus and the norm space, the convergence of the solutions.
FEM formulations	3	FEM approximations for linear problems, formulations of iso-parametric elements, numerical instability problems such as shear locking, formulations of reduced integration elements, non-conforming elements, the mixed approach, and assumed-stress elements.
Classifications of nonlinearities and their formulations	4	Classifications of nonlinearities and numerical methods to deal with these nonlinearities.
Numerical practice	2	Numerical practice using COMSOL.
Evaluation of student achievements	1	

【Textbook】

【Textbook(supplemental)】 Bath, K.-J., Finite Element Procedures, Prentice Hall

Belytschko, T., Liu, W. K., and Moran, B., Nonlinear Finite Elements for Continua and Structures, Wiley

【Prerequisite(s)】 Solid Mechanics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Biomedical Engineering

医工学基礎

【Code】 10W603 【Course Year】 Master and Doctor Course 【Term】 1st term

【Class day & Period】 Intensive lecture using 3 days on Saturdays since mid-June 【Location】 Katsura

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Intensive Lecture 【Language】 Japanese

【Instructor】 ,,,

【Course Description】 Understand basic concepts related to clinical medicine and medical engineering . And expand the range of research by exchange each engineering knowledge and experience.

【Grading】 Participate to the workshops submit a report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction to medicine for engineering students	3	
Introduction to Medical Engineeri	4	
Cross-field workshop	8	

【Textbook】 no

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantum Theory of Molecular Physics

量子分子物理学特論

【Code】10B617 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Mon 2nd

【Location】C3-Lecture Room 2 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】Senami, Junior associate professor (Lecturer)

【Course Description】Basics for the application of quantum theory to molecular physics and recent progress. Main topics: analytic mechanics, relativistic quantum mechanics, quantum field theory, and path integral.

【Grading】Homework paper instructed in class

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
1. Analytic mechanics and symmetry in physics	2	Principle of least action, Equation of motion, Hamiltonian mechanics, Symmetry and conservation law in physics, Noether's theorem, Group theory
2. Classical relativistic theory	2	Invariance of the speed of light, Lorentz transformation, Relativistic form of electromagnetism, Four component vector potential
3. Relativistic quantum mechanics	4-6	Relativistic equation of motion, Nonrelativistic limit of Dirac equation, Covariance of Dirac equation, Plane wave solution for Dirac equation and negative energy, Hole theory and problem, Tani-Foldy-Wouthuysen transformation, Chirality
4. A primer of quantum field theory	2-4	Field operator, Charge conjugation, Noether's theorem, Gauge transformation and gauge symmetry, Application of quantum field theory to theoretical study of molecules and condensed matter
5. Electronic Structure Computation	2	Time evolution and propagator, Transition amplitude and path integral, Aharonov-Bohm effect, Path integral in quantum field theory
Confirmation	1	

【Textbook】

【Textbook(supplemental)】J. D. Bjorken, S. D. Drell, Relativistic Quantum Mechanics

J. J. Sakurai, Modern Quantum Mechanics, and Advanced Quantum Mechanics

R. P. Feynmann, A. R. Hibbs, Quantum Mechanics and Path Integrals

【Prerequisite(s)】Quantum Mechanics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】If English support is required, please contact the instructor by email. Then words written on a blackboard and some supplementary documents are provided in English.

Quantum Theory of Chemical Physics

量子化学物理学特論

【Code】 10Q408 【Course Year】 Master and Doctor Course 【Term】 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Akitomo TACHIBANA

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	4	
	4	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Solid State Physics 2

物性物理学 2

【Code】 10V205 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Wed 2nd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4-5	
	4-5	
	4-5	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Mechanical Engineering

先端機械システム学通論

【Code】 10K013 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day & Period】 Tue 5th and Thu 4th 【Location】 C3-Lecture Room 5 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Faculty members from several fields

【Course Description】 Lectures on recent topics in various fields of mechanical engineering will be given in English. This is mainly for foreign students (MC/DC), but Japanese students are also welcome.

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Mechanics	2	Detailed schedule will be announced later.
Materials	2	
Thermodynamics	2	
Fluid dynamics	2	
Control	2	
Design	2	
Microengineering	2	
Examination/Feedback	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This class will be given every two years; Not given in 2017.

Advanced Modern Science and Technology (8 times course) (English lecture)

現代科学技術特論（8回コース）（英語科目）

【Code】10i056 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 5th

【Location】A2-306 【Credits】1 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】English

【Instructor】 ER Center, J. Assoc. Prof., Ashida
ER Center, J. Assoc. Prof., Matsumoto
ER Center, J. Assoc. Prof., Maeda
ER Center, J. Assoc. Prof., Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '8 times course' should attend the lectures of the both topics. (Students who take '4 times course' should select one of the topics and attend the lectures.)

Design of Complex Mechanical Systems

複雑系機械システムのデザイン

【Code】 10X411 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 3rd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	2	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Theory for Designing Artifacts

アーティファクトデザイン論

【Code】10X402 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 5th 【Location】C3-Lecture Room 4a 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English 【Instructor】Tetsuo Sawaragi, Kumiyo Nakakoji

【Course Description】The activity of design is fundamentally similar across a wide variety of domains. I use artifact in a broad and atypical sense to describe any product of intentional creation, including physical goods, services, information systems, buildings, landscapes, organizations, and societies. The central theme of this lecture is that a unifying framework informs the human activity of design across all domains. Especially, understanding user needs is a key element of problem definition, and that understanding is usually best developed with interactive and immersive methods. In this lecture, a variety of methodologies for participatory systems approach and an idea of user-experience are provided, and its contributions to the design process are discussed.

【Grading】Students will be evaluated based on the following criteria, in the order listed. (1) Exercises assigned in class: approx. 20% (2) Final exam: approx. 60% (3) Contributions to classwork (e.g., asking good questions): approx. 20%

【Course Goals】This course is aimed at developing the ability to apply methods for identifying problems and interactively analyzing/evaluating systems, based on understanding of the principles of artifact design and on systematic thinking.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	We will shed light on the concept of artifacts as something to be put on equal footing with natural objects and examine the history of artifacts in terms of how they were viewed in different ages?namely, artifacts as modes of representation in the ancient world, artifacts as necessities for survival in the middle ages, artifacts as forms of convenience in modern times, and artifacts as a means of perpetuation in the current era.
Artifact function and purpose	3	The effects that artifacts have on the outside world?i.e., other things?are " functions. " Function is the concept of questioning the existence of an artifact, and design is the formulation of functions for achieving an intended purpose. We will discuss the categorization of artifacts in terms of how the " purpose " of artifacts relates to the context in which they are used, and look at the origins of artifacts from the perspective of semiosis.
Artifact design principles	2	To understand an artifact is to know how its internal structure acts on the outside world to realize its function. Today, cybernetics?which has explored the interaction between the physical world and the world of information?is expanding into a concept that encompasses society as well (second-order cybernetics), and concepts have been put forward for actively rethinking how human cognition and decision-making interact with the outside world (ecological approaches, socially distributed cognition, naturalistic decision-making). We will examine artifact design principles based on theories related human activity at the boundary of these externalities.
Artifact design representation and evaluation	3	Design must fulfill its role of enhancing the quality of life through the creation of not only individual artifacts, but also environments and social systems that encompass groups of artifacts and natural objects. We will discuss the path toward expanding the scope of design from physical objects to environments and social systems that include intangible services, including with regard to problem development/representation methods, how to set purposes of design, how to eliminate the ambiguities and conflicts among various goals, searching for alternative design strategies, design evaluation, and principles and methods of consensus-forming among different stakeholders.
User-centered artifact design	2	The quality of designs is something to be evaluated by the user, and hence there must be collaboration between users and designers/producers. Moreover, complex design challenges cannot be resolved by experts of only one discipline; they must be tackled by pooling the design-related knowledge of different domains. We will discuss the concept of user-centered design, design rationale, and international standards of design processes for achieving design that is grounded in the user ' s needs/perspective.
Participatory systems approach	2	In order to deal with the design of large-scale, complex artifacts, one must take the approach of systemically structuring problems and basing design on diverse perspectives. We will broadly examine: interactive processes among system designers, users, and computers; methods of structurally modeling problems through repeated dialogue between experts in relative disciplines and computers; and ways of supporting the perceptions, interpretations, and decision-making of designers and users. We will also consider the utility of the participatory systems approach in smooth, effective implementation of system design.
Exercise in participatory systems approach	2	Students will apply the participatory systems approach to a real-world artifact design challenge, and report the results of this exercise.

【Textbook】Lecture notes used in class will be distributed as needed. Refer to " Textbook (supplemental) " below.

【Textbook(supplemental)】1. 吉川弘之 [2007] 人工物観, 横幹, 1(2), 59-65 2. Suh, N.P. [1990] The Principles of Design, Oxford University Press (邦訳: スー (翻訳: 畑村洋太郎) 「設計の原理?創造的機械設計論」, 朝倉書店, 1992.) 3. 吉川弘之 [1979] 一般設計学序説, 精密機械 45 (8) 20?26, 1979. 4. Vladimir Hubka and W. Ernst Eder [1995] Design Science, Springer 5. Simon, H. [1996] The Sciences of the Artificial Third edition 秋葉元吉、吉原英樹訳 [1999] 『システムの科学』 パーソナルメディア 6. H・A・サイモン [1979] 稲葉元吉・倉井武夫訳, 『意思決定の科学』, 産業能率大学出版部 7. Hutchins, Edwin [1995] Cognition in the Wild. MIT Press 8. Klein, G., Orasanu, J., Calderwood, R., and Zsombok, C.E. [1993] Decision Making in Action: Models and Methods. Ablex Publishing Co., Norwood, NJ. 9. D・ノーマン [1986] The Design of Everyday Things, 野島久雄訳 『誰のためのデザイン?: 認知科学者のデザイン原論』, 新曜社 10. 榎木、河村 [1981]: 参加型システムズ・アプローチ 手法と応用、日刊工業新聞社ほか

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Office hours will be held for one hour before and after each class period (preferably 5th period on Tuesdays, but also 3rd period on Wednesdays). Appointments for other times can be requested by e-mail.

Advanced Exercise in Micro Engineering A

マイクロエンジニアリング特別演習 A

【Code】 10V210 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	10	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Exercise in Micro Engineering B

マイクロエンジニアリング特別演習B

【Code】10V211 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	10	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Exercise in Micro Engineering C

マイクロエンジニアリング特別演習C

【Code】 10V212 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	10	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Exercise in Micro Engineering D

マイクロエンジニアリング特別演習D

【Code】10V213 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	10	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Exercise in Micro Engineering E

マイクロエンジニアリング特別演習 E

【Code】 10V214 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	10	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Exercise in Micro Engineering F

マイクロエンジニアリング特別演習F

【Code】 10V215 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	10	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Micro/Nano Scale Material Engineering

マイクロ・ナノスケール材料工学

【Code】10Z101 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】3, 4, 5, 6 September 【Location】C3-Lecture Room 3 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Intensive Lecture 【Language】English

【Instructor】TABATA,HIRAKATA,HOJO,ADACHI,TSUCHIYA,YOKOKAWA,SUMIGAWA,INOUE,NAKAMURA,KAME,(Aichi Institute of Technology) NAMAzu, (Seoul National University) KIM

【Course Description】This class lectures specific mechanical properties and behavior of micro to nano scale materials, underlying mechanism of those properties and behavior and characterization method. Furthermore, techniques of measurements, analysis and structural design of biomaterial such as protein and DNA which are expected to be utilized as micro nano scale materials are lectured.

【Grading】The evaluation will be based on the reports given in each lecture. (All reports submission is mandatory.)

【Course Goals】Educate engineers and researchers with fundamental knowledge on specific mechanical properties and behavior of micro to nano scale materials. They can promote industrial application of micro and nano materials based on the deep understanding about how specific mechanical properties and behavior of micro to nano scale materials dominate performance, reliability and lifetime of MEMS (Micro Electromechanical Systems), microsystems and micro scale components.

【Course Topics】

Theme	Class number of times	Description
Outline	1	In this lecture, application examples of micro and nano scale material on devices and importance of mechanical properties and its behavior on device characteristics are described. (Tabata)
Fracture and fatigue mechanism of materials in the micro- and nano- meter scale	4	We explain fundamentals on the fracture and fatigue mechanism of materials in the micro- and nano-meter scale. At first, the characteristic properties of deformation and fracture in small components such as thin films, wires, dots etc. are discussed in terms of the solid mechanics. Focus is put on the interface strength of dissimilar materials as well including the effect of fatigue, creep and environment. Then, we explain the characteristics and mechanisms of "size effects" on the strength of micro- and nano-materials. As a representative example of materials with microscale structures, properties of composite materials are lectured. Characterization of microscopic components such as fibers and matrices are explained from the view points of the difference from bulk materials. Testing methods and properties of fiber/matrix interface are described. The relationship between the deformation and fracture of microscopic components and those of macroscopic composite materials are explained including the underlying mechanism. Explanation is also made to anisotropy of elastic properties and strength. (Hirakata, Sumigawa, Hojo)
Mechanical properties of Silicon	1	Silicon, one of the most widely used materials in micro/nano devices, is used not only a semiconductor material but also a mechanical material because of its superior mechanical properties. In this lecture, the properties of silicon, such as physical, electrical, mechanical, electro-mechanical properties, will be presented in the view point of a mechanical structural material. Especially the lecture will focus on the elastic properties, piezoresistive effect, and fracture/fatigue properties of silicon, indispensable for designing micro/nano-devices. (Tsuchiya)
Characterization of micro nano material	1	In this class, first I will lecture the evaluation method for the mechanical properties of micro and nano-scale materials used for MEMS and semiconductor devices. Several representative experimental techniques for micro and nano mechanical testing will be presented and explained. Then I will lecture representative functional materials, such as shape memory alloy films and self-propagating exothermic foils, and lecture regarding the possibility of their application to MEMS. (Namazu)
Piezoresistive effect of micro and nano material	2	In this theme, we will study the fundamental concepts of electronic-state theory and band structures to represent behavior of electrons in materials, and will discuss the electromechanical properties of materials based on the electronic-state theory. In particular, the principle and features of the piezoresistive effect, the change in the electrical resistivity due to mechanical stresses and strains, will be derived from the band structures of materials. The mechanisms of scale dependence of piezoresistivity in nanoscale materials such as silicon, carbon nanotube, and graphene will be also discussed. (Nakamura)
Bio/Nano material (1)	2	In tissue adaptation, regeneration and stem cell differentiation in tissue morphogenesis, cellular functional activities such as cell migration and division are regulated by complex mechano-chemical couplings at molecular level. To understand such a hierarchical dynamics from nanoscopic molecular events to microscopic cellular dynamics, we will discuss analysis of the molecular and cellular mechanical behaviors as bio-nano materials by integrating experiments, mathematical modeling and computer simulations. (Adachi, Inoue)
Bio/Nano material (2)	1	Cells are well regulated their fates and functions by extracellular microenvironments, consisted with chemical/physical cues and cell-cell interaction at a nano/micro-meter scale. This lecture provides an insight of design methods of biomaterials and their applications to recapitulate extracellular microenvironments. (Kamei)
Bio/Nano material (3)	1	Motor proteins are nano-scale actuators in vivo. Their active functions can be reconstructed in vitro to be utilized as a driving source of micro/nano systems. This lecture introduces fundamentals of their mechanical properties and molecular design methods. (Yokokawa)
Bio/Nano material (4)	1	This lecture describes DNA nanotechnology to construct nanoscale structures using DNA as a structural material. Fundamental knowledge, design methodology and application of DNA origami technique are focused. (Kim)
Feedback	1	

【Textbook】

【Textbook(supplemental)】Biomaterial: Bionano material: Mechanics of Motor Proteins & the Cytoskeleton, Jonathon Howard, Sinauer Associates (January 2001)

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】This lecture is provided as a part of NIP (Nanotech Innovation Professional) course of the Nanotech Career-up Alliance (Nanotech CUPAL) project.

Internship M

インターンシップ M (機械工学群)

【Code】 10G049 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Exercise 【Language】 Japanese

【Instructor】 Tabata, Hasuo

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Orientation	1	
Internship	13	
Presentation	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Internship DS

インターンシップ DS (機械工学群)

【Code】 10V019 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 Tabata, Hasuo

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Orientation	1	
Internship	28	
Presentation	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Internship DL

インターンシップ DL (機械工学群)

【Code】 10V020 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 6 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 Tabata, Hasuo

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	1	
Internship	43	
Presentation	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar of Complex Mechanical Engineering,A

複雑系機械工学セミナー A

【Code】 10V025 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Tue 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at
cme-seminar@me.kyoto-u.ac.jp

Seminar of Complex Mechanical Engineering,B

複雑系機械工学セミナー B

【Code】 10V027 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at
cme-seminar@me.kyoto-u.ac.jp

Seminar of Complex Mechanical Engineering,C

複雑系機械工学セミナー C

【Code】 10V029 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Tue 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at
cme-seminar@me.kyoto-u.ac.jp

Seminar of Complex Mechanical Engineering,D

複雑系機械工学セミナー D

【Code】 10V031 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at
cme-seminar@me.kyoto-u.ac.jp

Seminar of Complex Mechanical Engineering,E

複雑系機械工学セミナー E

【Code】 10V033 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Tue 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at
cme-seminar@me.kyoto-u.ac.jp

Seminar of Complex Mechanical Engineering,F

複雑系機械工学セミナー F

【Code】 10V035 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Experiments on Micro Engineering, Adv. I

マイクロエンジニアリング特別実験及び演習第一

【Code】 10G226 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	9	
	10	
	10	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Experiments on Micro Engineering, Adv. II

マイクロエンジニアリング特別実験及び演習第二

【Code】 10G228 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	9	
	10	
	10	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Applied Numerical Methods

応用数値計算法

【Code】 10G001 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Mon 1st

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Toshiyuki Tsuchiya

【Course Description】 Numerical techniques, such as the finite element method and numerical control method, are indispensable in mechanical engineering. In this lecture, basics of numerical techniques which are required to study advanced methods for graduated students will be explained. The lecture will cover the linear system solution ($Ax=b$), eigenvalue analysis, interpolation approximation method, solutions of ordinary differential equation and partial differential equation. The programming exercise is included in this lecture.

【Grading】 Home works (four home works will be assigned) and examination.

【Course Goals】 Understandings of mathematical theories and programming implementations of the numerical methods.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction of this class
		Numerical representations and errors
		Macro programming using spread sheet applications
Linear system	1	Matrix
		Norms
		Singular value decomposition
Linear simultaneous equation 1	2	Solution of simultaneous linear equations direct method, iteration method
Eigenvalue analysis	2	Eigenvalue problems
Interpolation	2	Interpolation and its errors
Numerical integra 1	2	Numerical integration methods
Normal differential equation and numerical integral	1	explicit method, implicit method initial value problem, boundary value problem
Partial differential equation	3	Differential expression of partial differential Diffusion equation, wave equation Poisson equation, Laplace equation
Examination	1	Feedback for homework and examination

【Textbook】 Lecture note will be distributed through the course website.

【Textbook(supplemental)】 Golub, G. H. and Loan, C. F. V., Matrix Computations, John Hopkins University Press
R.D.Richtmyer and K.W.Morton, Difference Methods for Initial-Value Problems, Second Edition, John Wiley & Sons 1967

【Prerequisite(s)】 Basic mathematics for undergraduates

Basic macro programming

【Independent Study Outside of Class】 Problems are based on macro on Microsoft Excel or LibreOffice.

【Web Sites】 Lecture notes, home works, and other info will be distributed through Panda:

<https://panda.ecs.kyoto-u.ac.jp>

【Additional Information】 Have a PC with Microsoft Excel with VBA or LibreOffice (<https://ja.libreoffice.org/>).

Solid Mechanics, Adv.

固体力学特論

【Code】10G003 【Course Year】Master Course 【Term】1st term 【Class day & Period】Thu 1st

【Location】C3-Lecture Room 1 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】H. Hirakata, T. Shimada

【Course Description】 This course provides fundamental concepts of solid mechanics such as stress, strain, and constitutive laws, and methods for analyzing stress/strain fields and deformation of solids and structures on the basis of the concepts. In particular, the course lectures theories of nonlinear problems such as plasticity and creep, and their numerical solutions, or finite element methods, which are important for design and development of mechanical structures.

【Grading】 Grading is based on the examination, possibly with considerations of the homework reports.

【Course Goals】 Students will be able to:

understand solid mechanics deeply and acquire basic knowledge to design mechanical structures.

analyze problems of plasticity and creep by finite element methods.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Overview of solid mechanics
Stress	1	Cauchy stress tensor, Equilibrium equation, Invariants
Deformation	2	Material description and spatial description, Displacement, Deformation gradient, Lagrange-Green strain and Euler-Almansi strain, Infinitesimal strain, Material time derivative
Constitutive equation: linear elasticity	1	Linear elastic stress-strain response, Hooke ' s law
Principle of virtual work and principle of minimum potential energy	1	Principle of virtual work, Principle of minimum potential energy
Finite element method for linear elasticity	3	Basis of finite element method, Finite element equilibrium equations, Elements, Numerical integration
Plasticity problems	3	Plasticity theory (uniaxial and multiaxial problems, yield criteria, flow rule, hardening rule, constitutive equations), Finite element method for elasto-plastic problems
Creep problems	2	Creep theory (uniaxial and multiaxial constitutive equations), Finite element method for creep problems
Summary	1	Discussions and reports

【Textbook】 Lecture materials are distributed in the classroom.

【Textbook(supplemental)】 T. Kyoya, Continuum Mechanics, Morikita (2008) (in Japanese)

Y. Tomita, “ Foundation and Application of Elastoplasticity ” Morikita (1995) (in Japanese)

E. Neto et al., “ Computational Methods for Plasticity, ” John Wiley & Sons (2008).

【Prerequisite(s)】 This course requires basic knowledge of mechanics of materials and solid mechanics.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Thermal Science and Engineering

熱物理工学

【Code】 10G005 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Mon 3rd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 H. Yoshida & M. Matsumoto

【Course Description】 Several topics in advanced thermal physics are discussed. From microscopic view points, basics of stochastic process and related topics are given. From macroscopic ones, after the concept of entropy is revisited, applications in global environments and hydrogen energy are described.

【Grading】 Reports, essays, and/or written examinations.

【Course Goals】 Microscopic Viewpoints: Ability of multi-scale modelling

Macroscopic Viewpoints: Ability of global environment modelling

【Course Topics】

Theme	Class number of times	Description
(M) Brownian Motion	1	
(M) Transport Phenomena and Correlation Functions	1	
(M) Spectral Analysis and Fractal Analysis	2	
(M) Stochastic Process and Its Applications	3	
(Y) Science of Atmosphere and Ocean	5	
(Y) Science of Hydrogen Energy	1	
(Y) Science of Nuclear Energy	1	
Check and feedback	1	

【Textbook】 Not specified.

【Textbook(supplemental)】

【Prerequisite(s)】 Elementary thermodynamics, Statistical physics, Heat transfer engineering, Numerical analysis etc.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 (2018)

Matsumoto: April 9 ~ May 28

Yoshida: June 4 ~ July 17

Introduction to Advanced Fluid Dynamics

基盤流体力学

【Code】 10G007 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Fri 1st

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	5	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantum Condensed Matter Physics

量子物性物理学

【Code】 10G009 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Thu 2nd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	4	
	1	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Design and Manufacturing Engineering

設計生産論

【Code】 10G011 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Fri 2nd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	3	
	2	
	3	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Dynamic Systems Control Theory

動的システム制御論

【Code】 10G013 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Tue 2nd

【Location】 C3-Lecture Room 1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	5	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Engineering Ethics and Management of Technology

技術者倫理と技術経営

【Code】 10G057 【Course Year】 Master 1st 【Term】 1st term 【Class day & Period】 Thu 3rd

【Location】Butsurikei-Kousya 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lectures and Exercise

【Language】 Japanese 【Instructor】 Sawaragi, Nishiwaki, Tomita, M. Komori, Tsuchiya, Noda, Sato, Iseda,

【Course Description】 Basic knowledge of Engineering Ethics and Management of Technology needed for future project leaders in companies and society is taught. Students have to make group work after-class hours as well as presentations of wrapping-up the discussions. Engineering ethics is the field of applied ethics and system of moral principles that apply to the practice of engineering. The field examines and sets the obligations by engineers to society, to their clients, and to the profession. Management of Technology is a set of management disciplines that allows organizations to manage their technological fundamentals to create competitive advantage. This course consists of lectures, exercises, discussions and oral presentations under supervision of professional faculties and extramural lecturers.

【Grading】 Submission of reports and presentations

【Course Goals】 To cultivate a spirit of self-sufficiency needed for engineers

【Course Topics】

Theme	Class number of times	Description
Engineering Ethics	9	1. Introduction to Engineering Ethics (EE) 2. Medical Engineering Ethics 3. EE by Institution of Professional Engineers, Japan and abroad 4. Product Safety and Product Liability 5. Comprehensive Manufacturing and EE (1) 6. Comprehensive Manufacturing and EE (2) 7. Group Discussions 8. History and Philosophy of EE 9. Presentation on exercise of EE
Management of Technology	5	1. Product Portfolio, Strategy for Competition 2. Business Domain and MOT for Marketing 3. Organizational Strategy for Corporates' R & D 4. Management Theory for R & D 5. Presentation on exercise of MOT
Summary	1	

【Textbook】 No textbook

【Textbook(supplemental)】 Nothing

【Prerequisite(s)】 Nothing particular

【Independent Study Outside of Class】

【Web Sites】 No Web Site

【Additional Information】 Nothing particular

Jet Engine Engineering

ジェットエンジン工学

【Code】 10G401 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Wed 1st

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	3-4	
	3-4	
	2-3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Propulsion Engineering, Adv.

推進工学特論

【Code】 10G405 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 1st

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	4	
	2	
	2	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Gas Dynamics, Adv.

気体力学特論

【Code】 10G406 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 1st

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	2	
	4	
	3	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Aerospace Systems and Control

航空宇宙システム制御工学

【Code】 10G409 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 2nd

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	4	
	4	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Fluid Dynamics for Aeronautics and Astronautics

航空宇宙流体力学

【Code】 10G411 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 4th

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	4	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Flight Dynamics of Aerospace Vehicle

航空宇宙機力学特論

【Code】 10C430 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 2nd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Kei Senda, Sinya Aoi

【Course Description】 Flight Dynamics and Control of Aerospace Vehicles including Analytical Mechanics, Attitude Dynamics of Vehicles, Orbital Mechanics, etc.

【Grading】 Evaluation depends on marks of examination (approximately 80%) and exercises (approximately 20%). Both marks should be 60% or better.

【Course Goals】 To understand analytical mechanics through flight dynamics of aerospace vehicles: Basic items of Analytical Mechanics, Attitude Dynamics of Vehicles, Orbital Mechanics, etc.

【Course Topics】

Theme	Class number of times	Description
Analytical Mechanics	7	1. Newton equations, 2. Lagrange equations, 3. Hamilton equations
Orbital Mechanics	4	1. Motions in central force field, 2. Conservation law, 3. Orbit transition
Attitude Dynamics and Control	4	1. Kinematics of rotation, 2. Attitude mechanics, 3. Stability analysis of equilibrium points, 4. Attitude Control

【Textbook】

【Textbook(supplemental)】 L. D. Landau and E. M. Lifshitz: Mechanics, Volume 1 (Course of Theoretical Physics

Herbert Goldstein: Classical Mechanics

Toda and Nakajima: Introductory course of physics #1, #2, #10, etc. (Iwnami Shoten)

【Prerequisite(s)】 Foundation of mechanics and mathematics, Flight Dynamics of Aerospace Vehicle (Undergraduate)

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Dynamics of Solids and Structures

動的固体力学

【Code】 10G230 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 2nd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 S. Biwa and T. Hayashi

【Course Description】 Fundamental principles for dynamic deformations of solids and structures are examined. In particular, basic characteristics of elastic wave motion in solid media are emphasized. Responses of materials and structures to impact loading are also considered.

【Grading】 Grading is based on the attendance, homework reports and the final examination.

【Course Goals】 This course aims to establish the understanding of basic characteristics of dynamic deformations and elastic waves in solid media, as well as to learn about technological applications of ultrasound in a variety of fields. Particular emphasis is put on the mathematical aspects of the physical phenomena involved.

【Course Topics】

Theme	Class number of times	Description
Fundamentals of elastodynamics	1	Expressions of stress and strain; Conservation laws; Hooke's law; Principle of virtual work; Hamilton's principle and its applications
Basics of wave propagation	2	One-dimensional wave equation; D'Alembert's solution; Harmonic waves; Spectral analysis; Waves in structural members; Dispersive waves; Phase and group velocities
Stress waves in a bar	1	Reflection and transmission at bi-material connection; Reflection at a free end; Stress wave by tensile loading at a bar end; Plastic wave
Waves in isotropic elastic media	1	Navier's equations; Longitudinal and transverse waves; Plane elastic waves in isotropic solids
Waves in anisotropic elastic media	1	Voigt representation; Plane elastic waves in anisotropic solids; Christoffel's equation; Propagation and polarization directions; Slowness surfaces
Reflection and transmission	2	Reflection and transmission of normal incident waves; Snell's law; Mode conversion; Reflection and refraction of oblique incident waves.
Guided elastic waves	3	Bulk waves and guided waves; Rayleigh wave; Love wave; Lamb wave.
Numerical analysis of elastic waves	2	Finite difference method; Finite element method; Boundary element method
Measurements of vibration and waves	2	Comparison of various measurement techniques; Analogue and digital data analysis

【Textbook】 No textbooks are assigned. Print-outs are handed in when needed.

【Textbook(supplemental)】

【Prerequisite(s)】 Basic knowledge of mechanics of materials (solid mechanics, continuum mechanics) is expected.

【Independent Study Outside of Class】 Enrolling students are expected to work on the lecture materials and the homework problems.

【Web Sites】

【Additional Information】 The time units and weights for each item on the above list are subject to possible changes.

Transport Phenomena in Reactive Flows

Transport Phenomena in Reactive Flows

【Code】 10G423 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Wed 1st

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 English 【Instructor】 YOSHIDA Hideo, IWAI Hiroshi,

【Course Description】 This lecture is designed for the students who want to gain their knowledge and understanding on transport phenomena associated mainly with convective flows with chemical reactions. It starts with a brief review of undergraduate level subjects followed by more advanced discussion on heat and mass transfer with reactions. The reactions of interest in the lecture include combustion (oxidation), reforming and electrochemical reactions. As the reactions may proceed on catalysts, the discussion covers the catalytic surface reactions, reactions in porous media as well as gas phase reactions. The students are expected to have learned fundamentals of Fluid dynamics, Thermodynamics and Heat transfer during their undergraduate courses.

【Grading】 Grade evaluation is based on attendance, short reports and one's term paper submitted at the end of the semester.

【Course Goals】 Starting from the basic heat and mass transfer, the lecture aims to expand the students' comprehensive understanding on transport phenomena in physicochemical processes including thermochemical and electrochemical reactions.

【Course Topics】

Theme	Class number of times	Description
Transport phenomena in reactive flows	14	Transport phenomena in convective flows with chemical reactions including combustion (oxidation), reforming and electrochemical reactions.
Achievement Confirmation	1	Achievement Confirmation

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 Fluid dynamics, Thermodynamics, Heat transfer

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This course will not be opened in 2015.

Advanced Finite Element Methods

有限要素法特論

【Code】10G041 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Wed 1st
 【Location】C3-Lecture Room 2 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture and Practice
 【Language】English 【Instructor】Kotera and Nishiwaki,

【Course Description】 This course presents the basic concept and mathematical theory of the Finite Element Method (FEM), and explains how the FEM is applied in engineering problems. We also address important topics such as the physical meaning of geometrical non-linearity, material non-linearity, and non-linearity of boundary conditions, and we explore numerical methods to deal with these nonlinearities. Also, we guide students in class in the use of software to solve several numerical problems, to develop practical skill in applying the FEM to engineering problems.

【Grading】 Grading is based the quality of two or three reports and the final exam.

【Course Goals】 The course goals are for students to understand the mathematical theory of the FEM and the numerical methods for analyzing non-linear problems based on the FEM.

【Course Topics】

Theme	Class number of times	Description
Basic knowledge of the FEM	3	What is the FEM? The history of the FEM, classifications of partial differential equations, linear problems and non-linear problems, mathematical descriptions of structural problems (stress and strain, strong form and weak form, the principle of energy).
Mathematical background of the FEM	2	Variational calculus and the norm space, the convergence of the solutions.
FEM formulations	3	FEM approximations for linear problems, formulations of iso-parametric elements, numerical instability problems such as shear locking, formulations of reduced integration elements, non-conforming elements, the mixed approach, and assumed-stress elements.
Classifications of nonlinearities and their formulations	4	Classifications of nonlinearities and numerical methods to deal with these nonlinearities.
Numerical practice	2	Numerical practice using COMSOL.
Evaluation of student achievements	1	

【Textbook】

【Textbook(supplemental)】 Bath, K.-J., Finite Element Procedures, Prentice Hall

Belytschko, T., Liu, W. K., and Moran, B., Nonlinear Finite Elements for Continua and Structures, Wiley

【Prerequisite(s)】 Solid Mechanics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Engineering Science of Ionized Gases

電離気体工学セミナー

【Code】 10V401 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 3rd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Gas Dynamics

気体力学セミナー

【Code】 10V412 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Tue 3rd

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Fluid Dynamics for Aeronautics and Astronautics

航空宇宙流体力学セミナー

【Code】10V405 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】Wed 5th

【Location】C3-Lecture Room 5 【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	14	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Aerospace systems

航空宇宙機システムセミナー

【Code】 10R410 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 4th

【Location】 C3-Lecture Room 2 【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】 Evaluation depends on marks of presentation, report, and so on.

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Aerospace Systems	15	1. Reading textbooks 2. Reviewing journal papers

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Systems and Control

システム制御工学セミナー

【Code】 10R419 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Tue 4th

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Optimum System Design Engineering

最適システム設計工学セミナー

【Code】10V407 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】Tue 3rd

【Location】C3-Lecture Room 2 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Seminar and Exercise

【Language】Japanese 【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	8	
	7	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Thermal Engineering Seminar

熱工学セミナー

【Code】 10V409 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Fri 3rd 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar 【Language】 Japanese

【Instructor】 Yoshida, Iwai

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Mechanics of Functional Solids and Structures

機能構造力学セミナー

【Code】 10V413 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 Wed 4th

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 Japanese 【Instructor】 S. Biwa and T. Hayashi

【Course Description】 This Seminar is to review advanced topics related to materials and structural systems involved in aeronautics and astronautics, as well as to nurture the presentation and discussion skills. Specific topics include the numerical methods for dynamic behavior of thin-walled structures and composite/functional materials, and advanced experimental techniques for structural health monitoring.

【Grading】 Grading is based on the literature survey, presentation, discussion and the final report.

【Course Goals】 The goal is to nurture the skills to survey and discuss advanced topics in the mechanics of functional materials and structures as well as structural health monitoring, and to utilize them in carrying out the research project.

【Course Topics】

Theme	Class number of times	Description
Subject setting	3	Literature survey is to be carried out for advanced topics in the mechanics of functional materials and structures as well as structural health monitoring.
Presentation and discussion	11	The results of literature survey are presented and discussed with the critical evaluations for them.
Assessment	1	The achievement is assessed by the final report.

【Textbook】 No textbooks are assigned.

【Textbook(supplemental)】

【Prerequisite(s)】 Enrolling students are expected to have the fundamental knowledge of solid mechanics and to be willing to work on advanced topics in the mechanics of solids/structures.

【Independent Study Outside of Class】 Enrolling students are expected to carry out the literature survey and to prepare the presentation.

【Web Sites】

【Additional Information】 The time units of each stage are subject to change depending on each year's conditions and due to the discussion by Instructors/students.

Design of Complex Mechanical Systems

複雑系機械システムのデザイン

【Code】 10X411 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 3rd

【Location】 C3-Lecture Room 3 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	2	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Mechanical Engineering

先端機械システム学通論

【Code】 10K013 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day & Period】 Tue 5th and Thu 4th 【Location】 C3-Lecture Room 5 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Faculty members from several fields

【Course Description】 Lectures on recent topics in various fields of mechanical engineering will be given in English. This is mainly for foreign students (MC/DC), but Japanese students are also welcome.

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Mechanics	2	Detailed schedule will be announced later.
Materials	2	
Thermodynamics	2	
Fluid dynamics	2	
Control	2	
Design	2	
Microengineering	2	
Examination/Feedback	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This class will be given every two years; Not given in 2017.

Dynamical Systems,Advanced

力学系理論特論

【Code】10X719 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 4th

【Location】Reserch Bldg.No8 Lecture Room4 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】Kazuyuki Yagasaki(Graduate School of Infomatics)

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	2	
	2	
	2	
	2	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Topics in Nonlinear Dynamics A

非線形力学特論A

【Code】10X721 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 4th

【Location】Integrated Research Bldg.-111 【Credits】2 【Restriction】 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2-3	
	1-2	
	2-3	
	2-3	
	1-3	
	2-3	
	2-3	
	2-3	
	1-2	
	1-2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Topics in Nonlinear Dynamics B

非線形力学特論 B

【Code】 10X722 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Wed 4th

【Location】 Integrated Research Bldg.-213 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
-------	--------------------------	-------------

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Meteorology I

気象学

【Code】10M226 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Tue 2nd

【Location】Science Building #6, room #303 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】Graduate School of Science, Professor Shigeo YODEN

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2 ~ 4	
	2 ~ 4	
	2 ~ 4	
	2 ~ 4	
	2 ~ 4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Meteorology II

気象学

【Code】10M227 【Course Year】Master Course 【Term】1st term 【Class day & Period】Wed 2nd 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3 ~ 4	
	3 ~ 4	
	3 ~ 4	
	3 ~ 4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Internship DS

インターンシップ DS (機械工学群)

【Code】 10V019 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 Tabata, Hasuo

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Orientation	1	
Internship	28	
Presentation	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Internship DL

インターンシップ DL (機械工学群)

【Code】 10V020 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 6 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 Tabata, Hasuo

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	1	
Internship	43	
Presentation	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar of Complex Mechanical Engineering,A

複雑系機械工学セミナー A

【Code】 10V025 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Tue 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at
cme-seminar@me.kyoto-u.ac.jp

Seminar of Complex Mechanical Engineering,B

複雑系機械工学セミナー B

【Code】 10V027 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at
cme-seminar@me.kyoto-u.ac.jp

Seminar of Complex Mechanical Engineering,C

複雑系機械工学セミナー C

【Code】 10V029 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Tue 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at
cme-seminar@me.kyoto-u.ac.jp

Seminar of Complex Mechanical Engineering,D

複雑系機械工学セミナー D

【Code】 10V031 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at
cme-seminar@me.kyoto-u.ac.jp

Seminar of Complex Mechanical Engineering,E

複雑系機械工学セミナー E

【Code】 10V033 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Tue 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Registration is required by the deadline. Contact at
cme-seminar@me.kyoto-u.ac.jp

Seminar of Complex Mechanical Engineering,F

複雑系機械工学セミナー F

【Code】 10V035 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 1st

【Location】 C3-Lecture Room 4a 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar

【Language】 English 【Instructor】 Hirakata, Kurose, Aoi, Sugimoto, Kono, Nakajima

【Course Description】 This seminar provides doctor-course students an opportunity of face-to-face group discussions to exchange ideas and information with those from other research fields. It is also emphasized in this seminar to give the attendees a chance to boost up the presentation skills necessary to broaden their own expertise across multi-disciplinary research fields. The primal aim is to offer these significant experiences of leadership as a young scientist with broad perspective in the global community.

【Grading】 Based on Group Activity Reports and Personal Report

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Self introduction	1-2	
Organizing groups	1	
Group activity	10-12	Each group chooses an activity theme, and pursue the goal through discussion in the group. Weekly reports on the activity are required.
Final presentation	1-2	Each group gives presentation of its final results.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 All activities should be done in English.

Experiments and Exercises in Aeronautics and Astronautics I

航空宇宙工学特別実験及び演習第一

【Code】 10G418 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Experiment and Exercise 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	5	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Experiments and Exercises in Aeronautics and Astronautics II

航空宇宙工学特別実験及び演習第二

【Code】 10G420 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Experiment and Exercise 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	5	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Quantum Science

基礎量子科学

【Code】10C070 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 2nd

【Location】C3-Lecture Room 5 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	9	
	2	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Advanced Nuclear Engineering

基礎量子エネルギー工学

【Code】10C072 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Tue 2nd

【Location】C3-Lecture Room 5 【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantum Field Theory

場の量子論

【Code】 10C004 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 2nd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Takayuki Miyadera, Kenzo Ogure

【Course Description】 An introduction to quantum field theory is presented with an emphasis on its mathematical difficulties.

【Grading】 exam

【Course Goals】 Our aim is to understand the difficulty of relativistic quantum field theory caused by the Poincare covariance and the infinite degrees of freedom.

【Course Topics】

Theme	Class number of times	Description
Free field	8	Poincare group, Wigner's theorem, Fock space, Wightman function, Weyl algebra, microlocal analysis and Wick product
Interacting field	6	Perturbative expansion (ϕ^4 model), Wick's theorem, Feynman diagram, divergences, renormalization, axiomatic quantum field theory
Confirmation of achievement in study	1	

【Textbook】

【Textbook(supplemental)】 None

【Prerequisite(s)】 Analysis, linear algebra, quantum mechanics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantum Science

量子科学

【Code】 10C074 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Tue 1st

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】 This course involves fundamental interactions of electrons, ions and photons to atoms, molecules and condensed matters, and practical applications for nanotechnology. Great emphases are on fundamental mechanisms of beam-solid interactions, characterization techniques, material synthesis and processing for quantum devices with quantum beam. Recent progress of related area of quantum beam will be also introduced in this course.

【Grading】 Coursework will be evaluated with attendance and report on subjects.

【Course Goals】 To provide students to understand fundamental interactions in quantum science.

【Course Topics】

Theme	Class number of times	Description
Interactions between quantum beams and solids	7	Interactions between quantum beams and solids are described with various formulas. Collisions with nucleus, electronic excitation, defect formation and energy loss will be discussed and related scientific topics, such as discovery of electron will be introduced.
Applications of quantum beams	7	The interactions of quantum beam are widely used for various applications. Material processing and analysis with quantum beams are essential in nanotechnology and quantum beams are also important for diagnostics of diseases and cancer therapy in medical field. Practical applications will be presented with recent progress and challenges.
Final examination and report	1	Evaluation will be given by the contents of the reports and quizzes of the subjects leaned in this course.

【Textbook】 Ion-Solid Interactions: Fundamentals and Applications (Cambridge Solid State Science Series) M. Nastasi, J. Mayer, J. Hirvonen

【Textbook(supplemental)】

【Prerequisite(s)】 Solid state physics, Quantum mechanics(beginner ' s), Electromagnetism

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Nuclear Materials

核材料工学

【Code】 10C013 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 1st

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Takagi Ikuji

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Fission Reactor Materials	5	Overview of nuclear reactors (nuclear fission and its control), Nuclear fuel (abundance of U-235, isotope enrichment, fission cross section), Cladding materials (Zr-based alloys, hydrogen embrittlement), Control materials, Moderating materials, Cooling materials, Structural materials
Fusion Reactor Materials	4	Brief history of nuclear fusion, Structural materials (radioactivation, irradiation damage), Coil materials, Blanket materials (tritium breeding, fuel cycle), Plasma-facing materials (divertor, hydrogen recycling, tritium inventory)
Recent Topics	5	
Feedback	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Nuclear Fuel Cycle 1

核燃料サイクル工学 1

【Code】 10C014 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Wed 1st

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Takayuki SASAKI, Taishi KOBAYASHI

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Introduction	1	
Nuclear fuel	3	
Actinide chemistry	3	
Disposal management	4	
Decommissioning	1	
Recent topics	2	
Support	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Radiation Physics and Engineering

放射線物理工学

【Code】 10C017 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 3rd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	5	
	2	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Neutron Science

中性子科学

【Code】 10C018 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 1st

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	6	
	2	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantum Manipulation Technology

量子制御工学

【Code】 10C031 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 1st

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	14	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Fundamentals of Magnetohydrodynamics

基礎電磁流体力学

【Code】 10C076 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Thu 2nd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 English Lecture

【Language】 English 【Instructor】 Tomoaki Kunugi, Sadayoshi Murakami,

【Course Description】 This course provides fundamentals of magnetohydrodynamics which describes the dynamics of electrically conducting fluids, such as plasmas and liquid metals. The course covers the fundamental equations in magnetohydrodynamics, dynamics and heat transfer of magnetofluid in a magnetic field, equilibrium and stability of magnetized plasmas, as well as illustrative examples.

【Grading】 Attendance and two reports

【Course Goals】 The students can understand fundamentals of magnetohydrodynamics which describes the dynamics of electrically conducting fluids, such as plasmas and liquid metals. Moreover, the students will figure out the applications of magnetohydrodynamics to the various science and engineering fields.

【Course Topics】

Theme	Class number of times	Description
Liquid Metal MHD	7	1. Introduction and Overview of Magnetohydrodynamics 2. Governing Equations of Electrodynamics and Fluid Dynamics 3. Turbulence and Its Modeling 4. Dynamics at Low Magnetic Reynolds Numbers 5. Glimpse at MHD Turbulence & Natural Convection under B field 6. Boundary Layers of MHD Duct Flows 7. MHD Turbulence at Low and High Magnetic Reynolds Numbers
Plasma MHD	8	1. Introduction to Plasma MHD 2. Basic Equation of Plasma MHD 3. MHD Equilibrium 4. Axisymmetric MHD Equilibrium 5. Ideal MHD Instabilities 6. Resistive MHD Instabilities 7. MHD Waves in Plasmas 8. Student Assessment

【Textbook】 Handout of the presentation will be provided at the lecture

【Textbook(supplemental)】 P. A. Davidson, " An Introduction to Magnetohydrodynamics, " Cambridge texts in applied mathematics, Cambridge University Press, 2001

【Prerequisite(s)】 Fundamental fluid dynamics and electromagnetics should be learned prior to attend this lecture.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Nuclear Energy Conversion and Reactor Engineering

核エネルギー変換工学

【Code】 10C034 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Wed 2nd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 KAWARA,KUNUGI,YOKOMINE,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	2	
	3	
	2	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Multiphase Flow Engineering and Its Application

混相流工学

【Code】10C037 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 2nd 【Location】
 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】KUNUGI, Tomoaki, YOKOMINE, Takehiko,

【Course Description】Reviewing of the fundamental definition and characteristics of multiphase flows, and to learn the governmental equations and some modelings of the constitutive equations and the current status of the multiphase flows. Moreover, to review and learn the fundamental definition and characteristics of particle flows, and to learn the numerical methods to track the particle laden flows and the particle measurement method.

【Grading】Present a summary of some papers regarding multiphase flows research by using a power point, and then answer several questions made by lecturers. The quality of your presentation and how deep understand your subject are the grading point.

【Course Goals】As for the multiphase flows, to learn its fluid dynamics behaviors, governing equations and numerical methods, and finally to discuss its applications to many engineering fields.

【Course Topics】

Theme	Class number of times	Description
What's the multiphase flows?	1	To review the definitions and fundamental characteristics of multiphase flows.
Governing equation of gas-liquid two phase flows	2	To learn the governing equation of gas-liquid two phase flows
Modeling of gas-liquid two phase flows	2	To learn modeling of gas-liquid two phase flows and its constitutive equations
Numerical methods	3	To learn the numerical methods to solve the single-phase and two-phase flows
Examples of gas-liquid two phase flow analysis	1	To show some examples of gas-liquid two phase flow analysis
Characteristics of particle flows	1	Review characteristics of particle flows
Fundamental aspect of particle flows	1	Explain variables and parameters subjected to interaction between particle and particle and/or particle and flow. Moreover, momentum and heat exchange between phases, i.e., to explain One-way, Two-way and Four-way coupling numerical methods.
Particle methods	2	Explain numerical method for thermofluid including static particles like a packed bed. Moreover, numerical methods for macroscopic and microscopic particles such as Discrete Element Method.
Measurements of particle characteristics	2	Review several measuring methods of particle characteristics and thermofluid behaviors

【Textbook】Handouts of the presentation will be provided in the lecture.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Physics of Fusion Plasma

核融合プラズマ工学

【Code】10C038 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 3rd

【Location】C3-Lecture Room 5 【Credits】2 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	2	
	1	
	1	
	3	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Hybrid Advanced Accelerator Engineering

複合加速器工学

【Code】 10C078 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Wed 3rd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Yoshihiro Ishi

【Course Description】 Particle accelerator is essential for proceeding nuclear and particle physics but also becomes a very important tool for future nuclear sciences and engineering. In this lecture, a basics theory of accelerator physics including beam optics and dynamics of the circular accelerators is given, and also various applications of the accelerators are also presented.

【Grading】 Reports on practical issues and subjects.

【Course Goals】 This lecture aims to learn a basic accelerator theory and to attain abilities to make a primitive design of circular accelerator.

【Course Topics】

Theme	Class number of times	Description
Hisitory and outline of particle accelerator	1	
Basic theory of beam dynamics in circular accelerator	1	
Major components of accelerators	1	
Orbit theories of the beam	3	
Theory of radio frequency acceleration	2	
Practice of accelerator designing	2	
Non linear beam dynamics and others	4	
Summary and check the accomplishment	1	

【Textbook】

【Textbook(supplemental)】 S.Y.Lee, Accelerator Physics, World Scientific (1999), J.J.Livingood, Cyclic Particle Accelerator, Van Nostland, New York (1961).E.D. Courant and H.S.Snyder, Ann. Physics, 3,1(1958).

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Nuclear Reactor Safety Engineering

原子炉安全工学

【Code】10C080 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Tue 2nd

【Location】C3-Lecture Room 5 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese

【Instructor】Ken NAKAJIMA, professor, Research Reactor Institute

Toshihiro YAMAMOTO, associate professor, Research Reactor Institute

Jun-ichi HORI, associate professor, Research Reactor Institute

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	3	
	5	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Applied Neutron Engineering

応用中性子工学

【Code】 10C082 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 3rd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	3	
	4	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Radiation Medical Physics

放射線医学物理学

【Code】 10C047 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Fri 3rd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Yoshinori Sakurai, Hiroki Tanaka, Takushi Takata

【Course Description】 Medical physics is the general term for the physics and technology which are supporting radiation diagnosis and therapy, and particle therapy. As it covers many different fields, the important subjects are “ promotion for the advance of radiation therapy ” and “ quality assurance for radiation therapy ” . The scope of this course is to learn the fundamental knowledge for radiation medical physics. Especially, the focus is put on the understanding for (1) the bases of physics, biology and so on for radiation, (2) the physics for the radiations applied to diagnosis, (3) the characteristics of radiations and particle beams applied to therapy, and (4) the quality assurance and so on for radiation diagnosis and therapy.

【Grading】 Attendance and reports

【Course Goals】 To learn the fundamental knowledge of medical physics, mainly for radiation physics in diagnosis and therapy

【Course Topics】

Theme	Class number of times	Description
Introduction to medical physics for radiation	1	
Fundamental biology for radiation	1	
Radiation measurement and evaluation	2	
Physics in radiation diagnosis	4	
Physics in radiation therapy	5	
Quality assurance and standard dosimetry	1	
Achievement Assessment	1	

【Textbook】 Not specified. Handouts will be given for each topic.

【Textbook(supplemental)】 F.M.Khan, “ The Physics of Radiation Therapy: Mechanisms, Diagnosis, and Management ” (Lippincott Williams & Wilkins, Baltimore, 2003)

【Prerequisite(s)】 It is recommended to attend the course, “ Radiation Measurement for Medicine ” , concurrently.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Nuclear Engineering, Adv.

原子核工学最前線

【Code】 10C084 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Thu 4th

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	13	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Nuclear Engineering Application Experiments

原子力工学応用実験

【Code】 10C068 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term 【Class day & Period】

【Location】 Research Reactor Institute 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Exercise

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	10	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantum Beam Science, Adv.

量子ビーム科学特論

【Code】 10R001 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Fri 4th

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	6	
	4	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantum Physics, Adv.

量子物理学特論

【Code】 10R004 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 Tue 3rd

【Location】 C3-Seminar Room d1 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 T. Miyadera,

【Course Description】 We study advanced quantum theories and their applications to technologies including quantum optics and quantum information. Keywords: Foundations of quantum theory, quantum information theory.

【Grading】 Presentations and discussions

【Course Goals】 We introduce recent progresses of technologies based on quantum dynamics.

【Course Topics】

Theme	Class number of times	Description
Quantum theories and their applications	14	We study a relevant textbook and related topics.
Confirmation of achievement in study	1	

【Textbook】 A relevant textbook is instructed at the beginning of the class every year.

【Textbook(supplemental)】

【Prerequisite(s)】 quantum physics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Nonlinear Physics in Fusion Plasmas

非線形プラズマ工学

【Code】 10R013 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Tue 3rd

【Location】 C3-Lecture Room 5 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 English 【Instructor】 Atsushi Fukuyama,

【Course Description】 This course provides a comprehensive introduction to computational modeling and simulation of magnetically confined fusion plasmas. Topics include elements of nonlinear plasma physics, modeling of various phenomena in fusion plasmas, computational methods in plasma physics, and integrated simulation of fusion plasmas

【Grading】 Report in English

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Nonlinear Phenomena in Plasma Physics	1	Review of nonlinear phenomena in plasmas; modeling of plasmas
Nonlinear Waves in Plasmas	2	Nonlinear ion acoustic waves; Korteweg de Vries equation; Soliton; Nonlinear Schrodinger equation
Wave-Particle Interaction in Plasmas	2	Linear wave particle resonant interaction; Landau damping; Trapping in a single wave; Nonlinear interaction with waves; Stochastic particle motion; Quasi-linear interaction
Wave-Wave Interaction in Plasmas	2	Parametric instability; Three-wave interaction
Numerical Analysis of Differential Equations	4	Basics of numerical simulations; Ordinary differential equation; Partial differential equation; Matrix solver
Numerical Simulation of Fusion Plasmas	3	Numerical simulation of fusion plasmas: equilibrium, transport, heating and current drive, stability, energetic particles, integrated modeling
Assessment of Achievement	1	Assessment of Achievement

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】 Plasma Physics, Fundamental Magnetohydrodynamics, Fusion Plasma Physics, or equivalents

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Nuclear Engineering 1

原子核工学序論 1

【Code】 10C086 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 2nd

【Location】 Engineering Science Depts Bldg.-101 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	7	
	7	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Nuclear Engineering 2

原子核工学序論 2

【Code】10C087 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Mon 2nd

【Location】Engineering Science Depts Bldg.-101 【Credits】2 【Restriction】 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	9	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Radiation Measurement for Medicine

医学放射線計測学

【Code】10W620 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Fri 2nd

【Location】C3-Lecture Room 5 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】Hidetsugu Tsuchida, Yoshinori Sakurai,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Fundamentals for Physical Effects of Radiation Interactions	2	
Fundamentals for Chemical Effects of Radiation Interactions	1	
Fundamental Quantities and Units for Radiation	2	
Radiation Measurements in Medical Physics	3	
Radiation Dosimetry	2	
Estimation for Dose Distribution	2	
Techniques for Radiation Control and Measurement in Medical Radiation Field	1	
Laws and Ordinances for Radiation Therapy	1	
Check of Study Achievement	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Advanced Material Science and Technology (15 times course)

(English lecture)

先端マテリアルサイエンス通論 (15 回コース) (英語科目)

【Code】10i054 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 5th 【Location】A2-306 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture

【Language】English

【Instructor】ER Center, J. Assoc. Prof., Ryuichi Ashida
Related professors

【Course Description】The various technologies used in the field of material science serve as bases for so-called high technologies, and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】The average score of the best five reports is employed.
Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Tumor Imaging and Therapy through Photoirradiation	1	The overview of current modalities through photoirradiation as well as the preparation of tumor imaging probes is given. Tumor therapy through photoirradiation is also shown in the lecture. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Carbon Nanorings	1	The preparation of carbon nanorings is outlined in the lecture. The supramolecular interaction as well as the photophysical properties of carbon nanorings is summarized. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Crystal Structure Analysis by Powder X-ray Diffraction Measurement	1	Chemical and physical properties of a material is strongly related with the structure of the material. So, structure analysis is one of the most important part in material researches. Powder X-ray diffraction analysis is powerful way to analyze the crystal structure of solid materials. We study how to use powder X-ray diffraction analysis for material researches. (T. Yamamoto: Dept. of Energy and Hydrocarbon Chemistry)
Principles and Applications of Fluorescence Spectroscopy	1	Fluorescence spectroscopy is applied to various disciplines of science and engineering, and provides unique information of a system upon photo-illumination. This course aims to introduce the background of fluorescence spectroscopy and practical knowledge in fluorescence experiments. (J. Park: Dept. of Molecular Engineering)
Synthesis of Novel π -Conjugated Molecules with Main Group Elements	1	The lecture will show synthesis and properties of novel π -conjugated molecules with main group elements, and their application as functional materials. (T. Higashino: Dept. of Molecular Engineering)
Chemistry of Asymmetric Catalysis Stereoselective Synthesis of Optically Active Pharmaceutical Compounds	1	This class will outline the progress on enantioselective catalysis for the asymmetric synthesis of optically active pharmaceutical compounds such as Herbesser, which is a blockbuster drug developed in a Japanese pharmaceutical company. (K. Asano: Dept. of Material Chemistry)
Electrical Conductivity of Conjugated Polymers and Application to Organic Electronics	1	In this class, structure and property of conjugated polymers are introduced and discussed. The discussion topics include the brief history of the discovery of electrical conductivity of conjugated polymers, mechanism of electrical conductivity in polymer chains, representative evaluation methods of conductivity for conjugated polymers, relationship between molecular and self-assembled structures of conjugated polymers, and recent examples of device applications using conjugated polymers. (I. Sakurai: Dept. of Molecular Engineering)
An Introduction to Smart Shape Changing Materials	1	This course will briefly introduce smart materials as a whole and will then focus specifically on the recent and very active field of smart shape changing materials. We will explore how the design and stimuli-sensitivity of various materials can allow for materials to have planned and useful motion. (K. Landenberger: Dept. of Polymer Chemistry)
Properties of Cementitious Materials and the Future	2	CEMENT may not necessarily be an advanced material, but must surely be a forefront material for human life and society, in the past, present and future. Then, what are your demands to cement? (A. Hattori: Dept. of Urban Management)
Application of Electrical Discharge to Material and Environmental Technology	1	(N. Sano: Dept. of Chemical Engineering)
Theory of Precision Cutting, Grinding, Polishing and Related Properties of Materials	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Metrology and Control Theory for Precision Manufacturing, and Applications	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Fabrication of Inorganic Nanofiber by Electrospinning	1	When a high voltage is applied to a polymer solution, the solution is sprayed as thread-like droplets, and turns to polymer nanofibers. This fiber forming technique is called electrospinning. This lecture will give a brief introduction on the fabrication of nanofibers of inorganic materials including metal oxide and carbon by electrospinning. (S. Nagamine: Dept. of Chemical Engineering)
Solid Surface Analysis, Including a Potential Method: Tip-Enhanced Raman Spectroscopy	1	Surface analytical techniques each have their own analytical volume. The students learn about the volume, and look at an issue for tip-enhanced Raman spectroscopy, a nanoscale Raman spectroscopy, as a potential surface analytical technique. (M. Nishi: Dept. of Material Chemistry)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Modern Science and Technology (4 times course) (English lecture)

現代科学技術特論 (4 回コース) (英語科目)

【Code】 10i055 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 5th

【Location】 A2-306 【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 ER Center, J. Assoc. Prof., Ashida
ER Center, J. Assoc. Prof., Matsumoto
ER Center, J. Assoc. Prof., Maeda
ER Center, J. Assoc. Prof., Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '4 times course' should select one of the topics and attend the lectures. (Students who take '8 times course' should attend the lectures of the both topics.) Attend a course orientation held before the first lecture (Nov. 1) even if you take only the second topic.

Advanced Modern Science and Technology (8 times course) (English lecture)

現代科学技術特論 (8 回コース) (英語科目)

【Code】 10i056 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 5th

【Location】 A2-306 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】	ER	Center,	J.	Assoc.	Prof.,	Ashida
	ER	Center,	J.	Assoc.	Prof.,	Matsumoto
	ER	Center,	J.	Assoc.	Prof.,	Maeda
	ER	Center,	J.	Assoc.	Prof.,	Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '8 times course' should attend the lectures of the both topics. (Students who take '4 times course' should select one of the topics and attend the lectures.)

Exercise in Practical Scientific English

实践的科学英語演習

【Code】 10i046 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Mon 5th

【Location】 Seminar Room at Cluster B, Katsura campus 【Credits】 1

【Restriction】 If the number of students in this course reaches the enrollment limit after the web-registration, a drawing will take place to decide who gets to be enrolled in the first class.

【Lecture Form(s)】 Seminar and Exercise 【Language】 English

【Instructor】 Engineering Education Research Center (M. Nishikawa), Related professors (J. Lintuluto, A. Beaucamp, C. Tassel, K. Landenberger, M. De Zoysa)

【Course Description】 This course is open to all master and doctoral engineering students. The aim is to enhance students' abilities to disseminate scientific findings to a wider audience in English. Throughout the course, feedback will be given to the presenter by different instructors specialized in Engineering. The course will help students gain confidence in Oral English presentations on scientific topics.

【Grading】 Evaluation: 20% participation (engaging the Q&As), 10% reflection paper, 10% poster presentation, 60% oral presentations

【Course Goals】 Throughout the course, students are expected to deliver an oral presentation about their research three times. In each class, four or five students (depending on the total number of students in class) will deliver a 10-minutes oral presentation using the visual aid in front of a small group. After each presentation, the audience, and the instructor(s) in the class will give some meaningful feedback (5 min). In addition, each presentation will be videotaped and stored in USB memory. Students can monitor the progress by watching own video and can write a reflection paper at the end of the course. In addition, we will have poster presentations scheduled during the course.

【Course Topics】

Theme	Class number of times	Description
Introduction: Effective Presentation	1	A lecture is given on how to prepare an effective presentation including: 1. Presenting with purpose, 2. How to organize your message, 3. How to use transitional words and phrases, 4. What to do for Questions and Answers.
Oral presentations	12	Here are some focal points for each round of oral presentations: 1. Organization-Presentation should be structurally organized and contains information in logical, interesting sequence which audience can follow, 2. Subject Knowledge-Students should be able to demonstrate the knowledge on the research topic with some degree of confidence, 3. Delivery: Students should be able to deliver a presentation that will merit the audience even if the audience does not come from the same research field.
Poster presentations	2	Here are some criteria for poster presentations: 1. Layout of information-The sequence of information should be logically organized and easy to follow, 2. Scientific knowledge-The poster should provide a content suitable for non-experts, 3. Delivery-Students need to demonstrate knowledge and enthusiasm for their work.

【Textbook】 Handout materials will be supplied by the instructor.

【Textbook(supplemental)】 Donovan, J. (2014). How to deliver a TED talk. Mc Graw, Hill Education.

【Prerequisite(s)】 This course is held in English. Students are expected to actively engage in class discussions.

【Independent Study Outside of Class】

【Web Sites】 None

【Additional Information】 Students who intend to join this course must attend the first class.

Office Hours: (by appointment) nishikawa.mikako7w@kyoto-u.ac.jp (Ext. 2052)

Safety and Health Engineering (4 times course)

安全衛生工学（4回コース）

【Code】 10i057 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 4th

【Location】 C3-Lecture Room 1 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

International Internship in Engineering 2

工学研究科国際インターンシップ 2

【Code】 10i011 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day & Period】 Intensive course 【Location】 【Credits】 2 【Restriction】 Defined by each internship program

【Lecture Form(s)】 Exercise 【Language】 English

【Instructor】 Faculty members in charge of educational affairs of the Global Leadership Engineering Education Center and of the department the registrant belongs to.

【Course Description】 Acquisition of international skills with the training of foreign language through the internship programs hosted by the University, the Graduate School of Engineering, or The Department the registrant belongs to.

【Grading】 Merit rating is performed based on the presentation or the report(s) after the participation in each internship program. Each department is responsible to identify the number of credits to be granted to the student of the department, if the credits are included in the mandatory ones. The Global Leadership Engineering Education Center takes the role to evaluate the credits if the department the student belongs to deals the credits as optional ones. The number of credits to be earned is 1 and 2, respectively to the subjects International Internship in Engineering 1 and 2 depending on the period and the contents of the internship program the students has participated in.

【Course Goals】 Acquisition of international skills with the training of foreign language. Detailed objectives should be described in each program.

【Course Topics】

Theme	Class number of times	Description
Overseas Internship	1	The contents to be acquired should be described in the brochure of each internship program.
Final Presentation	1	A presentation by the student is required followed by discussion among participants.

【Textbook】 Not Applicable.

【Textbook(supplemental)】 Not Applicable.

【Prerequisite(s)】 Described in the application booklet for each internship program. The registrant is requested to have enough language skills for the participation.

【Independent Study Outside of Class】 Not Applicable.

【Web Sites】 Not Applicable.

【Additional Information】 It is required for students to check if the internship program to participate in could be evaluated as part of mandatory credits or not and could earn how many credits before the participation to the department or educational program the student is enrolled. If the credit could not be treated as mandatory ones, get in touch with the Global Leadership Engineering Education Center.

Internship M

インターンシップM (原子核)

【Code】 10C050 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Exercise 【Language】 Japanese

【Instructor】 Hidetsugu Tsuchida,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
-------	-----------------------	-------------

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Experiments and Exercises on Nuclear Engineering, Adv. I

原子核工学特別実験及び演習第一

【Code】10C063 【Course Year】Master Course 【Term】1st+2nd term 【Class day & Period】Mon 1st and 2nd

【Location】 【Credits】4 【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	6	
	10	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Experiments and Exercises on Nuclear Engineering, Adv. II

原子核工学特別実験及び演習第二

【Code】 10C064 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	6	
	10	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Nuclear Engineering A

原子核工学セミナー A

【Code】 10C089 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 1 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	10	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Nuclear Engineering B

原子核工学セミナー B

【Code】 10C090 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 1 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	10	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Engineering Internship D

インターンシップD (原子核)

【Code】10R017 【Course Year】Doctor Course 【Term】1st+2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Exercise 【Language】 【Instructor】Manabu Saito

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
-------	--	-------------

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Nuclear Engineering, Adv. A

原子核工学特別セミナー A

【Code】 10R019 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	10	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Nuclear Engineering, Adv. B

原子核工学特別セミナー B

【Code】 10R021 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	1	
	2	
	10	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Nuclear Engineering, Adv. C

原子核工学特別セミナーC

【Code】 10R023 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	10	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Nuclear Engineering, Adv. D

原子核工学特別セミナーD

【Code】10R025 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	1	
	2	
	10	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Nuclear Engineering, Adv. E

原子核工学特別セミナー E

【Code】 10R027 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	10	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Nuclear Engineering, Adv. F

原子核工学特別セミナーF

【Code】10R029 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar 【Language】 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	1	
	2	
	10	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Non-ferrous extractive metallurgy, Adv.

非鉄製錬学特論

【Code】 10C209 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 2nd

【Location】 Engineering Science Depts Bldg.-112 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	1	
	1	
	2	
	1	
	1	
	2	
	1	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Material and Chemical Information Analysis

物質情報工学

【Code】10C210 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Tue 2nd

【Location】Engineering Science Depts Bldg.-112 【Credits】2 【Restriction】No Restriction

【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】Jun Kawai

【Course Description】Lectures on data processing methods such as Fourier transform and smoothing of measured data, ISO standards for chemical analysis, detection limits, standard deviation of measured data.calculations.

【Grading】By reports

【Course Goals】To get skills to extract information from data measured by the students by themselves during the research in graduate school.

【Course Topics】

Theme	Class number of times	Description
Central limit theorem	2	Central limit theorem, generating functions, Gaussian distribution, standard deviation.
Sampling and precision	1	Limit of detection, the error of the first kind, second kind, ISO standard of analytical chemistr.
Smoothing	2	Liest square method, Savitzky-Golay method, peak deconvolution,
Fourier transform	2	Fourier transform, convolution, deconvolution, smoothing by Fourier transfom.
Entropy	2	Akaike's information criteria, spline function, Tsallis entropy.
Difference between heat and temperature	1	Laplace transform.
Canonical ensamble	1	
Green function and density matrix	2	Similarity between Schrodinger equation and diffusion equation.
Materials informatics	1	
Feedback	1	

【Textbook】not used.

【Textbook(supplemental)】Y. Gohshi (ed.) Instrumentation Chemistry, Shoukoudo (1997).

【Prerequisite(s)】not needed.

【Independent Study Outside of Class】

【Web Sites】www.process.mtl.kyoto-u.ac.jp

【Additional Information】

Microstructure, solidification and crystal growth

凝固・結晶成長学

【Code】 10C214 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Mon 2nd

【Location】 Engineering Science Depts Bldg.-112 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Hideyuki Yasuda, Yoshitaro Nose

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	6-7	
	6-7	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Ceramic Materials Science

セラミックス材料学

【Code】 10C267 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 2nd

【Location】 Engineering Science Depts Bldg.-112 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 I. Tanaka and A. Seko

【Course Description】 This lecture covers the mechanical, optical, and electronic properties of ceramics, their microscopic mechanisms, and fundamental knowledge required for the design of ceramics. Applications of advanced experimental and theoretical approaches to ceramic research are also discussed.

【Grading】 Evaluations are made based on the examination or reports.

【Course Goals】 Systematic understanding of the properties of ceramics on macroscopic and microscopic scales and learning approaches to the issues in ceramic research.

【Course Topics】

Theme	Class number of times	Description
Introduction to ceramics	2	Overview of the history and commercial applications of ceramics.
Fundamentals of ceramics	4	Fundamentals of ceramics such as crystal structure, electronic structure, and thermodynamical properties. The atomic and electronic structure of point defects, surfaces, grain boundaries, and their impacts on the properties of ceramics.
Structural ceramics	2	Mechanical properties of ceramics.
Energy ceramics	2	Ceramics for energy applications and their understanding from the viewpoint of the atomic and electronic structure.
Optical and electronic ceramics	4	Optical and electronic properties of ceramics for laser and electronic device applications and their understanding from the viewpoint of the atomic and electronic structure.
Assessment of mastery of the course content	1	The mastery of the course content is assessed.

【Textbook】

【Textbook(supplemental)】 Yet-Ming Chiang et al., Physical Ceramics (John Wiley & Sons)

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Physical Properties of Crystals Adv.

結晶物性学特論

【Code】10C263 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Wed 2nd

【Location】Engineering Science Depts Bldg.-112 【Credits】2 【Restriction】No Restriction

【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】Haruyuki Inui, Kyosuke Kishida,

【Course Description】Properties of crystals are generally

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Magnetism and magnetic materials

磁性物理

【Code】10C271 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Mon 2nd

【Location】Engineering Science Depts Bldg.-112 【Credits】2 【Restriction】No Restriction

【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	4	
	2	
	3	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Atomic-molecular scale engineering

原子分子工学特論

【Code】10C286 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Fri 2nd

【Location】Engineering Science Depts Bldg.-112 【Credits】2 【Restriction】No Restriction

【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	5	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Microstructure theory and structure evaluation

材料組織・構造評価学

【Code】 10C288 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 2nd

【Location】 Engineering Science Depts Bldg.-112 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	3	
	3	
	2	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Structural Metallic Materials

先進構造材料特論

【Code】 10C289 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Thu 2nd

【Location】 Engineering Science Depts Bldg.-101 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Akinobu Shibata, Nobuhiro Tsuji

【Course Description】 Structural metallic materials, in particular steels, achieve their various mechanical properties based on microstructural control in micro and nano scales. This lecture treats mainly steels, and explains the mechanism of microstructure formation by solid state reactions (phase transformation / precipitation / recrystallization), and relationship between microstructure and mechanical properties. Moreover, the lecture introduces the new metallurgy for developing microstructural control methodology.

【Grading】 Evaluations are made based on attendance and report

【Course Goals】 Understanding the microstructure formation mechanism by phase transformation / precipitation / recrystallization, and acquiring the knowledge for improvement of mechanical properties through microstructural control in micro and nano scales.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Overview of the lecture
Formation mechanism of microstructure	8	1. Iron and Steel, 2. Phase diagram of steel, 3. Diffusional phase transformation, 4. Diffusionless phase transformation (martensitic transformation), 5. Precipitation, 6. Recrystallization
Microstructural control methodology	5	1. Relationship between microstructure and mechanical properties, 2. Thermomechanical processing, 3. New metallurgy for microstructural control
	1	

【Textbook】 Materials will be distributed.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Electrochemistry for Materials Processing,

材料電気化学特論

【Code】 10C290 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Wed 2nd

【Location】 Engineering Science Depts Bldg.-112 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Kuniaki MURASE, Kazuhiro FUKAMI,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Modern electroplating	4	
Thermodynamics of electrodeposition	2	
Corrosion engineering and anodization	4	
Semiconductor electrochemistry	2	
Advanced materials electrochemistry	2	
Self-assessment of achievement	1	

【Textbook】 No textbook is required for this course.

【Textbook(supplemental)】

【Prerequisite(s)】 Knowledge of fundamental electrochemistry and chemical thermodynamics are required.

【Independent Study Outside of Class】

【Web Sites】 Not available

【Additional Information】 Not available

Introduction to Advanced Material Science and Technology (15 times course)

(English lecture)

先端マテリアルサイエンス通論 (15 回コース) (英語科目)

【Code】10i054 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 5th 【Location】A2-306 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture

【Language】English

【Instructor】ER Center, J. Assoc. Prof., Ryuichi Ashida
Related professors

【Course Description】The various technologies used in the field of material science serve as bases for so-called high technologies, and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】The average score of the best five reports is employed.
Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Tumor Imaging and Therapy through Photoirradiation	1	The overview of current modalities through photoirradiation as well as the preparation of tumor imaging probes is given. Tumor therapy through photoirradiation is also shown in the lecture. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Carbon Nanorings	1	The preparation of carbon nanorings is outlined in the lecture. The supramolecular interaction as well as the photophysical properties of carbon nanorings is summarized. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Crystal Structure Analysis by Powder X-ray Diffraction Measurement	1	Chemical and physical properties of a material is strongly related with the structure of the material. So, structure analysis is one of the most important part in material researches. Powder X-ray diffraction analysis is powerful way to analyze the crystal structure of solid materials. We study how to use powder X-ray diffraction analysis for material researches. (T. Yamamoto: Dept. of Energy and Hydrocarbon Chemistry)
Principles and Applications of Fluorescence Spectroscopy	1	Fluorescence spectroscopy is applied to various disciplines of science and engineering, and provides unique information of a system upon photo-illumination. This course aims to introduce the background of fluorescence spectroscopy and practical knowledge in fluorescence experiments. (J. Park: Dept. of Molecular Engineering)
Synthesis of Novel π -Conjugated Molecules with Main Group Elements	1	The lecture will show synthesis and properties of novel π -conjugated molecules with main group elements, and their application as functional materials. (T. Higashino: Dept. of Molecular Engineering)
Chemistry of Asymmetric Catalysis Stereoselective Synthesis of Optically Active Pharmaceutical Compounds	1	This class will outline the progress on enantioselective catalysis for the asymmetric synthesis of optically active pharmaceutical compounds such as Herbesser, which is a blockbuster drug developed in a Japanese pharmaceutical company. (K. Asano: Dept. of Material Chemistry)
Electrical Conductivity of Conjugated Polymers and Application to Organic Electronics	1	In this class, structure and property of conjugated polymers are introduced and discussed. The discussion topics include the brief history of the discovery of electrical conductivity of conjugated polymers, mechanism of electrical conductivity in polymer chains, representative evaluation methods of conductivity for conjugated polymers, relationship between molecular and self-assembled structures of conjugated polymers, and recent examples of device applications using conjugated polymers. (I. Sakurai: Dept. of Molecular Engineering)
An Introduction to Smart Shape Changing Materials	1	This course will briefly introduce smart materials as a whole and will then focus specifically on the recent and very active field of smart shape changing materials. We will explore how the design and stimuli-sensitivity of various materials can allow for materials to have planned and useful motion. (K. Landenberger: Dept. of Polymer Chemistry)
Properties of Cementitious Materials and the Future	2	CEMENT may not necessarily be an advanced material, but must surely be a forefront material for human life and society, in the past, present and future. Then, what are your demands to cement? (A. Hattori: Dept. of Urban Management)
Application of Electrical Discharge to Material and Environmental Technology	1	(N. Sano: Dept. of Chemical Engineering)
Theory of Precision Cutting, Grinding, Polishing and Related Properties of Materials	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Metrology and Control Theory for Precision Manufacturing, and Applications	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Fabrication of Inorganic Nanofiber by Electrospinning	1	When a high voltage is applied to a polymer solution, the solution is sprayed as thread-like droplets, and turns to polymer nanofibers. This fiber forming technique is called electrospinning. This lecture will give a brief introduction on the fabrication of nanofibers of inorganic materials including metal oxide and carbon by electrospinning. (S. Nagamine: Dept. of Chemical Engineering)
Solid Surface Analysis, Including a Potential Method: Tip-Enhanced Raman Spectroscopy	1	Surface analytical techniques each have their own analytical volume. The students learn about the volume, and look at an issue for tip-enhanced Raman spectroscopy, a nanoscale Raman spectroscopy, as a potential surface analytical technique. (M. Nishi: Dept. of Material Chemistry)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Internship M for Materials Science & Engineering

インターンシップM (材料工学)

【Code】 10C277 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	13	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Materials Science and Engineering A

材料工学セミナー A

【Code】 10C251 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Tue 4th 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	1	
	1	
	12	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Materials Science and Engineering B

材料工学セミナー B

【Code】10C253 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Tue 4th 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar and Exercise 【Language】Japanese 【Instructor】，

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	12	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Laboratory & Seminar in Materials Science and Engineering, Adv.

材料工学特別実験及演習第一

【Code】10C240 【Course Year】Master Course 【Term】1st+2nd term 【Class day & Period】Tue and Thu, 3ed

【Location】 【Credits】4 【Restriction】 【Lecture Form(s)】Seminar and Exercise 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	5	
	10	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Laboratory & Seminar in Materials Science and Engineering, Adv.II

材料工学特別実験及演習第二

【Code】 10C241 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	5	
	10	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Materials Science and Engineering, Adv. B

材料工学特別セミナー A

【Code】 10R241 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	12	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Materials Science and Engineering, Adv. B

材料工学特別セミナー B

【Code】 10R242 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	1	
	1	
	12	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Materials Science and Engineering, Adv. C

材料工学特別セミナー C

【Code】 10R243 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	12	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Materials Science and Engineering, Adv. D

材料工学特別セミナーD

【Code】10R244 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar and Exercise 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	12	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Materials Science and Engineering, Adv. E

材料工学特別セミナー E

【Code】 10R245 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	1	
	1	
	12	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Materials Science and Engineering, Adv. A ~ F

材料工学特別セミナー F

【Code】 10R247 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	12	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (12H course)

現代科学技術の巨人セミナー「知のひらめき」(12Hコース)

【Code】10i052 【Course Year】Doctor Course 【Term】First term/Spring term

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】1

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 12H course, students have to complete all four classes and will earn 1 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later
Topic 3	2	Detail will be announced later
Topic 4	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

International Standards

国際標準と国際規格

【Code】 10C292 【Course Year】 Master and Doctor Course

【Term】 This lecture is not open for this year (2018). 【Class day & Period】 Fri 3rd 【Location】 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Jun Kawai, Professor, Department of Materials Science and Engineering

【Course Description】 See the Japanese page.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	3	
	1	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

International Internship in Engineering 1

工学研究科国際インターンシップ 1

【Code】 10i010 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day & Period】Intensive course 【Location】 【Credits】1 【Restriction】Defined by each internship program

【Lecture Form(s)】 Exercise 【Language】 English

【Instructor】 Faculty members in charge of educational affairs of the Global Leadership Engineering Education Center and of the department the registrant belongs to.

【Course Description】 Acquisition of international skills with the training of foreign language through the internship programs hosted by the University, the Graduate School of Engineering, or The Department the registrant belongs to.

【Grading】 Merit rating is performed based on the presentation or the report(s) after the participation in each internship program. Each department is responsible to identify the number of credits to be granted to the student of the department, if the credits are included in the mandatory ones. The Global Leadership Engineering Education Center takes the role to evaluate the credits if the department the student belongs to deals the credits as optional ones. The number of credits to be earned is 1 and 2, respectively to the subjects International Internship in Engineering 1 and 2 depending on the period and the contents of the internship program the students has participated in.

【Course Goals】 Acquisition of international skills with the training of foreign language.

【Course Topics】

Theme	Class number of times	Description
Overseas Internship	1	The contents to be acquired should be described in the brochure of each internship program.
Final Presentation	1	A presentation by the student is required followed by discussion among participants.

【Textbook】 Not Applicable

【Textbook(supplemental)】 Not Applicable

【Prerequisite(s)】 Described in the application booklet for each internship program. The registrant is requested to have enough language skills for the participation.

【Independent Study Outside of Class】 Not Applicable

【Web Sites】 Not Applicable

【Additional Information】 It is required for students to check if the internship program to participate in could be evaluated as part of mandatory credits or not and could earn how many credits before the participation to the department or educational program the student in enrolled. If the credit could not be treated as mandatory ones, get in touch with the Global Leadership Engineering Education Center.

International Internship in Engineering 2

工学研究科国際インターンシップ 2

【Code】 10i011 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day & Period】 Intensive course 【Location】 【Credits】 2 【Restriction】 Defined by each internship program

【Lecture Form(s)】 Exercise 【Language】 English

【Instructor】 Faculty members in charge of educational affairs of the Global Leadership Engineering Education Center and of the department the registrant belongs to.

【Course Description】 Acquisition of international skills with the training of foreign language through the internship programs hosted by the University, the Graduate School of Engineering, or The Department the registrant belongs to.

【Grading】 Merit rating is performed based on the presentation or the report(s) after the participation in each internship program. Each department is responsible to identify the number of credits to be granted to the student of the department, if the credits are included in the mandatory ones. The Global Leadership Engineering Education Center takes the role to evaluate the credits if the department the student belongs to deals the credits as optional ones. The number of credits to be earned is 1 and 2, respectively to the subjects International Internship in Engineering 1 and 2 depending on the period and the contents of the internship program the students has participated in.

【Course Goals】 Acquisition of international skills with the training of foreign language. Detailed objectives should be described in each program.

【Course Topics】

Theme	Class number of times	Description
Overseas Internship	1	The contents to be acquired should be described in the brochure of each internship program.
Final Presentation	1	A presentation by the student is required followed by discussion among participants.

【Textbook】 Not Applicable.

【Textbook(supplemental)】 Not Applicable.

【Prerequisite(s)】 Described in the application booklet for each internship program. The registrant is requested to have enough language skills for the participation.

【Independent Study Outside of Class】 Not Applicable.

【Web Sites】 Not Applicable.

【Additional Information】 It is required for students to check if the internship program to participate in could be evaluated as part of mandatory credits or not and could earn how many credits before the participation to the department or educational program the student is enrolled. If the credit could not be treated as mandatory ones, get in touch with the Global Leadership Engineering Education Center.

Project Management in Engineering

エンジニアリングプロジェクトマネジメント

【Code】 10i049 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 4th 【Location】 A2-308 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu

Assoc.Prof. Lintuluoto, J. Assoc. Prof. Tanaka

【Course Description】 This course provides a basic knowledge required for the project management in various engineering fields such as process design, plant design, construction, and R&D projects. Also, visiting lecturers from industry and public works provide management insights of actual engineering projects.

【Grading】 Evaluated by assignments (project report exercise) and class contribution

【Course Goals】 This course will help students gain a fundamental knowledge of what project management in engineering is. Throughout the course, students will learn various tools applied in project management. Students will also understand the importance of costs and money, risks, leadership, and environmental assessment in managing engineering projects. This course is followed with the course Seminar on Project Management in Engineering. in the second semester.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	4/13 (Matsumoto) Course guidance
Special lecture by extramural instructor 1	1	4/20 (Inaoka(JICA))@A2-306 Project management in the case of Japanese ODA
Introduction to project management	1	4/27 (Maeda) Introduction to project management Project phases
Tools for project management I	1	5/11 (Lintuluoto) Tools for project management, cost, and cash flows I
Tools for project management II	1	5/18 (Lintuluoto) Tools for project management, cost, and cash flows II
Tools for project management III	1	5/25 (Lintuluoto) Tools for project management, cost, and cash flows III
Project scheduling I	1	6/1 (Ashida) Project scheduling I
Project scheduling II	1	6/8 (Ashida) Project scheduling II
Leadership I	1	6/15 (Tanaka) Leadership I
Leadership II	1	6/22 (Tanaka) Leadership II
Risk management I	1	6/29 (Matsumoto) Risk management I
Risk management II	1	7/6 (Matsumoto) Risk management II
Environmental Impact Assessment	1	7/13 (Yorozu) Environmental Impact Assessment
Special lecture by extramural instructor 2	1	7/20 (Kumagai(JGC CORPORATION)) To be announced
Feedback	1	7/27 (Matsumoto) Feedback

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 1. Lock, Dennis. Project Management. 10th edition. Gower Publishing Ltd.

2. Cleland, David L., and Lewis R. Ireland. Project Management. 5th edition. McGraw-Hill Professional

3. Roger Miller and Donald R. Lessard. The strategic management of large engineering projects, Shaping Institutions, Risks, and Governance, The MIT Press

【Prerequisite(s)】 No pre-requisite

【Independent Study Outside of Class】

【Web Sites】 The web-site is opened in the home page of the GL education center.

【Additional Information】

Exercise on Project Management in Engineering

エンジニアリングプロジェクトマネジメント演習

【Code】 10i059 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day & Period】 Friday 4th period and 5th period 【Location】 B-Cluster 2F Seminar Room 【Credits】 2

【Restriction】 Student number will be limited. 【Lecture Form(s)】 Seminar 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu
Assoc.Prof. Lintuluoto

【Course Description】 In this course, students will apply the engineering know-how and the skills of management, and group leadership which they learned in the course of Project Management in Engineering to build and carry out a virtual inter-engineering project. This course provides a forum where students' team-plan based on ideas and theories, decision making, and leadership should produce realistic engineering project outcomes. The course consists of intensive group work, presentations, and a few intermediate discussions. A written report will be required.

【Grading】 Report, class activity, presentation

【Course Goals】 This course prepares engineering students to work with other engineers within a large international engineering project. In particular this course will focus on leadership and management of projects along with applied engineering skills where the students learn various compromises, co-operation, responsibility, and ethics.

【Course Topics】

Theme	Class number of times	Description
		10/5
Guidance	1	Introduction to Exercise on Project Management in Engineering Lecture on tools for the Project management in engineering Practice
Teamwork	7	Each project team may freely schedule the group works within given time frame. The course instructors are available if any need is required.
Mid-term presentation	1	Each project team will have a mid-term presentation.
Lecture & Teamwork	2	Some lectures will be provided, such as Leadership structuring, Risk Management, and Environmental Impact Assessment, depending on projects you propose.
Presentation	1	Each project team will have a presentation based on its proposed project.

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 Fundamental skills about group leading and communication, scientific presentation.

【Independent Study Outside of Class】

【Web Sites】 The web-site will be opened in the home page of the GL education center.

【Additional Information】 The number of students may be restricted. Students are requested to check in advance whether the credit from this course will be accepted as a graduation requirement for their department.

Advanced Experiments and Exercises in Electrical Engineering ,

電気工学特別実験及演習 1

【Code】 10C643 【Course Year】 Master 1st 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	30	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Experiments and Exercises in Electrical Engineering II

電気工学特別実験及演習 2

【Code】 10C646 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	30	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Electrical Engineering Seminar

電気工学特別セミナー

【Code】 10R610 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	30	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

State Space Theory of Dynamical Systems

状態方程式論

【Code】10C628 【Course Year】Master Course 【Term】1st term 【Class day & Period】Wed 3rd 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese or English

【Instructor】T. Hagiwara, Y. Ebihara

【Course Description】The course deals with the dynamical system theory based on linear time-invariant state equations. It covers such topics as state equations, controllability and observability, mode decomposition and its relevance to controllability/observability, stability of dynamical systems, and the Kalman canonical decomposition.

【Grading】The grading will be based on the exam.

【Course Goals】To acquire the knowledge on the basic theory for linear system analysis by means of state equations.

【Course Topics】

Theme	Class number of times	Description
feedback systems and state equations	3?4	fundamentals of state equations, their relationship to transfer functions and block diagram representations
responses of linear systems	5?6	state transition matrices, equivalence transformation of systems, mode decomposition and Lyapunov stability
controllability and observability	5?6	controllability and observability, mode decomposition and its relevance to controllability/observability, controllable subspace and unobservable subspace, and the Kalman canonical decomposition; Checking degrees of understanding of all the lecture topics closes the class.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】classical control theory (in terms of transfer functions), linear algebra and calculus

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】Handouts will be given at the class.

Applied Systems Theory

応用システム理論

【Code】10C604 【Course Year】Master 1st 【Term】2nd term 【Class day & Period】Tue 1st

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】E. Furutani

S.Tanaka

【Course Description】 The course deals with mathematical methods of system optimization mainly for combinatorial optimization problems. It covers such topics as the integer optimization and its typical problems, exact solution methods including the dynamic programming and the branch and bound method, approximate solution methods including the greedy method, meta-heuristics including the genetic algorithms, the simulated annealing method, and the tabu search.

【Grading】 In principle, the grading will be based on the absolute and comprehensive evaluation of the reports on the subjects given in the class.

【Course Goals】 To acquire the knowledge on formulation of combinatorial optimization problems into integer programming problems, basic concepts, algorithms, characteristics, and application procedures of exact solution methods, approximate solution methods, and meta-heuristics.

【Course Topics】

Theme	Class number of times	Description
combinatorial optimization problems and complexity	1-2	necessity and importance of combinatorial optimization, typical problems, complexity, classes P and NP, complexity of combinatorial optimization problems, limitation of exact solution methods, necessity of approximate solution methods and meta-heuristics
exact solution methods	3	principle of optimality, dynamic programming, branch and bound method, and their applications
integer programming	2-3	formulation into integer programming problem, relaxation problem, and cutting plane algorithm
approximate solution methods	1-2	greedy method, relaxation method, partial enumeration method, etc.
meta-heuristics	5-6	local search, basic ideas of meta-heuristics, genetic algorithms, simulated annealing method, tabu search, etc. Checking degrees of understanding of all the lecture topics closes the class.

【Textbook】

【Textbook(supplemental)】 M. Fukushima: Introduction to Mathematical Programming (in Japanese), Asakura, 1996.

Y. Nishikawa, N. Sannomiya, and T. Ibaraki: Optimization (in Japanese), Iwanami, 1982.

M. Yagiura, and T. Ibaraki: Combinatorial Optimization ---With a Central Focus on Meta-heuristics--- (in Japanese), Asakura, 2001.

B. Korte, and J. Vygen: Combinatorial Optimization ---Theory and Algorithms, Third Edition, Springer, 2006.

【Prerequisite(s)】 linear programming, nonlinear programming

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Handouts and exercises are given at the class.

Applied Mathematics for Electrical Engineering

電気数学特論

【Code】 10C601 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】

【Instructor】 S. Doi & T. Hikihara

【Course Description】 In the class, fundamental mathematics is lectured for electrical engineering, electronics, system engineering, and material science. In particular, system theory, nonlinear dynamics, and particle dynamics in force field can be discussed with mathematical clear image.

【Grading】 Students are requested to reply to report assignments. The grading is based on the evaluation of the reports.

【Course Goals】 Professors expect students to model their system and analyze the models theoretically. Students will be requested to understand their system in principle mechanics and control them based on system theory.

【Course Topics】

Theme	Class number of times	Description
Introduction 1	1	Several examples of linear operators encountered in electrical engineering, e.g. in quantum mechanics are explained. Then, Linear vector space is reviewed and linear dynamical system is introduced.
Fundamentals of linear vector space	2-4	Direct sum decomposition, projection operator, and the structure of vector spaces such as Jordan normal form are explained.
Linear dynamical system	3-5	On the basis of the knowledge of the vector space, linear dynamical systems theory is explained as a simple application of vector spaces.
Introduction 2	1	The introduction to nonlinear dynamics will be explained based on oscillation theory.
Hamiltonian mechanics	1-3	Hamiltonian mechanics is lectured on linear symplectic space.
Manifold and vector field	2-4	Manifold is discussed in nonlinear system with relation to vector field analysis.

【Textbook】

【Textbook(supplemental)】 S. Wiggins, Introduction to Applied Nonlinear Dynamical Systems and Chaos, Springer-Verlag.

【Prerequisite(s)】 Linear algebra

【Independent Study Outside of Class】

【Web Sites】 <https://www.t.kyoto-u.ac.jp/lecturenotes/gse/kueeng/10C601/syllabus>

【Additional Information】 Appropriate references will be shown in classes.

Electrical and Electromagnetic Circuits

電気電磁回路論

【Code】 10C647 【Course Year】 Master 1st 【Term】 1st term 【Class day & Period】 Wed 2nd

【Location】 A1-001 (Katsura) 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Osami Wada, Professor, Department of Electrical Engineering

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Guidance	1	
Circuit description including electromagnetic coupling effects	2	
Evaluation and description methods for high-frequency circuits	2	
Transmission line and its characteristics (1)	2	
Transmission line and its characteristics (2)	2	
Description of electromagnetic couplings	2	
E-system integrity design technology for electric and electronic systems	3	
Final exam and feedback	1	

【Textbook】 Materials for this course will be distributed at the lectures.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Electromagnetic Theory, Adv.

電磁気学特論

【Code】 10C610 【Course Year】 Master 1st 【Term】 2nd term 【Class day & Period】 Wed 3rd 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 T. Matsuo,

【Course Description】 The first half: the special theory of relativity and the covariance of Maxwell's equations
The latter half: the differential form in the electromagnetic field theory and its application to computational electromagnetics

【Grading】 Submission of reports (twice)

【Course Goals】 1. Understanding of the basic concepts of special theory of relativity and the covariant formulation of Maxwell's equations
2. Understanding of the basics of differential form in electromagnetic field theory

【Course Topics】

Theme	Class number of times	Description
Introduction to special theory of relativity	2-3	- Galilean relativity and special relativity - Lorentz transformation
Tensor representation and relativistic dynamics	2-3	- Introduction to tensor representation - Relativistic dynamics
Covariant formulation of Maxwell ' s equations	2-3	- Electromagnetic field tensor - Lorentz covariance of Maxwell ' s equations
Differential form in electromagnetic field theory	3-4	- Basics of differential form in electromagnetic field theory
Application to computational electromagnetics	3-4	- Application of integral form of Maxwell ' s equations to computational electromagnetics

【Textbook】

【Textbook(supplemental)】 Y. Kazama, Introductory Lectures on the Theory of Relativity (in Japanese), Baifukan, 1997.

【Prerequisite(s)】 Basic electromagnetic theory

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Superconductivity Engineering

超伝導工学

【Code】10C613 【Course Year】Master Course 【Term】1st term 【Class day & Period】Mon 4th 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3 ~ 4	
	2 ~ 3	
	3 ~ 4	
	2 ~ 3	
	1 ~ 2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Biological Function Engineering

生体機能工学

【Code】 10C614 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 Wed 2nd

【Location】 A1-001(桂 1) 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Tetsuo Kobayashi, Takenori Oida

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Basics of nervous system	2	Study about detail structure of the human brain to understand higher brain functions. In particular, learn about cortical structure and functional map.
Neurons and glial cells	1	Study about detail structures and functions of neuron and glial cells.
Neuroimaging techniques	3	Study about measurement principles and analytical methods of representative non-invasive neuro-imaging techniques.
Sensory functions	2	Study about organizations of sensory systems such as visual, auditory and somatosensory systems.
Motor functions	1	Study about organizations and functions of primary motor, premotor and supplementary motor areas.
Magnetic Resonance Imaging and its Application	3	Study about basic principle and pulse sequences of magnetic resonance imaging (MRI) and its application.
Practice of MRI	2	Practice of MRI acquisition of the head as well as image processing of the MRI data.
Evaluation of understanding	1	We are going to check students' achievement by answering questions from students.

【Textbook】

【Textbook(supplemental)】 Tetsuo Kobayashi, Isamu Ozaki and Ken Nagata (eds.): Brain topography and multimodal imaging, (Kyoto Univ. Press, 2009)

Eric. R. Kandel et al., "Principles of Neural Science", Mc Graw Hill, New York (2013)

【Prerequisite(s)】 Electricity and magnetism, Fundamentals of biomedical engineering

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Applied Hybrid System Engineering

応用ハイブリッドシステム工学

【Code】 10C621 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】

【Instructor】 Takashi Hikihara, Shinji Doi,

【Course Description】 Many engineering systems show hybrid dynamical structure, which is accompanied with discrete change of vector flow by control and regulate the trajectory to target dynamically. In the course, the fundamental characteristics and theorems are lectured. The framework of hybrid system, automaton model, and singular perturbation theorem are explain. Dynamic quantizer, power system, and network are picked up as examples.

【Grading】 Exercise and repots are evaluated.

【Course Goals】 Students are requested to understand the characteristics of hybrid system, approaching method, and control methods.

【Course Topics】

Theme	Class number of times	Description
Fundamentals of hybrid system	4	As fundamentals, the definition of hybrid system and the method of modeling is explained.
Singular perturbation and asymptotic expansion	3	Singular perturbation theorema and asymptotic expansion are explained. For the global oscillation of singular perturbed system, analytical and geometrical singular perturbation methods are introduced.
Application of hybrid system-1: power system	3	The application to power system is explained. The outline of power system, then safety and examination, the stability analysis, and the modeling towards control are given.
Application of hybrid system-2: dynamic quantizer	2	As an application, dynamic quantizer is adopted. The outline of the dynamic quantizer, the analysis, and the design of the system are given.
Application of hybrid system-3: networking	3	As an application, the communication network is adopted. The internet network is also explained as an example of modeling and control.

【Textbook】 Each professors prepare the prints of lectures.

【Textbook(supplemental)】 No textbook.

【Prerequisite(s)】 Nothing.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Theory of Electric Circuits, Adv.

電気回路特論

【Code】 10C625 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 Mon 2nd

【Location】 A1-001 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese and English 【Instructor】

【Course Description】

【Grading】 Reports

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Introduction	1	
Modeling by circuit	4	
Circuit equation	4	
Phenomena in circuit	3	
Property of circuit	2	
Achievement test	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Design of Control Systems

制御系設計理論

【Code】10C631 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Tue 2nd 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese or English

【Instructor】T. Hagiwara, Y. Ebihara

【Course Description】The course is based on State Space Theory of Dynamical Systems, and provides the applications of the concepts given therein to systematic control system design. The course covers such topics as state feedback and pole assignment, observers, synthesis of feedback control systems, servo conditions and feedforward, and optimal control under quadratic performance indices.

【Grading】In principle, the grading will be based on the absolute and comprehensive evaluation of the reports on the subjects given in the class. Should this change due to inadequate efforts on the submitted reports, an exam might be also imposed, in which case the details will be announced at the class at least two weeks before the exam term.

【Course Goals】To understand the basic ideas of control system design based on state space representations, and acquire fundamental knowledge and skills on practical control system design through simulated experiences with the report subjects.

【Course Topics】

Theme	Class number of times	Description
pole assignment by state feedback	4?5	state feedback, controllable canonical forms and pole assignment of scalar/multivariable systems, computation of the state feedback gains for pole assignment, transient responses, uncontrollable poles and stabilizability
observers	3?4	observable canonical forms and observability conditions, full-order observer, minimal-order observer, conditions for observers and observer-based feedback
synthesis of feedback systems	2?3	feedback systems with integral compensation, servo systems, internal model principle, synthesis of servo systems
optimal control under quadratic performance index	3?4	optimal regulators and their closed-loop poles, Riccati equations and their solutions, relationship with the pole assignment problem; Checking degrees of understanding of all the lecture topics closes the class.

【Textbook】Handouts will be given at the class.

【Textbook(supplemental)】

【Prerequisite(s)】The contents given in State Space Theory of Dynamical Systems, and linear algebra.

【Independent Study Outside of Class】

【Web Sites】(Info) <http://www-lab22.kuee.kyoto-u.ac.jp/~hagiwara/ku/matlab-octave.html>

【Additional Information】

Computer Simulations of Electrodynamics

電磁界シミュレーション

【Code】 10C611 【Course Year】 Master 1st 【Term】 1st term 【Class day & Period】 Tue 5th

【Location】 A1-101/Electrical Engineering Bldg.-Lecture Room (M)/Uji Campus(Remote Lecture Room) 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English 【Instructor】 ,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Variables and Classification of Simulation Codes	1	
Finite Difference Methods	1	
Difference Form of Maxwell's Equation and Grid Assignment / Time Step Chart	1	
Courant Condition	1	
Electromagnetic Radiation from a Thin Current	1	
Buneman-Boris Method for Equation of Motion (Relativistic Eqs.)	1	
Interporation of Electromagnetic Field	1	
Computatin of Charge and Current Densities, Self-force Cancellation	1	
Initilization of Particles and Fields	1	
Renormalization and Diagnostics	1	
Advection/Wave Equation for 1D Case (FTCS, Lax, Upwind and Lax-Wendroff Methods)	1	
von Neumann Stability Analysis	1	
Limiter Function	1	
Advection/Wave Equation for Multi-Dimensional Case	1	
Vlasov Equation	1	

【Textbook】

【Textbook(supplemental)】 (1) H. Matsumoto and Y. Omura, Computer Space Plasma Physics: Simulation Techniques and Softwares, Terra Scientific, Tokyo, 1993.

(2) H. Usui and Y. Omura, Advanced Methods for Space Simulations, Terra Pub, 2007.

【Prerequisite(s)】 Electrodynamics, Vector Analysis, Computer Language

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Space Radio Engineering

宇宙電波工学

【Code】 10C612 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 Tue 3rd

【Location】 N1 lecture room Yoshida campus, A1-131 in Katsura campus, Uji 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese or English

【Instructor】 Hirotugu Kojima,

【Course Description】 The present lecture provides the guideline how the technology on the electronics is used in spacecraft and space systems. In particular, we give how space environments affect spacecraft design in the view points of radiations, and spacecraft charging. The lecture also provides the design of onboard components such as power, communication, and attitude control systems.

【Grading】 attendance and final examination

【Course Goals】 Mastery of the way how we can make use of the knowledges of the physics and technology to the space engineering.

【Course Topics】

Theme	Class number of times	Description
Space environment and its impacts to spacecraft design	5-6	The space environment and its impacts to the design of spacecraft in the view point of spacecraft design such as radiations, plasma, and spacecraft charging.
Attitude control system	1	Introduction of attitude control systems of spacecraft.
Power	2	Power source and system on board spacecraft.
Electromagnetic Compatibility of spacecraft	1	Electromagnetic Compatibility in the view point of spacecraft designs
Thermal design of spacecraft	1-2	Introduction of the thermal design of spacecraft systems to keep proper temperatures inside spacecraft in space.
Communication and commands	2	Communication system between Earth and spacecraft including command/House Keeping system.
History of rockets	1	History of the development of rockets.
Feedback	1	Questions are accepted via e-mails during the feedback week.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 Plasma physics, Electromagnetics. Radio engineering, Electronics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Applied Microwave Engineering

マイクロ波応用工学

【Code】 10C617 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Tue 4th

【Location】 (Katsura)A1-131, (Yoshida)N1, (Uji)S-143H 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 (RISH) Shinohara,

【Course Description】 This lecture picks up microwave power transmission (MPT) technology, rectifying antenna (rectenna), antenna and propagation for the MPT, microwave transmitters, and some MPT applications like the Space Solar Power Satellite/Station. This lecture also picks up the other wireless power transmission technologies like resonance coupling, energy harvesting, and applied microwave technologies of microwave processing, wireless communications, and radar.

【Grading】 Reports

【Course Goals】 Students learn about applied microwave engineering, mainly microwave power transmission.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The purpose and constitution of the lecture, and review of microwave engineering are explained.
Applications of Wireless Power Transmission	3-4	Space Solar Power Satellite/Station and Ubiquitous power source as applications of microwave power transmission, the resonance coupling and energy harvesting as the other battery-less technologies are explained.
rectifying antenna (rectenna)	1-2	rectifying antenna (rectenna) for the MPT are explained.
antenna and propagation for the MPT	5-6	Calculation of beam collection efficiency and beam propagation with FDTD method are explained. Phased array technologies, beam targetting method, non linear physics of microwave-plasma interation are overiwied.
Microwave transmitters	2	High efficient semi-conductor amplifiers and microwave tubes are explained.
microwave processing, wireless communications, and radar	2	Microwave processing, wireless communications, and radar texhnologies are explained.

【Textbook】 Naoki Shinohara, Solar Power Satellite (in Japanese), ISBN978-4-274-21233-8, Ohm-Sya

【Textbook(supplemental)】 Naoki Shinohara and Kimiya Komurasaki, Wireless Power Transmission Technologies - Inductive Coupling, Resonance Coupling and Microwave Power Transmission - (in Japanese), ISBN978-4-904-77402-1, Kagaku-Gijutsu-Syuppan

【Prerequisite(s)】 Microwave engineering

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Number of the lectures may change.

Spacio-Temporal Media Analysis

時空間メディア解析特論

【Code】 10C714 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Tue 3rd

【Location】 Yoshida campus(N1) · Katsura campus(A1-131) · Ujicampus(S-143) 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese or English

【Instructor】 Yuichi Nakamura, Kazuaki Kondo

【Course Description】 Representation, feature extraction, recognition of media with two or higher dimensions, especially images and videos, are explained with comparing to human vision and biological systems.

【Grading】 Evaluation is based on participation and reports.

【Course Goals】 To learn the basic of representation, feature extraction, and pattern recognition of signals with two or higher dimension, and their applications.

【Course Topics】

Theme	Class number of times	Description
Spatio-Temporal Media	1	What is spatio-temporal media. Some examples.
Light and Colors	1-2	Intensity, colors, and spectrum in image media.
Features and Segmentation	2	Features such as edge, region, etc. for analysing image media.
Filtering and Wavelet Transform	1-2	Introduction to filtering and Wavelet Transform.
Discrete Wavelet Transform and Applications	1-2	Discrete Wavelet Transform and applications such as image enhancement, image compression, etc.
Geometry of Image Capturing	1-2	The mechanism and geometry of image capturing: projection of a 3D world into 2D images.
3D Measurements and Reconstruction	2	3D measurements and 3D world reconstruction from a set of 2D images.
Measurement of Motions	1-2	Motion detection and measurement, and object tracking.
Pattern Recognition	0-2	The basic idea of pattern recognition and useful tools such as Support Vector Machine.

【Textbook】 No specific textbooks. Handouts will be given when necessary.

【Textbook(supplemental)】 Computer Vision: A Modern Approach, Forsyth and Ponce, Prentice Hall

【Prerequisite(s)】 Fundamental knowledge of digital signal processing

【Independent Study Outside of Class】

【Web Sites】 Please see Panda (<https://panda.ecs.kyoto-u.ac.jp/portal>).

【Additional Information】

Visualized Simulation Technology

可視化シミュレーション学

【Code】10C716 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Tue 4th 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	1	
	2-3	
	1-2	
	1-2	
	2-3	
	2-3	
	1-2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Recent Advances in Electrical and Electronic Engineering

先端電気電子工学通論

【Code】 10K010 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day & Period】 Tuesday, 5 【Location】 Laboratories 【Credits】 2 【Restriction】 Foreign students

【Lecture Form(s)】 Seminar 【Language】 English 【Instructor】

【Course Description】 The class consists of a series of seminars at 3 laboratories related to Department of Electrical and Electronic Engineering (energy and electrical machinery, computers, control and systems, communications and radio engineering, and electronic devices and applied physics). Each seminar intends to give a brief introduction into a specific research field so that students can get a feel for the state-of-the-art in each topic and broaden their scope beyond their majors.

【Grading】 The evaluation of a student ' s work is given based on his/her attendance, reports and discussions, not on examinations.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	6	
	9	

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Digital Communication Engineering

デジタル通信工学

【Code】 10X723 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 2nd

【Location】 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Hiroshi Harada

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
History of wireless communication systems	1	
Digital modulation and demodulation technologies	4	
Cellular based mobile communication systems	3	
Broadband wireless communication systems	4	
Convolutional coding and maximum likelihood decoding schemes	1	
MIMO transmission technologies	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Information Network

情報ネットワーク

【Code】10X724 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】Tue 2nd 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Eiji Oki (Graduate School of Informatics) and Ryoichi Shinkuma (Graduate School of Informatics)

【Course Description】This course introduces architecture of information networks including communication protocol and layered structure. Various networks and their technologies, such as circuit switching network, IP network, photonic network, and mobile network, are explained.

【Grading】Students are evaluated about how much they understand the knowledge about communication networks and network applications according to the results of the semester and a couple of small tests

【Course Goals】Through this course, students could obtain and explain the knowledge, required for them after their graduations, about communication networks as our life infrastructure and application networks as our social and economic infrastructure.

【Course Topics】

Theme	Class number of times	Description
Communication protocols, transmission systems, history of information networks	2	
Internet protocol, routing, and mobile IP. Datalink, network, transport, and application layers.	5	
Design of overlay network, QoS/QoE, and cellular network.	3	
Relationship between research&development and patent strategy.	1	
Fundamental traffic theory.	1	
Review, exercise, and examination.	3	

【Textbook】Instructors will distribute materials at every class.

【Textbook(supplemental)】Andrew S. Tanenbaum, Computer Networks, Prentice Hall.

【Prerequisite(s)】Students are expected to have some knowledge of the fundamentals of digital communication and probability theory and statics.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】E-mail: oki@i.kyoto-u.ac.jp, shinkuma@i.kyoto-u.ac.jp

Prospects of Interdisciplinary Photonics and Electronics

融合光・電子科学の展望

【Code】 10X001 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Fri 2nd 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
-------	--	-------------

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Seminar in Electrical Engineering I

電気工学特別研修 1 (インターン)

【Code】 10C718 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Seminar in Electrical Engineering II

電気工学特別研修2 (インターン)

【Code】 10C720 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Research Internship(M)

研究インターンシップ M (電気)

【Code】 10C627 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar and Exercise 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
-------	--------------------------	-------------

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Research Internship (D)

研究インターンシップ D (電気)

【Code】 10R630 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
-------	--------------------------	-------------

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Exercises on Electrical Engineering I, II

電気工学特別演習 1

【Code】 10R632 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Exercises on Electrical Engineering I, II

電気工学特別演習 2

【Code】 10R633 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (6H course)

現代科学技術の巨人セミナー「知のひらめき」(6Hコース)

【Code】10i051 【Course Year】Doctor Course 【Term】First term, intensive

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】0.5

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 6H course, students have to select two classes and will earn 0.5 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (12H course)

現代科学技術の巨人セミナー「知のひらめき」(12H コース)

【Code】 10i052 【Course Year】 Doctor Course 【Term】 First term/Spring term

【Class day & Period】 Intensive (Saturday, Jun.-Jul) 【Location】 B-Cluster 2F Seminar Room 【Credits】 1

【Restriction】 Student number will be limited. 【Lecture Form(s)】 Intensive Lecture 【Language】 Japanese

【Instructor】 GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】 This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】 Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 12H course, students have to complete all four classes and will earn 1 credits.

【Course Goals】 This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later
Topic 3	2	Detail will be announced later
Topic 4	2	Detail will be announced later

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Advanced Material Science and Technology (15 times course)

(English lecture)

先端マテリアルサイエンス通論 (15 回コース) (英語科目)

【Code】10i054 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 5th 【Location】A2-306 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture

【Language】English

【Instructor】ER Center, J. Assoc. Prof., Ryuichi Ashida
Related professors

【Course Description】The various technologies used in the field of material science serve as bases for so-called high technologies, and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】The average score of the best five reports is employed.
Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Tumor Imaging and Therapy through Photoirradiation	1	The overview of current modalities through photoirradiation as well as the preparation of tumor imaging probes is given. Tumor therapy through photoirradiation is also shown in the lecture. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Carbon Nanorings	1	The preparation of carbon nanorings is outlined in the lecture. The supramolecular interaction as well as the photophysical properties of carbon nanorings is summarized. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Crystal Structure Analysis by Powder X-ray Diffraction Measurement	1	Chemical and physical properties of a material is strongly related with the structure of the material. So, structure analysis is one of the most important part in material researches. Powder X-ray diffraction analysis is powerful way to analyze the crystal structure of solid materials. We study how to use powder X-ray diffraction analysis for material researches. (T. Yamamoto: Dept. of Energy and Hydrocarbon Chemistry)
Principles and Applications of Fluorescence Spectroscopy	1	Fluorescence spectroscopy is applied to various disciplines of science and engineering, and provides unique information of a system upon photo-illumination. This course aims to introduce the background of fluorescence spectroscopy and practical knowledge in fluorescence experiments. (J. Park: Dept. of Molecular Engineering)
Synthesis of Novel π -Conjugated Molecules with Main Group Elements	1	The lecture will show synthesis and properties of novel π -conjugated molecules with main group elements, and their application as functional materials. (T. Higashino: Dept. of Molecular Engineering)
Chemistry of Asymmetric Catalysis Stereoselective Synthesis of Optically Active Pharmaceutical Compounds	1	This class will outline the progress on enantioselective catalysis for the asymmetric synthesis of optically active pharmaceutical compounds such as Herbesser, which is a blockbuster drug developed in a Japanese pharmaceutical company. (K. Asano: Dept. of Material Chemistry)
Electrical Conductivity of Conjugated Polymers and Application to Organic Electronics	1	In this class, structure and property of conjugated polymers are introduced and discussed. The discussion topics include the brief history of the discovery of electrical conductivity of conjugated polymers, mechanism of electrical conductivity in polymer chains, representative evaluation methods of conductivity for conjugated polymers, relationship between molecular and self-assembled structures of conjugated polymers, and recent examples of device applications using conjugated polymers. (I. Sakurai: Dept. of Molecular Engineering)
An Introduction to Smart Shape Changing Materials	1	This course will briefly introduce smart materials as a whole and will then focus specifically on the recent and very active field of smart shape changing materials. We will explore how the design and stimuli-sensitivity of various materials can allow for materials to have planned and useful motion. (K. Landenberger: Dept. of Polymer Chemistry)
Properties of Cementitious Materials and the Future	2	CEMENT may not necessarily be an advanced material, but must surely be a forefront material for human life and society, in the past, present and future. Then, what are your demands to cement? (A. Hattori: Dept. of Urban Management)
Application of Electrical Discharge to Material and Environmental Technology	1	(N. Sano: Dept. of Chemical Engineering)
Theory of Precision Cutting, Grinding, Polishing and Related Properties of Materials	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Metrology and Control Theory for Precision Manufacturing, and Applications	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Fabrication of Inorganic Nanofiber by Electrospinning	1	When a high voltage is applied to a polymer solution, the solution is sprayed as thread-like droplets, and turns to polymer nanofibers. This fiber forming technique is called electrospinning. This lecture will give a brief introduction on the fabrication of nanofibers of inorganic materials including metal oxide and carbon by electrospinning. (S. Nagamine: Dept. of Chemical Engineering)
Solid Surface Analysis, Including a Potential Method: Tip-Enhanced Raman Spectroscopy	1	Surface analytical techniques each have their own analytical volume. The students learn about the volume, and look at an issue for tip-enhanced Raman spectroscopy, a nanoscale Raman spectroscopy, as a potential surface analytical technique. (M. Nishi: Dept. of Material Chemistry)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Exercise in Practical Scientific English

実践的科学英語演習

【Code】 10i045 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Thu 4th or 5th 【Location】 A2-304

【Credits】 1 【Restriction】 Up to 20 students for each class 【Lecture Form(s)】 Seminar 【Language】 English (Japanese)

【Instructor】 M. Nishikawa, R. Matsumoto, R. Ashida, M. Maeda,

【Course Description】 This course is open to all master and doctoral engineering students. It is designed to help students understand how to write a research paper step by step. In this course, the students will write a short research paper (i.e. Extended Research Abstract for Proceeding, approx. 1000 -1500 words) on a topic drawn from assigned readings.

【Grading】 Evaluation based on 30% participation, 40% reports, 30% final paper *More than twice unexcused absence can result in course failure

【Course Goals】 The primary goal of this course is to deepen an understanding of the main features of each part of a scientific paper (IMRaD). Throughout the course, students will develop the core competencies required for language, grammar, and style to produce a research manuscript in English.

【Course Topics】

Theme	Class number of times	Description
Unit 1: Course Overview	1	Course Overview: Introduction to writing scientific research articles
Unit 2: Introduction	1	Raising awareness of the register of science research articles (genre, audience, purpose)
Unit 3: Preparing to Write	1	Writing a proposal for a research paper, using corpus-based approach (Exercise: Creating own Corpus)
Unit 4: Preparing to Write	1	Paraphrasing ideas from source texts, using citations and references in formal writing
Unit 5: Writing Processes	1	Identifying the “ moves ” for an Abstract section by hint expressions
Unit 6: Writing Processes	1	Writing an Abstract (Title) & peer feedback
Unit 7: Writing Processes	1	Identifying the “ moves ” for an Introduction section by hint expressions
Unit 8: Writing Processes	1	Writing an Introduction section & peer feedback
Unit 9: Writing Processes	1	Writing a Method section & peer feedback
Unit 10: Writing Processes	1	Writing a Result section & peer feedback
Unit 11: Writing Processes	1	Writing a Discussion and a Conclusion section
Unit 12: Writing Processes	1	Writing a cover letter to reviewers and how to respond to reviewers
Unit 13: Monitoring and Revising	1	Online feedback
Unit 14: Monitoring and Revising	1	Revising a paper based on peer feedback
Unit 15: Submission	1	Final Paper Due, August 6.

【Textbook】 Handout materials will be supplied by the instructor.

【Textbook(supplemental)】 ALESS (2012). Active English for Science- 英語で科学する - レポート、論文、プレゼンテーション . The University of Tokyo Press. Cargill, M., & O'Connor, P. (2013). Writing scientific research articles: Strategy and steps. John Wiley & Sons. Cowell, R., & She, L. (2015). Mastering the Basics of Technical English 『技術英語の基礎』 . 2nd Ed., Corona Publishing. 野口ジュディー・深山晶子・岡本真由美 . (2007) . 『理系英語のライティング』 . アルク

【Prerequisite(s)】 Students who intend to join this course must attend the first class.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 We may restrict the class size to enhance students ' learning. Students who intend to join the course are required to attend the first-day guidance. Office Hours: (by appointment) nishikawa.mikako7w@kyoto-u.ac.jp (Ext. 2052)

Advanced Modern Science and Technology (4 times course) (English lecture)

現代科学技術特論 (4 回コース) (英語科目)

【Code】 10i055 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 5th

【Location】 A2-306 【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 ER Center, J. Assoc. Prof., Ashida
ER Center, J. Assoc. Prof., Matsumoto
ER Center, J. Assoc. Prof., Maeda
ER Center, J. Assoc. Prof., Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '4 times course' should select one of the topics and attend the lectures. (Students who take '8 times course' should attend the lectures of the both topics.) Attend a course orientation held before the first lecture (Nov. 1) even if you take only the second topic.

Advanced Modern Science and Technology (8 times course) (English lecture)

現代科学技術特論（8回コース）（英語科目）

【Code】10i056 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 5th

【Location】A2-306 【Credits】1 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】English

【Instructor】 ER Center, J. Assoc. Prof., Ashida
ER Center, J. Assoc. Prof., Matsumoto
ER Center, J. Assoc. Prof., Maeda
ER Center, J. Assoc. Prof., Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '8 times course' should attend the lectures of the both topics. (Students who take '4 times course' should select one of the topics and attend the lectures.)

Advanced Experiments and Exercises in Electronic Science and Engineering

，
電子工学特別実験及演習 1

【Code】10C710 【Course Year】Master 1st 【Term】1st+2nd term 【Class day & Period】 【Location】

【Credits】4 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	30	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Experiments and Exercises in Electronic Science and Engineering**II**

電子工学特別実験及演習 2

【Code】 10C713 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	30	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Seminar on Electronic Science and Engineering

電子工学特別セミナー

【Code】 10R701 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	30	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantum Mechanics for Electronics Engineering

量子論電子工学

【Code】10C825 【Course Year】Master Course 【Term】1st term 【Class day & Period】Tue 3rd

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	1	
	1	
	2	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Semiconductor Nanospintronics

半導体ナノスピントロニクス

【Code】 10C800 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 Tue 2nd 【Location】 A1-131
 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English or Japanese (depends on students)
 【Instructor】 Masashi Shiraishi

【Course Description】 Spintronics is now attracting tremendous attention, and is recognized as one of the most potential candidates to overcome the limit of the Moore's law. Spintronics possesses attractive and profound basis physics and also a potential to practical applications towards MRAMs and spin FETs. In this lecture, I introduce some important and basic theories and experimental techniques in spintronics using semiconductors, metals, insulators, oxides and so on.

【Grading】 Report submission

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Spin is a quantum quantity, and thus it is induced by rotation of an electron (an electron is an elementary particle, i.e., it has no domain. Thus, rotation of an electron cannot be defined). Nevertheless, the spin degree of freedom can be coupled to spatial rotation because spin is a generator of infinitesimal rotation. I explain the essence of spin, its SU(2) algebra and so on.
Relativistic quantum physics and spin-orbit interaction	5	To understand spin manipulation and spin coherence in semiconductor, it is quite important what the spin-orbit interaction (SOI) is. The SOI is a manifestation of a relativistic effect, and the Dirac equation, the equation of motion in relativistic quantum physics, is derived to understand the SOI. Next, the SOI is explicitly derived by expanding the Dirac equation. As a related important topic, electron motion in graphene, which can be described as massless Dirac fermion, and the Berry phase (a geometric phase that plays an important role in spintronics) of electrons in graphene are discussed.
Electrical and dynamical spin injection into condensed matters and generation of pure spin current	5-6	Pure spin current is a quite significant physical current in spintronics using semiconductors and so on. Pure spin current is a current of only a spin degree of freedom without a net charge flow. I introduced some important papers and show how to derive essential equations describing generation and propagation of pure spin current. (1) Spin drift-diffusion equation, (2) Hanle-type spin precession, (3) spin pumping using magnetization dynamics, and (4) spin current circuit theory are discussed.
Recent topics in spintronics	2-3	Topological insulators and the Berry phase are important topics in modern spintronics. To understand the essence of them, I show the derivation of the Kubo formula, and the calculation of the Hall conductivity based on the Kubo theory. The above mentioned topics are the main contents of this lecture, but I may add or omit some topics as requests from students.

【Textbook】 None

【Textbook(supplemental)】 For foreign students, I recommend the following review articles: 1. Spin Hall effect, J. Sinova et al., Rev. Mod. Phys. 87, 1213 (2015). 2. Spintronics: Fundamentals and applications, I. Zutic et al., Rev. Mod. Phys. 76, 1 (2004). 3. Nonlocal magnetization dynamics in ferromagnetic heterostructures, Y. Tserkovnyak et al., Rev. Mod. Phys. 77, 1375 (2005).

【Prerequisite(s)】 Solid State Physics and Quantum Physics at the level of undergraduate school.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Charged Particle Beam Apparatus

電子装置特論

【Code】10C801 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Wed 4th

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Yasuhito Gotoh

【Course Description】Fundamental technologies of an ion beam system, such as ion sources, formation and evaluation of ion beams, transport of ion beams, and ion-solid interaction will be presented. Taking ion implantation as one of the example of the ion beam application, the relationship between the incident ion energy and implantation depth will be presented. Each element of a typical ion beam system is explained in detail.

【Grading】Evaluation will be made with the results of final examination. Achievements of exercises in the class are also taken into consideration.

【Course Goals】To understand the details of an ion beam apparatus: generation, transport and evaluation of an ion beam. Understanding of the entire ion beam apparatus as a system is also purpose of the class.

【Course Topics】

Theme	Class number of times	Description
Ion beam systems and their applications	1	Outline of the class is presented. Physical properties of ions in vacuum are given, and ion beam apparatuses and their application will be introduced with some typical examples.
Ion-solid interaction	3	Interaction between high energy ion and solid atoms are given. Major topics are: how the ions transfer their energy to the target atoms, i.e., how the ions are decelerated in the solid, and relationship between incident ion energy and implantation depth is given. Concept of sputtering phenomenon is also presented.
Nature of ion beam	2	Concept of the acceleration voltage is introduced to explain the principle of the ion beam systems. Nature of an ion beam is also presented.
Generation and transport of ion beam	3	Methods of ion generation for various elements are explained. Important equations of beam extraction and beam transport are given. Starting with the paraxial ray equation, concept of transfer matrix is given. Finally, some important physical parameters of ion beams are given.
Mass separators and energy analyzers	3	Details of magnetic sector as mass separator are given. Transfer matrix of the mass separator are presented and focusing effect is described. An important parameter of mass resolution is given. Some different kinds of energy analyzers are also introduced. Deflection and detection systems are also introduced.
Fundamentals of vacuum engineering	2	Fundamentals of vacuum engineering is given. Several pumps used for ion beam systems are also introduced.
Design of ion beam systems	1	Design of an ion beam system under a given condition will be presented. In the last class, achievement test will be performed.

【Textbook】Yasuhito Gotoh, Charged Particle Beam Apparatus, 2018 version (to be sold at CO-OP shop in Katsura Campus)

【Textbook(supplemental)】Junzo Ishikawa, Charged Particle Engineering (Corona).

【Prerequisite(s)】Vacuum Electronic Engineering (undergraduate course)

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】We will have brief practice in each class. Bring your calculator and A4-size writing papers.

Quantum Information Science

量子情報科学

【Code】 10C803 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Mon 3rd

【Location】 A1-001 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 English or Japanese

【Instructor】 Professor Shigeki Takeuchi

Associate Professor Ryo Okamoto

【Course Description】 An overview of the quantum information sciences will be given. The topics includes the basic picture of wave/particle duality, quantum key distribution, quantum computation, quantum communication, quantum measurements.

【Grading】 the number of days one has attended, and the score of reports will be considered.

【Course Goals】 To understand the basic concepts/mechanisms of quantum key distribution, quantum computers, and quantum metrology so that one can read and understand the scientific papers of the related area.

【Course Topics】

Theme	Class number of times	Description
Introduction	3	First, we outline the whole lecture and then explain basic concepts such as quantum bit, quantum gate, quantum entanglement etc.
Quantum Computer (Theory)	3	On quantum computation, various quantum algorithms are discussed.
Quantum Computer (Experiment)	3	Quantum information processing is being studied in various physical systems such as photon, ion trap, nuclear spin and the like. We will explain how to realize them.
Quantum Key distribution and Quantum metrology	4	Describe the basic concept of quantum cryptography and quantum measurements and their recent research trends.
Summary and Outlook	2	In addition to summarizing the whole, if time permits, discuss the problems of quantum information science and ethics.

【Textbook】 No text book will be used.

【Textbook(supplemental)】 Nielsen & Chuang, Quantum Computation and Quantum Information, Cambridge University Press

Shigeki Takeuchi, Quantum Computer, Kodansha (in Japanese)

【Prerequisite(s)】 Basic understanding of quantum mechanics will be helpful.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 We welcome your positive questions and comments. We select the language (Japanese or English) used in the lecture taking into account the situation and hope of the students taking this lecture.

Semiconductor Engineering Adv.

半導体工学特論

【Code】10C810 【Course Year】Master Course 【Term】1st term 【Class day & Period】Wed 3rd

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Prof. Tsunenobu Kimoto (Department of Electronic Science and Engineering)

【Course Description】This course explores the fundamentals of semiconductor physics and engineering, which are essential to understand semiconductor materials and devices.

【Grading】Final examination and a few reports

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Band theory	2-3	Electronic band structures are discussed. Nearly free electron and tight-binding approaches are explained. Band structures of major semiconductors such as Si and GaAs are also discussed.
Carrier transport and scattering	3-4	Carrier transport and electrical conduction are explained by using the Boltzmann transport equation. Scattering mechanism of carriers and mobility are discussed.
High-field effect	2-3	Drift of carriers and junction breakdown under high electric field are discussed. A few phenomena under high magnetic field are also explained.
Defects in semiconductors	1-2	Crystallographic and electronic properties of defects (both extended and point defects) in a semiconductor are explained.
MOS physics	2-3	Energy band diagrams and carrier statistics in a metal/insulator/semiconductor (MIS) structure are discussed.

【Textbook】No textbook is assigned.

【Textbook(supplemental)】S. M. Sze Physics of Semiconductor Devices (Wiley Interscience)

P.Y. Yu and M. Cardona Fundamentals of Semiconductors (Springer)

【Prerequisite(s)】Semiconductor engineering, quantum mechanics (undergraduate level)

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Electronic Materials Adv.

電子材料学特論

【Code】10C813 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Thu 2nd

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Prof. Tsunenobu Kimoto (Department of Electronic Science and Engineering)

【Course Description】Fundamentals and recent progress in semiconductor materials and various advanced devices are explained.

【Grading】Report evaluation, taking account of lecture attendance

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Si semiconductor	3-4	Bulk growth, wafering, defect engineering, and impurity gettering of Si are reviewed. Silicon-On-Insulator (SOI) is also explained.
Advanced CMOS devices and materials	2-3	Basic structures and performance enhancement of advanced CMOS devices, the core devices in LSI, are explained.
High-frequency devices and materials	2-3	Structure and operation principle of high-frequency devices are explained. Semiconductor materials suitable for high-frequency applications are discussed.
Power devices and materials	2-3	Structure and operation principle of power devices are explained. Semiconductor materials suitable for power conversion applications are discussed.

【Textbook】No textbook is assigned.

【Textbook(supplemental)】

【Prerequisite(s)】Basics of solid state physics and semiconductor engineering

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Molecular Electronics

分子エレクトロニクス

【Code】10C816 【Course Year】Master Course 【Term】1st term 【Class day & Period】Mon 5th

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	4	
	3	
	3	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Surface Electronic Properties

表面電子物性工学

【Code】 10C819 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Tue 5th

【Location】 A1-001 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】

【Instructor】 Hirofumi Yamada, Kei Kobayashi

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	3	
	4	
	2	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Optical Properties and Engineering

光物性工学

【Code】10C822 【Course Year】Master Course 【Term】1st term 【Class day & Period】Tue 4th

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2-3 回	
	7-8 回	
	4-5 回	
	1 回	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantum Optoelectronics Devices

光量子デバイス工学

【Code】10C828 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Tue 4th

【Location】A1-001 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	5	
	5	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantum Optics

量子光学

【Code】10C829 【Course Year】Master 1st 【Term】1st term 【Class day & Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	3	
	3	
	3	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantum Measurement

量子計測工学

【Code】 10C830 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 Mon 4th
 【Location】 A1-131 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture
 【Language】 Japanese, but there is a possibility of some lectures in English. 【Instructor】 Kazuhiko Sugiyama
 【Course Description】 As an example of high precision measurements using quantum phenomena, frequency standards, which is realized with the smallest uncertainty in all measurement quantities at present, are discussed. The principle and evaluation of frequency standards are explained.
 【Grading】 Report(two times, at the first lecture and the after all lectures)
 【Course Goals】 The goal of this lecture is to understand that precision measurements are realized with combination of the best technologies and is based on physics.

【Course Topics】

Theme	Class number of times	Description
Introduction and principle of time measurement	1	Two principles of time measurement: Reproducibility postulate and dynamic model
Fundamentals of atomic frequency standards	2.5	Atomic states, its energy shifts, high-resolution spectroscopy and high-sensitive detection
Cesium frequency standard and atom interferometer	2.5	Principle of Ramsey resonance and its interpretation as atom interferometer
Specification of frequency standards: evaluation methods and theoretical limit	2	Fundamentals of evaluation of frequency stability with Allan variance, and theoretical limit of frequency stability
Noise	2	Incoherent signals and shot noise
Relativistic theory and time	3	Impact of special and general relativistic theory on time measurement
Others	1	If we have time, the frequency noises of masers and lasers, and other subjects will be lectured.
Evaluation of understanding	1	

【Textbook】

【Textbook(supplemental)】 C. Audoin and B. Guinot, The Measurement of Time, (Cambridge University Press, 2001). M. Kitano, Fundamentals of electronic circuits (Reimei publishing, 2009) in Japanese.

【Prerequisite(s)】 Fundamentals of physics (quantum physics, in particular) and electric circuits including linear system.

The level which average graduate students of electric and electronic science and technology acquire is sufficient.

【Independent Study Outside of Class】

【Web Sites】 <https://www.kogaku.kyoto-u.ac.jp/lecturenotes/> (Unfortunately, this web page is discontinued from 2014. New pages would appear on PandA system.)

【Additional Information】 Office of instructor: A1-124

Electrical Conduction in Condensed Matter

電気伝導

【Code】 10C851 【Course Year】 Master 1st 【Term】 1st term 【Class day & Period】 Wed 2nd

【Location】 Electrical Engineering Bldg.-Lecture Room (M) 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Itsuhiro Kakeya

Toshiya Doi

【Course Description】 A fundamental aspect of the electrical conduction in solids is discoursed in terms of physics based on the classical dynamics and later on the quantum physics. An important concept of the phonon and the electron-phonon is discoursed, which play a very important role in the electrical conduction in solids. The electrical conductivity is discoursed with a frequency from 0, that is dc, to optical frequency, by which a unified understanding of electrical conduction and the optical property is intended.

【Grading】 Basically, an examination is imposed after the last class. A report may be imposed in case of necessity.

【Course Goals】 This class is intended to bestow the understanding of the solid state physics of a level dealt in the celebrated textbook by Ashcroft and Mermin. It is also intended for those attending in this class to acquire an ability sufficient to strive through such a textbook by himself or herself after the class is completed.

【Course Topics】

Theme	Class number of times	Description
Lattice and reciprocal lattice	2	
Fundamentals of quantum mechanics and hydrogen atom model	2	
Free electron fermi gas	3	
Electron-phonon interaction and the electrical conduction in metals and semiconductors	3	
Superconductivity	4	
Feedback	1	

【Textbook】 C. Kittel, Introduction to Solid State Physics, 8th ed., Wiley

【Textbook(supplemental)】 Solid State Physics by Ashcroft and Mermin

【Prerequisite(s)】 Those who would like to attend in this class are recommended to study electrodynamics, statistical physics, and introduction to the solid state devices in advance. The lecture is, however, given in Japanese.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

High Performance Thin Film Engineering

高機能薄膜工学

【Code】10C834 【Course Year】Master 1st 【Term】1st term 【Class day & Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】,,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3-4	
	3-4	
	2-3	
	2-3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Recent Advances in Electrical and Electronic Engineering

先端電気電子工学通論

【Code】 10K010 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day & Period】 Tuesday, 5 【Location】 Laboratories 【Credits】 2 【Restriction】 Foreign students

【Lecture Form(s)】 Seminar 【Language】 English 【Instructor】

【Course Description】 The class consists of a series of seminars at 3 laboratories related to Department of Electrical and Electronic Engineering (energy and electrical machinery, computers, control and systems, communications and radio engineering, and electronic devices and applied physics). Each seminar intends to give a brief introduction into a specific research field so that students can get a feel for the state-of-the-art in each topic and broaden their scope beyond their majors.

【Grading】 The evaluation of a student ' s work is given based on his/her attendance, reports and discussions, not on examinations.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	6	
	9	

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Integrated Circuits Engineering, Advanced.

集積回路工学特論

【Code】 10X725 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Wed 4th

【Location】 Electrical Engineering Bldg.-Lecture Room (M) etc. 【Credits】 2 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Hidetoshi Onodera

【Course Description】 An integrated circuit is a key device that enables functionality enhancement, performance increase, and cost reduction of an electronic system. Steady progress in fabrication technology leads to exponential increase in integration scale. This course focuses on the design methodology of a large-scale integrated circuit (LSI), with particular emphasis on logical and physical design process. Topics covered by the course include the current status and future directions regarding LSI design technology, CMOS process technology, CMOS layout design, CMOS device characteristics, CMOS static gates, CMOS dynamic gates, and LSI design methodology.

【Grading】 The level of achievement will be examined by several reports assigned during lectures. All assignments of all reports are mandatory.

【Course Goals】 The target of this lecture is to obtain basic knowledge on a design method of integrated circuits such that he/she can complete logic, circuit and layout design for a simple digital circuit.

【Course Topics】

Theme	Class number of times	Description
1. Current status and future directions of Integrated Circuit Technology	2	The current status of integrated circuit development will be explained. Brief history and future directions of integrated circuit technology will be covered.
CMOS Process Technology	2	Fabrication process of CMOS will be explained with particular emphasis on photo-masks required for lithography.
MOS Devices	3	Structure and performance characteristics of MOSFET, capacitor and resistor will be explained. Performance degradation of scaled interconnect will be discussed with possible solutions.
CMOS Logic Gates	3	CMOS complementary static gates and dynamic gates will be presented with performance analysis and design methods.
LSI Design Methodology	3	Synchronous design method will be explained. Timing analysis and clocking techniques will be discussed. Low power design methodology will be explained.
FPGA	2	Field programmable gate array and its application will be explained.

【Textbook】 NA.

Hand-outs will be provided.

【Textbook(supplemental)】 Neil H.E. Weste and David Harris, " CMOS VLSI Design, 4th Ed. "

Addison-Wesley, 2011.

Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, " Digital Integrated Circuits, 2nd Ed. " Prentice Hall, 2003.

【Prerequisite(s)】 Basic knowledge on electronic circuits, digital circuits, logic circuits.

【Independent Study Outside of Class】 Reports include design and analysis of small circuits. A simulation program (SPICE) is required for performance analysis. Instructions for obtaining SPICE are given and students need to install SPICE by themselves.

【Web Sites】

【Additional Information】

Prospects of Interdisciplinary Photonics and Electronics

融合光・電子科学の展望

【Code】 10X001 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Fri 2nd 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
-------	--	-------------

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Seminar in Electronic Science and Engineering I

電子工学特別研修 1 (インターン)

【Code】 10C846 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Seminar in Electronic Science and Engineering II

電子工学特別研修2 (インターン)

【Code】 10C848 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Research Internship(M)

研究インターンシップ M (電子)

【Code】 10C821 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar and Exercise 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
-------	--	-------------

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Research Internship(D)

研究インターンシップ D (電子)

【Code】 10R823 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
-------	--------------------------	-------------

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Exercises on Electronic Science and Engineering I, II

電子工学特別演習 1

【Code】 10R825 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Exercises on Electronic Science and Engineering I, II

電子工学特別演習 2

【Code】 10R827 【Course Year】 Doctor Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (6H course)

現代科学技術の巨人セミナー「知のひらめき」(6Hコース)

【Code】 10i051 【Course Year】 Doctor Course 【Term】 First term, intensive

【Class day & Period】 Intensive (Saturday, Jun.-Jul) 【Location】 B-Cluster 2F Seminar Room 【Credits】 0.5

【Restriction】 Student number will be limited. 【Lecture Form(s)】 Intensive Lecture 【Language】 Japanese

【Instructor】 GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】 This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】 Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 6H course, students have to select two classes and will earn 0.5 credits.

【Course Goals】 This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (12H course)

現代科学技術の巨人セミナー「知のひらめき」(12Hコース)

【Code】10i052 【Course Year】Doctor Course 【Term】First term/Spring term

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】1

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 12H course, students have to complete all four classes and will earn 1 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later
Topic 3	2	Detail will be announced later
Topic 4	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Advanced Material Science and Technology (15 times course)

(English lecture)

先端マテリアルサイエンス通論 (15 回コース) (英語科目)

【Code】10i054 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 5th 【Location】A2-306 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture

【Language】English

【Instructor】ER Center, J. Assoc. Prof., Ryuichi Ashida
Related professors

【Course Description】The various technologies used in the field of material science serve as bases for so-called high technologies, and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】The average score of the best five reports is employed.
Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Tumor Imaging and Therapy through Photoirradiation	1	The overview of current modalities through photoirradiation as well as the preparation of tumor imaging probes is given. Tumor therapy through photoirradiation is also shown in the lecture. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Carbon Nanorings	1	The preparation of carbon nanorings is outlined in the lecture. The supramolecular interaction as well as the photophysical properties of carbon nanorings is summarized. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Crystal Structure Analysis by Powder X-ray Diffraction Measurement	1	Chemical and physical properties of a material is strongly related with the structure of the material. So, structure analysis is one of the most important part in material researches. Powder X-ray diffraction analysis is powerful way to analyze the crystal structure of solid materials. We study how to use powder X-ray diffraction analysis for material researches. (T. Yamamoto: Dept. of Energy and Hydrocarbon Chemistry)
Principles and Applications of Fluorescence Spectroscopy	1	Fluorescence spectroscopy is applied to various disciplines of science and engineering, and provides unique information of a system upon photo-illumination. This course aims to introduce the background of fluorescence spectroscopy and practical knowledge in fluorescence experiments. (J. Park: Dept. of Molecular Engineering)
Synthesis of Novel π -Conjugated Molecules with Main Group Elements	1	The lecture will show synthesis and properties of novel π -conjugated molecules with main group elements, and their application as functional materials. (T. Higashino: Dept. of Molecular Engineering)
Chemistry of Asymmetric Catalysis Stereoselective Synthesis of Optically Active Pharmaceutical Compounds	1	This class will outline the progress on enantioselective catalysis for the asymmetric synthesis of optically active pharmaceutical compounds such as Herbesser, which is a blockbuster drug developed in a Japanese pharmaceutical company. (K. Asano: Dept. of Material Chemistry)
Electrical Conductivity of Conjugated Polymers and Application to Organic Electronics	1	In this class, structure and property of conjugated polymers are introduced and discussed. The discussion topics include the brief history of the discovery of electrical conductivity of conjugated polymers, mechanism of electrical conductivity in polymer chains, representative evaluation methods of conductivity for conjugated polymers, relationship between molecular and self-assembled structures of conjugated polymers, and recent examples of device applications using conjugated polymers. (I. Sakurai: Dept. of Molecular Engineering)
An Introduction to Smart Shape Changing Materials	1	This course will briefly introduce smart materials as a whole and will then focus specifically on the recent and very active field of smart shape changing materials. We will explore how the design and stimuli-sensitivity of various materials can allow for materials to have planned and useful motion. (K. Landenberger: Dept. of Polymer Chemistry)
Properties of Cementitious Materials and the Future	2	CEMENT may not necessarily be an advanced material, but must surely be a forefront material for human life and society, in the past, present and future. Then, what are your demands to cement? (A. Hattori: Dept. of Urban Management)
Application of Electrical Discharge to Material and Environmental Technology	1	(N. Sano: Dept. of Chemical Engineering)
Theory of Precision Cutting, Grinding, Polishing and Related Properties of Materials	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Metrology and Control Theory for Precision Manufacturing, and Applications	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Fabrication of Inorganic Nanofiber by Electrospinning	1	When a high voltage is applied to a polymer solution, the solution is sprayed as thread-like droplets, and turns to polymer nanofibers. This fiber forming technique is called electrospinning. This lecture will give a brief introduction on the fabrication of nanofibers of inorganic materials including metal oxide and carbon by electrospinning. (S. Nagamine: Dept. of Chemical Engineering)
Solid Surface Analysis, Including a Potential Method: Tip-Enhanced Raman Spectroscopy	1	Surface analytical techniques each have their own analytical volume. The students learn about the volume, and look at an issue for tip-enhanced Raman spectroscopy, a nanoscale Raman spectroscopy, as a potential surface analytical technique. (M. Nishi: Dept. of Material Chemistry)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Exercise in Practical Scientific English

実践的科学英語演習

【Code】 10i045 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Thu 4th or 5th 【Location】 A2-304

【Credits】 1 【Restriction】 Up to 20 students for each class 【Lecture Form(s)】 Seminar 【Language】 English (Japanese)

【Instructor】 M. Nishikawa, R. Matsumoto, R. Ashida, M. Maeda,

【Course Description】 This course is open to all master and doctoral engineering students. It is designed to help students understand how to write a research paper step by step. In this course, the students will write a short research paper (i.e. Extended Research Abstract for Proceeding, approx. 1000 -1500 words) on a topic drawn from assigned readings.

【Grading】 Evaluation based on 30% participation, 40% reports, 30% final paper *More than twice unexcused absence can result in course failure

【Course Goals】 The primary goal of this course is to deepen an understanding of the main features of each part of a scientific paper (IMRaD). Throughout the course, students will develop the core competencies required for language, grammar, and style to produce a research manuscript in English.

【Course Topics】

Theme	Class number of times	Description
Unit 1: Course Overview	1	Course Overview: Introduction to writing scientific research articles
Unit 2: Introduction	1	Raising awareness of the register of science research articles (genre, audience, purpose)
Unit 3: Preparing to Write	1	Writing a proposal for a research paper, using corpus-based approach (Exercise: Creating own Corpus)
Unit 4: Preparing to Write	1	Paraphrasing ideas from source texts, using citations and references in formal writing
Unit 5: Writing Processes	1	Identifying the “ moves ” for an Abstract section by hint expressions
Unit 6: Writing Processes	1	Writing an Abstract (Title) & peer feedback
Unit 7: Writing Processes	1	Identifying the “ moves ” for an Introduction section by hint expressions
Unit 8: Writing Processes	1	Writing an Introduction section & peer feedback
Unit 9: Writing Processes	1	Writing a Method section & peer feedback
Unit 10: Writing Processes	1	Writing a Result section & peer feedback
Unit 11: Writing Processes	1	Writing a Discussion and a Conclusion section
Unit 12: Writing Processes	1	Writing a cover letter to reviewers and how to respond to reviewers
Unit 13: Monitoring and Revising	1	Online feedback
Unit 14: Monitoring and Revising	1	Revising a paper based on peer feedback
Unit 15: Submission	1	Final Paper Due, August 6.

【Textbook】 Handout materials will be supplied by the instructor.

【Textbook(supplemental)】 ALESS (2012). Active English for Science- 英語で科学する - レポート、論文、プレゼンテーション . The University of Tokyo Press. Cargill, M., & O'Connor, P. (2013). Writing scientific research articles: Strategy and steps. John Wiley & Sons. Cowell, R., & She, L. (2015). Mastering the Basics of Technical English 『技術英語の基礎』 . 2nd Ed., Corona Publishing. 野口ジュディー・深山晶子・岡本真由美 . (2007) . 『理系英語のライティング』 . アルク

【Prerequisite(s)】 Students who intend to join this course must attend the first class.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 We may restrict the class size to enhance students ' learning. Students who intend to join the course are required to attend the first-day guidance. Office Hours: (by appointment) nishikawa.mikako7w@kyoto-u.ac.jp (Ext. 2052)

Advanced Modern Science and Technology (4 times course) (English lecture)

現代科学技術特論 (4 回コース) (英語科目)

【Code】 10i055 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 5th

【Location】 A2-306 【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 ER Center, J. Assoc. Prof., Ashida
ER Center, J. Assoc. Prof., Matsumoto
ER Center, J. Assoc. Prof., Maeda
ER Center, J. Assoc. Prof., Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '4 times course' should select one of the topics and attend the lectures. (Students who take '8 times course' should attend the lectures of the both topics.) Attend a course orientation held before the first lecture (Nov. 1) even if you take only the second topic.

Advanced Modern Science and Technology (8 times course) (English lecture)

現代科学技術特論 (8 回コース) (英語科目)

【Code】 10i056 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 5th

【Location】 A2-306 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 ER Center, J. Assoc. Prof., Ashida
ER Center, J. Assoc. Prof., Matsumoto
ER Center, J. Assoc. Prof., Maeda
ER Center, J. Assoc. Prof., Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '8 times course' should attend the lectures of the both topics. (Students who take '4 times course' should select one of the topics and attend the lectures.)

Chemistry of Inorganic Materials

無機材料化学

【Code】10H001 【Course Year】Master Course 【Term】 【Class day & Period】Mon 2nd 【Location】A2-306

【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Tanaka, Hirao, Miura,

【Course Description】Structure, characterization, synthesis, and properties of inorganic materials are described on the basis of solid-state chemistry of inorganic matters.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	4	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Chemistry of Organic Materials

有機材料化学

【Code】 10H004 【Course Year】 Master Course 【Term】 【Class day & Period】 Fri 1st 【Location】 A2-302

【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Matsubara, Shimizu,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	3	
	1	
	1	
	3	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Chemistry of Polymer Materials

高分子材料化学

【Code】10H007 【Course Year】Master Course 【Term】 【Class day & Period】Fri 2nd 【Location】A2-302

【Credits】 【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
physical properties of polymers	3	physical properties of polymers
structure and physics of high-performance polymers	3	structure and physics of high-performance polymers
molecular design and function of functional polymers	6	molecular design and function of functional polymers

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Chemistry of Functional Materials

機能材料化学

【Code】10H010 【Course Year】Master Course 【Term】 【Class day & Period】Wed 1st 【Location】A2-302

【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	2	
	1	
	1	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Chemistry and Structure of Inorganic Compounds

無機構造化学

【Code】 10H013 【Course Year】 Master Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	3	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Synthetic Chemistry of Inorganic Solids

固体合成化学

【Code】10H016 【Course Year】Master Course 【Term】(not held; biennially) 【Class day & Period】Tue 2nd
 【Location】A2-302 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese
 【Instructor】 ,

【Course Description】 Methods to synthesize various inorganic solids and the structure and properties of the resultant materials are described.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	2	
	4	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Synthesis of Organic Materials

有機材料合成化学

【Code】10H019 【Course Year】Master Course 【Term】(not held; biennially) 【Class day & Period】Fri 2nd

【Location】A2-302 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	3	
	3	
	3	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Chemistry of Organic Natural Products

有機天然物化学

【Code】 10H022 【Course Year】 Master Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Shimizu, Nakao,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	2	
	3	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Analysis and Characterization of Materials

材料解析化学

【Code】10H025 【Course Year】Master Course 【Term】Spring 【Class day & Period】Wed 1st

【Location】A2-302 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Prof. Koji Otsuka

Assoc. Prof. Munetaka Oyama

Assoc. Prof. Takuya Kubo

【Course Description】Recent advances in instrumental analysis will be discussed in terms of principle, instrumentation, method and applications.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	3	
	3	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Polymer Physics and Function

高分子機能物性

【Code】10H029 【Course Year】Master Course 【Term】(not held; biennially) 【Class day & Period】Tue 2nd

【Location】A2-302 【Credits】 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	2	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Chemistry of Biomaterials

生体材料化学

【Code】 10H031 【Course Year】 Master Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
biological functions in light of biomaterials	6	
cross-talk of polysaccharide with living systems	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Analysis and Characterization of Materials

材料解析化学

【Code】 10H034 【Course Year】 Master Course 【Term】 Autumn (not in 2018)

【Class day & Period】 Wednesday, 2nd 【Location】 A2-302 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Prof. Koji Otsuka

Assoc. Prof. Munetaka Oyama

Assoc. Prof. Takuya Kubo

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	3	
	3	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Laboratory and Exercise in Material Chemistry

材料化学特别实验及演习

【Code】10D037 【Course Year】Master 2nd 【Term】1st+2nd term 【Class day & Period】 【Location】

【Credits】8 【Restriction】 【Lecture Form(s)】Seminar and Exercise 【Language】Japanese 【Instructor】，

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	60	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Advanced Material Science and Technology (11 times course)

(English lecture)

先端マテリアルサイエンス通論 (11 回コース) (英語科目)

【Code】 10i053 【Course Year】 Master and Doctor Course 【Term】 Spring term 【Class day & Period】 Fri 5th 【Location】 A2-306 【Credits】 1.5

【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 ER Center, J. Assoc. Prof., Ryuichi Ashida

Related professors

【Course Description】 The various technologies used in the field of material science serve as bases for so-called high technologies, and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】 The average score of the best four reports is employed.

Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Tumor Imaging and Therapy through Photoirradiation	1	The overview of current modalities through photoirradiation as well as the preparation of tumor imaging probes is given. Tumor therapy through photoirradiation is also shown in the lecture. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Carbon Nanorings	1	The preparation of carbon nanorings is outlined in the lecture. The supramolecular interaction as well as the photophysical properties of carbon nanorings is summarized. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Crystal Structure Analysis by Powder X-ray Diffraction Measurement	1	Chemical and physical properties of a material is strongly related with the structure of the material. So, structure analysis is one of the most important part in material researches. Powder X-ray diffraction analysis is powerful way to analyze the crystal structure of solid materials. We study how to use powder X-ray diffraction analysis for material researches. (T. Yamamoto: Dept. of Energy and Hydrocarbon Chemistry)
Principles and Applications of Fluorescence Spectroscopy	1	Fluorescence spectroscopy is applied to various disciplines of science and engineering, and provides unique information of a system upon photo-illumination. This course aims to introduce the background of fluorescence spectroscopy and practical knowledge in fluorescence experiments. (J. Park: Dept. of Molecular Engineering)
Synthesis of Novel π -Conjugated Molecules with Main Group Elements	1	The lecture will show synthesis and properties of novel π -conjugated molecules with main group elements, and their application as functional materials. (T. Higashino: Dept. of Molecular Engineering)
Chemistry of Asymmetric Catalysis Stereoselective Synthesis of Optically Active Pharmaceutical Compounds	1	This class will outline the progress on enantioselective catalysis for the asymmetric synthesis of optically active pharmaceutical compounds such as Herbesser, which is a blockbuster drug developed in a Japanese pharmaceutical company. (K. Asano: Dept. of Material Chemistry)
Electrical Conductivity of Conjugated Polymers and Application to Organic Electronics	1	In this class, structure and property of conjugated polymers are introduced and discussed. The discussion topics include the brief history of the discovery of electrical conductivity of conjugated polymers, mechanism of electrical conductivity in polymer chains, representative evaluation methods of conductivity for conjugated polymers, relationship between molecular and self-assembled structures of conjugated polymers, and recent examples of device applications using conjugated polymers. (I. Sakurai: Dept. of Molecular Engineering)
An Introduction to Smart Shape Changing Materials	1	This course will briefly introduce smart materials as a whole and will then focus specifically on the recent and very active field of smart shape changing materials. We will explore how the design and stimuli-sensitivity of various materials can allow for materials to have planned and useful motion. (K. Landenberger: Dept. of Polymer Chemistry)
Properties of Cementitious Materials and the Future	2	CEMENT may not necessarily be an advanced material, but must surely be a forefront material for human life and society, in the past, present and future. Then, what are your demands to cement? (A. Hattori: Dept. of Urban Management)
Application of Electrical Discharge to Material and Environmental Technology	1	(N. Sano: Dept. of Chemical Engineering)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Advanced Material Science and Technology (15 times course)

(English lecture)

先端マテリアルサイエンス通論 (15 回コース) (英語科目)

【Code】10i054 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 5th 【Location】A2-306 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture

【Language】English

【Instructor】ER Center, J. Assoc. Prof., Ryuichi Ashida
Related professors

【Course Description】The various technologies used in the field of material science serve as bases for so-called high technologies, and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】The average score of the best five reports is employed.
Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Tumor Imaging and Therapy through Photoirradiation	1	The overview of current modalities through photoirradiation as well as the preparation of tumor imaging probes is given. Tumor therapy through photoirradiation is also shown in the lecture. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Carbon Nanorings	1	The preparation of carbon nanorings is outlined in the lecture. The supramolecular interaction as well as the photophysical properties of carbon nanorings is summarized. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Crystal Structure Analysis by Powder X-ray Diffraction Measurement	1	Chemical and physical properties of a material is strongly related with the structure of the material. So, structure analysis is one of the most important part in material researches. Powder X-ray diffraction analysis is powerful way to analyze the crystal structure of solid materials. We study how to use powder X-ray diffraction analysis for material researches. (T. Yamamoto: Dept. of Energy and Hydrocarbon Chemistry)
Principles and Applications of Fluorescence Spectroscopy	1	Fluorescence spectroscopy is applied to various disciplines of science and engineering, and provides unique information of a system upon photo-illumination. This course aims to introduce the background of fluorescence spectroscopy and practical knowledge in fluorescence experiments. (J. Park: Dept. of Molecular Engineering)
Synthesis of Novel π -Conjugated Molecules with Main Group Elements	1	The lecture will show synthesis and properties of novel π -conjugated molecules with main group elements, and their application as functional materials. (T. Higashino: Dept. of Molecular Engineering)
Chemistry of Asymmetric Catalysis Stereoselective Synthesis of Optically Active Pharmaceutical Compounds	1	This class will outline the progress on enantioselective catalysis for the asymmetric synthesis of optically active pharmaceutical compounds such as Herbesser, which is a blockbuster drug developed in a Japanese pharmaceutical company. (K. Asano: Dept. of Material Chemistry)
Electrical Conductivity of Conjugated Polymers and Application to Organic Electronics	1	In this class, structure and property of conjugated polymers are introduced and discussed. The discussion topics include the brief history of the discovery of electrical conductivity of conjugated polymers, mechanism of electrical conductivity in polymer chains, representative evaluation methods of conductivity for conjugated polymers, relationship between molecular and self-assembled structures of conjugated polymers, and recent examples of device applications using conjugated polymers. (I. Sakurai: Dept. of Molecular Engineering)
An Introduction to Smart Shape Changing Materials	1	This course will briefly introduce smart materials as a whole and will then focus specifically on the recent and very active field of smart shape changing materials. We will explore how the design and stimuli-sensitivity of various materials can allow for materials to have planned and useful motion. (K. Landenberger: Dept. of Polymer Chemistry)
Properties of Cementitious Materials and the Future	2	CEMENT may not necessarily be an advanced material, but must surely be a forefront material for human life and society, in the past, present and future. Then, what are your demands to cement? (A. Hattori: Dept. of Urban Management)
Application of Electrical Discharge to Material and Environmental Technology	1	(N. Sano: Dept. of Chemical Engineering)
Theory of Precision Cutting, Grinding, Polishing and Related Properties of Materials	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Metrology and Control Theory for Precision Manufacturing, and Applications	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Fabrication of Inorganic Nanofiber by Electrospinning	1	When a high voltage is applied to a polymer solution, the solution is sprayed as thread-like droplets, and turns to polymer nanofibers. This fiber forming technique is called electrospinning. This lecture will give a brief introduction on the fabrication of nanofibers of inorganic materials including metal oxide and carbon by electrospinning. (S. Nagamine: Dept. of Chemical Engineering)
Solid Surface Analysis, Including a Potential Method: Tip-Enhanced Raman Spectroscopy	1	Surface analytical techniques each have their own analytical volume. The students learn about the volume, and look at an issue for tip-enhanced Raman spectroscopy, a nanoscale Raman spectroscopy, as a potential surface analytical technique. (M. Nishi: Dept. of Material Chemistry)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Modern Science and Technology (4 times course) (English lecture)

現代科学技術特論 (4 回コース) (英語科目)

【Code】10i055 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 5th

【Location】A2-306 【Credits】0.5 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】English

【Instructor】 ER Center, J. Assoc. Prof., Ashida
ER Center, J. Assoc. Prof., Matsumoto
ER Center, J. Assoc. Prof., Maeda
ER Center, J. Assoc. Prof., Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '4 times course' should select one of the topics and attend the lectures. (Students who take '8 times course' should attend the lectures of the both topics.) Attend a course orientation held before the first lecture (Nov. 1) even if you take only the second topic.

Advanced Modern Science and Technology (8 times course) (English lecture)

現代科学技術特論 (8 回コース) (英語科目)

【Code】 10i056 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 5th

【Location】 A2-306 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】	ER	Center,	J.	Assoc.	Prof.,	Ashida
	ER	Center,	J.	Assoc.	Prof.,	Matsumoto
	ER	Center,	J.	Assoc.	Prof.,	Maeda
	ER	Center,	J.	Assoc.	Prof.,	Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '8 times course' should attend the lectures of the both topics. (Students who take '4 times course' should select one of the topics and attend the lectures.)

Exercise in Practical Scientific English

実践的科学英語演習

【Code】 10i045 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Thu 4th or 5th 【Location】 A2-304

【Credits】 1 【Restriction】 Up to 20 students for each class 【Lecture Form(s)】 Seminar 【Language】 English (Japanese)

【Instructor】 M. Nishikawa, R. Matsumoto, R. Ashida, M. Maeda,

【Course Description】 This course is open to all master and doctoral engineering students. It is designed to help students understand how to write a research paper step by step. In this course, the students will write a short research paper (i.e. Extended Research Abstract for Proceeding, approx. 1000 -1500 words) on a topic drawn from assigned readings.

【Grading】 Evaluation based on 30% participation, 40% reports, 30% final paper *More than twice unexcused absence can result in course failure

【Course Goals】 The primary goal of this course is to deepen an understanding of the main features of each part of a scientific paper (IMRaD). Throughout the course, students will develop the core competencies required for language, grammar, and style to produce a research manuscript in English.

【Course Topics】

Theme	Class number of times	Description
Unit 1: Course Overview	1	Course Overview: Introduction to writing scientific research articles
Unit 2: Introduction	1	Raising awareness of the register of science research articles (genre, audience, purpose)
Unit 3: Preparing to Write	1	Writing a proposal for a research paper, using corpus-based approach (Exercise: Creating own Corpus)
Unit 4: Preparing to Write	1	Paraphrasing ideas from source texts, using citations and references in formal writing
Unit 5: Writing Processes	1	Identifying the “ moves ” for an Abstract section by hint expressions
Unit 6: Writing Processes	1	Writing an Abstract (Title) & peer feedback
Unit 7: Writing Processes	1	Identifying the “ moves ” for an Introduction section by hint expressions
Unit 8: Writing Processes	1	Writing an Introduction section & peer feedback
Unit 9: Writing Processes	1	Writing a Method section & peer feedback
Unit 10: Writing Processes	1	Writing a Result section & peer feedback
Unit 11: Writing Processes	1	Writing a Discussion and a Conclusion section
Unit 12: Writing Processes	1	Writing a cover letter to reviewers and how to respond to reviewers
Unit 13: Monitoring and Revising	1	Online feedback
Unit 14: Monitoring and Revising	1	Revising a paper based on peer feedback
Unit 15: Submission	1	Final Paper Due, August 6.

【Textbook】 Handout materials will be supplied by the instructor.

【Textbook(supplemental)】 ALESS (2012). Active English for Science- 英語で科学する - レポート、論文、プレゼンテーション . The University of Tokyo Press. Cargill, M., & O'Connor, P. (2013). Writing scientific research articles: Strategy and steps. John Wiley & Sons. Cowell, R., & She, L. (2015). Mastering the Basics of Technical English 『技術英語の基礎』 . 2nd Ed., Corona Publishing. 野口ジュディー・深山晶子・岡本真由美 . (2007) . 『理系英語のライティング』 . アルク

【Prerequisite(s)】 Students who intend to join this course must attend the first class.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 We may restrict the class size to enhance students ' learning. Students who intend to join the course are required to attend the first-day guidance. Office Hours: (by appointment) nishikawa.mikako7w@kyoto-u.ac.jp (Ext. 2052)

Frontiers in Modern Science and Technology (6H course)

現代科学技術の巨人セミナー「知のひらめき」(6Hコース)

【Code】10i051 【Course Year】Doctor Course 【Term】First term, intensive

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】0.5

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 6H course, students have to select two classes and will earn 0.5 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (12H course)

現代科学技術の巨人セミナー「知のひらめき」(12Hコース)

【Code】10i052 【Course Year】Doctor Course 【Term】First term/Spring term

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】1

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 12H course, students have to complete all four classes and will earn 1 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later
Topic 3	2	Detail will be announced later
Topic 4	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Safety and Health Engineering (4 times course)

安全衛生工学（4回コース）

【Code】 10i057 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 4th

【Location】 C3-Lecture Room 1 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Instrumental Analysis, Adv.

先端科学機器分析及び実習

【Code】 10D043 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】

【Location】 A2-307 【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Instrumental Analysis, Adv.

先端科学機器分析及び実習

【Code】 10D046 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】

【Location】 A2-307 【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Organotransition Metal Chemistry 1

有機金属化学 1

【Code】10H041 【Course Year】Master Course 【Term】 【Class day & Period】Fri 1st 【Location】A2-306

【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Nakamura,Matsubara,Suginome,Tsuji,Kurahashi,Omura,Murakami

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Organomagnesium compounds	1	Synthesis, structure, and reaction of organomagnesium compounds
Organolithium compounds	1	Synthesis, structure, and reaction of organolithium compounds
Organozinc compounds	1	Synthesis, structure, and reaction of organozinc compounds
Organoboron compounds	1	Synthesis, structure, and reaction of organoboron compounds
Organosilicon compounds	1	Synthesis, structure, and reaction of organosilicon compounds
Organocopper compounds	1	Synthesis, structure, and reaction of organocopper compounds
Rare earth metals	1	Synthesis, structure, and reaction of rare earth metals
Other transition-metal compounds	1	Synthesis, structure, and reaction of other transition-metal compounds such as Ti, Zr, Cr, and Fe
Basic reaction of organotransition-metal compounds	1	Ligand substitution reaction, oxidative addition, oxidative cyclization, reductive elimination, transmetallation, carbonyl insertion
Catalytic enantioselective reaction	1	Enantioselective hydrogenation, enantioselective oxidation (Sharpless reactions), enantioselective C-C bond formation
Coupling reaction	1	C-C Bond forming reactions (cross coupling reactions)

【Textbook】none

【Textbook(supplemental)】J. F. Hartwig, Organotransition metal chemistry. From bonding to catalysis., University Science Books, Mill Valley, CA, 2010.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Organotransition Metal Chemistry 2

有機金属化学 2

【Code】10H042 【Course Year】Master Course 【Term】 【Class day & Period】 【Location】 【Credits】1.5

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Ozawa, Murakami, Kondo, Nakao, Ohuchi, Kurahashi, Miki

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	2	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Material Chemistry Adv. I

材料化学特論第一

【Code】10P055 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】 【Restriction】 【Lecture Form(s)】 Intensive Lecture 【Language】 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Material Chemistry Adv. II

材料化学特論第二

【Code】10P056 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】 【Lecture Form(s)】 Intensive Lecture 【Language】 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Material Chemistry Adv.

材料化学特論第三

【Code】10P057 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】 【Lecture Form(s)】 Intensive Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Material Chemistry Adv.

材料化学特論第四

【Code】10P058 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】 【Lecture Form(s)】 Intensive Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Design of Functional Materials

機能材料設計学

【Code】10S001 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】Wed 1st

【Location】A2-302 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	2	
	1	
	1	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Design of Functional Materials,Advanced

機能材料設計学特論

【Code】 10S002 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Thu 3rd

【Location】 A2-122 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	8	
	7	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Inorganic Structural Chemistry,Advanced

無機構造化学特論

【Code】 10S003 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Mon 3rd

【Location】 A2-302 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	8	
	7	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Industrial Solid-State Chemistry,Advanced

応用固体化学特論

【Code】 10S006 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Mon 5th

【Location】 A2-302 【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	8	
	7	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Organic Reaction Chemistry,Advanced

有機反応化学特論

【Code】10S010 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】Wed 5th

【Location】A2-302 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	1 5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Organic Chemistry of Natural Products, Advanced

天然物有機化学特論

【Code】 10S013 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Wed 5th

【Location】 A2-302 【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar 【Language】 Japanese

【Instructor】 Nakao

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Analytical Chemistry of Materials, Advanced

材料解析化学特論

【Code】10S016 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】Wed 4th

【Location】A2-122 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Physical Properties of Polymer Materials,Advanced

高分子材料物性特論

【Code】10S019 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】Tue 5th

【Location】A2-302 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Synthesis of Polymer Materials,Advanced

高分子材料合成特論

【Code】10S022 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】Fri 5th

【Location】A2-302 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Professional Scientific Presentation Exercises (English lecture)

科学技術者のためのプレゼンテーション演習 (英語科目)

【Code】10i041 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】Thu 5th

【Location】B-Cluster 2F Seminar Room 【Credits】1

【Restriction】The number of students might be limited if too many students will get enrolled.

【Lecture Form(s)】Seminar 【Language】English

【Instructor】Juha Lintuluoto, Associate Professor, Department of Synthetic Chemistry and Biological Chemistry

【Course Description】It is imperative for future engineers to be able to communicate and deliver effectively scientific information to large variety of audiences. This skill enables engineers to share and absorb information to more extended audiences, and facilitates success in selling ideas and products, publishing and team working. The purpose of this course is to teach the basic rules needed for successful professional scientific presentation, both orally and written. The course also prepares students to deliver scientific information presentations to wide audiences. The course is consisted of excessive exercises, of which the student should complete seven (7) tasks. The course holds 3-4 tasks for oral presentation exercises, and 3-4 tasks for professional scientific writing exercises. The exact number of both exercises is adjusted for each student ' s needs. The course is aimed for doctor course (DC) students, both Japanese and Foreign nationals

【Grading】Reports, class activity, presentation

【Course Goals】This course is aimed to foster engineering students ' scientific presentation skills. The successfully course completed students will be able to express and present complicated and specific scientific information at more generally understandable level. The students will also be able to pose relevant questions and effectively answer to the wide variety of questions.

【Course Topics】

Theme	Class number of times	Description
	1	Guidance and Professional presentation rules and etiquette
	3	Oral presentations & questioning I, Written report I
	3	Oral presentations & questioning I, Written report I
	3	Oral presentations & questioning II, Written report II
	3	Oral presentations & questioning II, Written report II
	2	Oral presentations & questioning III, Written report III
		Oral presentations & questioning III, Written report III
		Oral presentations & questioning IV, Written report IV
		Oral presentations & questioning IV, Written report IV I
		Course summary and discussion

【Textbook】Course materials will be provided.

【Textbook(supplemental)】Will be informed if necessary.

【Prerequisite(s)】-Fundamental skills about scientific presentation

-Advanced English skills

-Sufficient personal research results

【Independent Study Outside of Class】

【Web Sites】The web-site is listed in the home page of the GL education center.

【Additional Information】Students are requested to check in advance whether the credit of this course is counted as the unit for graduation requirement at department level. Course starts at April 12th, and the 1st lesson is repeated on April 19th. The course schedule is irregular. Most classes are biweekly, the detailed schedule is provided at the 1st lecture.

Advanced Engineering and Economy (English lecture)

工学と経済 (上級)(英語科目)

【Code】 10i042 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Tue 5th 【Location】 B-Cluster 2F Seminar Room

【Credits】 2 【Restriction】 The number of students might be limited if too many students will get enrolled. 【Lecture Form(s)】 Lectures, Group works&tasks

【Language】 English 【Instructor】 Juha Lintuluoto, Associate Professor, Department of Synthetic Chemistry and Biological Chemistry

【Course Description】 Engineering economics plays central role in any industrial engineering project. For an engineer, it is important to apply the engineering know-how with the economic analysis skills to obtain the best available materials, methods, devices, etc. in the most economical way. This course is aimed to teach engineering students the basic economic methods to manage economically an engineering project. In addition, the report writing on various engineering economic issues prepares to write reports in a professional form. The lab sessions are meant for the verbal skills improvement as well as improvement of analytical thinking. The topics are of current relevant topics Small-group brain-storming method is used. The exercise sessions cover the use of Ms-Excel for various quantitative economic analyses.

【Grading】 Final test, reports, class activity

【Course Goals】 This course is aimed to strengthen engineering students' skills in economics. The course concept is to teach students selectively those subjects which serve as major tools to solve economic tasks in engineering environment. The reports and lab sessions provide students stimulating and analytical thinking requiring tasks, and presentation skills training is an important part of this course.

【Course Topics】

Theme	Class number of times	Description
Student orientation and Introduction to engineering economy	1	Course contents, goals
Cost concepts and design economics	1	Cost terminology and classification
Cost estimation techniques	1	WBS for cost estimation, estimation techniques (indexes, unit, factor, power-sizing, learning curve, CER, top down, bottom up), target costing
The time value of money	1	Simple interest, compound interest, economic equivalence concept, cash-flow diagrams, PW, FW, AW
Evaluating a single project	1	MARR, present worth method, bond value, capitalized worth, internal rate of return, external rate of return, payback method
Comparison and selection among alternatives	1	Investment and cost alternatives, study period, equal and unequal useful lives, rate-of-return method, imputed market value
Depreciation and income taxes	1	SL and DB depreciation methods, book value, after-tax MARR, marginal income tax rate, gain(loss) on asset disposal, after-tax economic analysis general procedure, EVA,
Price changes and exchange rates	1	Actual dollars, real dollars, inflation, fixed and responsive annuities, exchange rates, purchasing power
Replacement analysis	1	Determining economic life of challenger, determining economic life of defender, abandonment, after-tax replacement study
Evaluating projects with the benefit-cost ratio method	1	Benefits, costs, dis-benefits, self-liquidating projects, multi-purpose projects, interest rate vs. public project, conventional B-C ratio PW and AW method, modified B-C ratio PW and AW method
Breakeven and sensitivity analysis	1	Breakeven analysis, sensitivity analysis, spider plot
Probabilistic risk analysis	1	Sources of uncertainty, discrete and continuous variables, probability trees, Monte Carlo simulation example, decision trees, real options analysis
The capital budgeting process	1	Capital financing and allocation, equity capital and CAPM, WACC, WACC relation to MARR, opportunity cost
Decision making considering multiattributes	1	Non-compensatory models (dominance, satisficing, disjunctive resolution, lexicography), compensatory models (non-dimensional scaling, additive weight)
Final test	1	90 minutes, concept questions, calculation task (option of choice)

Additionally, students will submit three reports during the course on given engineering economy subjects. Also, required are the five lab participations (ca.60 min/each) for each student. Additionally, three exercise sessions (ca.60 min/each), where use of Ms-Excel will be practiced for solving various engineering economy tasks, should be completed

【Textbook】 Engineering Economy 15th ed. William G. Sullivan (2011)

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 -This course is highly recommended for those who attend " Project Management in Engineering course , Small group working method

【Independent Study Outside of Class】

【Web Sites】 The web-site is listed in the home page of the GL education center.

【Additional Information】 Students are requested to check in advance whether the credits of this course are counted as the units for graduation requirement at department level. The course starts on Oct.2nd.

Project Management in Engineering

エンジニアリングプロジェクトマネジメント

【Code】 10i049 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 4th 【Location】 A2-308 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu

Assoc.Prof. Lintuluoto, J. Assoc. Prof. Tanaka

【Course Description】 This course provides a basic knowledge required for the project management in various engineering fields such as process design, plant design, construction, and R&D projects. Also, visiting lecturers from industry and public works provide management insights of actual engineering projects.

【Grading】 Evaluated by assignments (project report exercise) and class contribution

【Course Goals】 This course will help students gain a fundamental knowledge of what project management in engineering is. Throughout the course, students will learn various tools applied in project management. Students will also understand the importance of costs and money, risks, leadership, and environmental assessment in managing engineering projects. This course is followed with the course Seminar on Project Management in Engineering. in the second semester.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	4/13 (Matsumoto) Course guidance
Special lecture by extramural instructor 1	1	4/20 (Inaoka(JICA))@A2-306 Project management in the case of Japanese ODA
Introduction to project management	1	4/27 (Maeda) Introduction to project management Project phases
Tools for project management I	1	5/11 (Lintuluoto) Tools for project management, cost, and cash flows I
Tools for project management II	1	5/18 (Lintuluoto) Tools for project management, cost, and cash flows II
Tools for project management III	1	5/25 (Lintuluoto) Tools for project management, cost, and cash flows III
Project scheduling I	1	6/1 (Ashida) Project scheduling I
Project scheduling II	1	6/8 (Ashida) Project scheduling II
Leadership I	1	6/15 (Tanaka) Leadership I
Leadership II	1	6/22 (Tanaka) Leadership II
Risk management I	1	6/29 (Matsumoto) Risk management I
Risk management II	1	7/6 (Matsumoto) Risk management II
Environmental Impact Assessment	1	7/13 (Yorozu) Environmental Impact Assessment
Special lecture by extramural instructor 2	1	7/20 (Kumagai(JGC CORPORATION)) To be announced
Feedback	1	7/27 (Matsumoto) Feedback

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 1. Lock, Dennis. Project Management. 10th edition. Gower Publishing Ltd.

2. Cleland, David L., and Lewis R. Ireland. Project Management. 5th edition. McGraw-Hill Professional

3. Roger Miller and Donald R. Lessard. The strategic management of large engineering projects, Shaping Institutions, Risks, and Governance, The MIT Press

【Prerequisite(s)】 No pre-requisite

【Independent Study Outside of Class】

【Web Sites】 The web-site is opened in the home page of the GL education center.

【Additional Information】

Exercise on Project Management in Engineering

エンジニアリングプロジェクトマネジメント演習

【Code】 10i059 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day & Period】 Friday 4th period and 5th period 【Location】 B-Cluster 2F Seminar Room 【Credits】 2

【Restriction】 Student number will be limited. 【Lecture Form(s)】 Seminar 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu
Assoc.Prof. Lintuluoto

【Course Description】 In this course, students will apply the engineering know-how and the skills of management, and group leadership which they learned in the course of Project Management in Engineering to build and carry out a virtual inter-engineering project. This course provides a forum where students' team-plan based on ideas and theories, decision making, and leadership should produce realistic engineering project outcomes. The course consists of intensive group work, presentations, and a few intermediate discussions. A written report will be required.

【Grading】 Report, class activity, presentation

【Course Goals】 This course prepares engineering students to work with other engineers within a large international engineering project. In particular this course will focus on leadership and management of projects along with applied engineering skills where the students learn various compromises, co-operation, responsibility, and ethics.

【Course Topics】

Theme	Class number of times	Description
		10/5
Guidance	1	Introduction to Exercise on Project Management in Engineering Lecture on tools for the Project management in engineering Practice
Teamwork	7	Each project team may freely schedule the group works within given time frame. The course instructors are available if any need is required.
Mid-term presentation	1	Each project team will have a mid-term presentation.
Lecture & Teamwork	2	Some lectures will be provided, such as Leadership structuring, Risk Management, and Environmental Impact Assessment, depending on projects you propose.
Presentation	1	Each project team will have a presentation based on its proposed project.

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 Fundamental skills about group leading and communication, scientific presentation.

【Independent Study Outside of Class】

【Web Sites】 The web-site will be opened in the home page of the GL education center.

【Additional Information】 The number of students may be restricted. Students are requested to check in advance whether the credit from this course will be accepted as a graduation requirement for their department.

Micro/Nano Scale Material Engineering

マイクロ・ナノスケール材料工学

【Code】10Z101 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】3, 4, 5, 6 September 【Location】C3-Lecture Room 3 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Intensive Lecture 【Language】English

【Instructor】TABATA,HIRAKATA,HOJO,ADACHI,TSUCHIYA,YOKOKAWA,SUMIGAWA,INOUE,NAKAMURA,KAME,(Aichi Institute of Technology) NAMAZU, (Seoul National University) KIM

【Course Description】This class lectures specific mechanical properties and behavior of micro to nano scale materials, underlying mechanism of those properties and behavior and characterization method. Furthermore, techniques of measurements, analysis and structural design of biomaterial such as protein and DNA which are expected to be utilized as micro nano scale materials are lectured.

【Grading】The evaluation will be based on the reports given in each lecture. (All reports submission is mandatory.)

【Course Goals】Educate engineers and researchers with fundamental knowledge on specific mechanical properties and behavior of micro to nano scale materials. They can promote industrial application of micro and nano materials based on the deep understanding about how specific mechanical properties and behavior of micro to nano scale materials dominate performance, reliability and lifetime of MEMS (Micro Electromechanical Systems), microsystems and micro scale components.

【Course Topics】

Theme	Class number of times	Description
Outline	1	In this lecture, application examples of micro and nano scale material on devices and importance of mechanical properties and its behavior on device characteristics are described. (Tabata)
Fracture and fatigue mechanism of materials in the micro- and nano- meter scale	4	We explain fundamentals on the fracture and fatigue mechanism of materials in the micro- and nano-meter scale. At first, the characteristic properties of deformation and fracture in small components such as thin films, wires, dots etc. are discussed in terms of the solid mechanics. Focus is put on the interface strength of dissimilar materials as well including the effect of fatigue, creep and environment. Then, we explain the characteristics and mechanisms of "size effects" on the strength of micro- and nano-materials. As a representative example of materials with microscale structures, properties of composite materials are lectured. Characterization of microscopic components such as fibers and matrices are explained from the view points of the difference from bulk materials. Testing methods and properties of fiber/matrix interface are described. The relationship between the deformation and fracture of microscopic components and those of macroscopic composite materials are explained including the underlying mechanism. Explanation is also made to anisotropy of elastic properties and strength. (Hirakata, Sumigawa, Hojo)
Mechanical properties of Silicon	1	Silicon, one of the most widely used materials in micro/nano devices, is used not only a semiconductor material but also a mechanical material because of its superior mechanical properties. In this lecture, the properties of silicon, such as physical, electrical, mechanical, electro-mechanical properties, will be presented in the view point of a mechanical structural material. Especially the lecture will focus on the elastic properties, piezoresistive effect, and fracture/fatigue properties of silicon, indispensable for designing micro/nano-devices. (Tsuchiya)
Characterization of micro nano material	1	In this class, first I will lecture the evaluation method for the mechanical properties of micro and nano-scale materials used for MEMS and semiconductor devices. Several representative experimental techniques for micro and nano mechanical testing will be presented and explained. Then I will lecture representative functional materials, such as shape memory alloy films and self-propagating exothermic foils, and lecture regarding the possibility of their application to MEMS. (Namazu)
Piezoresistive effect of micro and nano material	2	In this theme, we will study the fundamental concepts of electronic-state theory and band structures to represent behavior of electrons in materials, and will discuss the electromechanical properties of materials based on the electronic-state theory. In particular, the principle and features of the piezoresistive effect, the change in the electrical resistivity due to mechanical stresses and strains, will be derived from the band structures of materials. The mechanisms of scale dependence of piezoresistivity in nanoscale materials such as silicon, carbon nanotube, and graphene will be also discussed. (Nakamura)
Bio/Nano material (1)	2	In tissue adaptation, regeneration and stem cell differentiation in tissue morphogenesis, cellular functional activities such as cell migration and division are regulated by complex mechano-chemical couplings at molecular level. To understand such a hierarchical dynamics from nanoscopic molecular events to microscopic cellular dynamics, we will discuss analysis of the molecular and cellular mechanical behaviors as bio-nano materials by integrating experiments, mathematical modeling and computer simulations. (Adachi, Inoue)
Bio/Nano material (2)	1	Cells are well regulated their fates and functions by extracellular microenvironments, consisted with chemical/physical cues and cell-cell interaction at a nano/micro-meter scale. This lecture provides an insight of design methods of biomaterials and their applications to recapitulate extracellular microenvironments. (Kamei)
Bio/Nano material (3)	1	Motor proteins are nano-scale actuators in vivo. Their active functions can be reconstructed in vitro to be utilized as a driving source of micro/nano systems. This lecture introduces fundamentals of their mechanical properties and molecular design methods. (Yokokawa)
Bio/Nano material (4)	1	This lecture describes DNA nanotechnology to construct nanoscale structures using DNA as a structural material. Fundamental knowledge, design methodology and application of DNA origami technique are focused. (Kim)
Feedback	1	

【Textbook】

【Textbook(supplemental)】Biomaterial: Bionano material: Mechanics of Motor Proteins & the Cytoskeleton, Jonathon Howard, Sinauer Associates (January 2001)

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】This lecture is provided as a part of NIP (Nanotech Innovation Professional) course of the Nanotech Career-up Alliance (Nanotech CUPAL) project.

General Material Chemistry

材料化学総論

【Code】10P011 【Course Year】Master 2nd 【Term】1st term 【Class day & Period】 【Location】 【Credits】

【Restriction】 【Lecture Form(s)】Seminar 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Chemical Industry, Advanced

化学産業特論

【Code】10P111 【Course Year】Master Course 【Term】Summer

【Class day & Period】July 26 & 27, 2017; 13:30~16:30 【Location】 【Credits】0.5 【Restriction】No Restriction

【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】Dr. Tadatsugu Tanino (Sawai Pharmaceutical Co.,Ltd.)

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Inorganic Solid-State Chemistry

無機固体化学

【Code】10H205 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 H.Kageyama,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	4	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Electrochemistry Advanced

電気化学特論

【Code】10H200 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 T.Abe,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	2	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Chemistry of Functional Interfaces

機能性界面化学

【Code】10H215 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 T.Sakka,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	5	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Catalysis in Organic Reactions

有機触媒化学

【Code】10H213 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Department of Energy and Hydrocarbon Chemistry, Professor, K.Ohe

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Total synthesis of Minfiensine	2	
Total synthesis of Vitamin E	1	
Total synthesis of (+)-Laurenyne	1	
Total synthesis of (+)-Laurenyne	2	
Total synthesis of Miriaporone 4	2	
Total synthesis of BIRT-377	1	
Total synthesis of Ningalin D	1	
Total synthesis of Sporolide B	1	
Total synthesis of (-)-Tetrodotoxin	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Biomedical Engineering

先端医工学

【Code】10H209 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Thu 2nd

【Location】A2-304 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	3	
	2	
	2	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Chemical Conversion of Carbon Resources

資源変換化学

【Code】10H217 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Wed 2nd 【Location】A2-303

【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】R. Abe

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
(1) Introduction of chemical conversion of resources	1	
(2) Chemical conversion using semiconductor photocatalysts	1	
(3) Hydrogen production from water using photocatalysts (1)	1	
(4) Hydrogen production from water using photocatalysts (2)	1	
(5) Reduction of CO ₂ using photocatalysts	1	
(6) Fine chemical synthesis using photocatalysts	1	
(7) Basic science of catalysis	1	
(8) Hydrogen production from fossil resources	1	
(9) Petroleum refinery process (1)	1	
(10) Petroleum refinery process (2)	1	
(11) Biomass technology and future energy carriers	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Chemistry of Organometallic Complexes

有機錯体化学

【Code】 10H210 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Mon 2nd 【Location】 A2-303 【Credits】
 【Restriction】 No Restriction 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 Tsuji, Terao,
 【Course Description】 Basic organometallic chemistry including history, structure, bonding, reactions, and survey of various metal complexes is lectured.
 Several typical catalytic reactions are explicated on the basis of elementary steps in organometallic chemistry such as ligand substitution, oxidative
 addition, reductive elimination, and insertion reactions.

【Grading】 Graded by written examination

【Course Goals】 Acquirement of basic idea of:

1. General properties of transition metal organometallic complexes
2. Reactivity of transition metal organometallic compounds
3. Homogeneous catalysis of practical importance
4. Recent research trends in homogeneous catalysis

【Course Topics】

Theme	Class number of times	Description
Introduction	1	History Application Research trends Zaise salt Grignard reagent Alkyl lithium Ferrocene
General properties of organometallic complexes	1	Bonding Structure in general Coordination number -Structure μ -Structure
Organometallic seminar (1)	1	Number of d- and s-electrons Classification and the nature of ligands Effect of complexation Formal charge Electron counting 18-electron rule Oxidation state
General properties and reactivities of transition metal organometallic complexes	3	Several important steps in transition-metal complex catalyzed reactions are discussed, including coordination, oxidative addition, insertion, reductive elimination.
Recent research trends in homogeneous catalysis (1)	1	Wacker process Various cross-coupling reaction Mizoroki-Heck reaction
Recent research trends in homogeneous catalysis (2)	1	C-H and C-C bond activation
Organometallics in materials science (1)	2	Asymmetric catalysis
Organometallics in materials science (2)	1	Structural materials
Organometallic seminar (2)	1	Electronic and optoelectronic applications

【Textbook】 No textbooks are used.

【Textbook(supplemental)】 R.H.Crabbtree, The Organometallic Chemistry of the Transition Metals Fourth Edition; Wiley-Interscience: Hoboken, 2005.

【Prerequisite(s)】 Basic knowledge in organic chemistry, physical chemistry, and inorganic chemistry is requisite.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Design of Solid Catalysts

固体触媒設計学

【Code】10H218 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】K.Eguchi,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	2	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Material Transformation Chemistry

物質変換化学

【Code】 10H222 【Course Year】 Master and Doctor Course 【Term】 【Class day & Period】 Wed 2nd

【Location】 A2-303 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Prof. M.Nakamura, Assoc. Prof. H. Takuya, (Assistant Profs. K. Isozaki and T. Iwamoto),

【Course Description】 This course explains the basic chemistry of functional organometallics, aiming to help students understand the syntheses/structures/reactivities/functions of these compounds with a focus on applications in molecular transformation and organic synthesis.

【Grading】 examinations (quizzes in classes and final achievement test)

【Course Goals】 To gain molecular-level insight into the reactivity and photo- and electro-functions of organometallic compounds based on elements science and to be able to apply it to the students' daily research, hopefully.

【Course Topics】

Theme	Class number of times	Description
course guidance and introduction	1	4/11 course guidance/introduction/assessment test
syntheses, properties, and applications of functional metal nano particles	6	4/18-5/30 main group organometallics in molecular transformations
syntheses, properties, and applications of organo main group metal compounds	4	6/6-6/27 transition metal organometallic in photo- and electro-functional materials

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 knowledge of undergraduate organic chemistry

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This course is provided at Uji campus in the odd-number academic years and at Katsura campus in the even-number academic years.

Structural Organic Chemistry

構造有機化学

【Code】10H219 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Tue 5th 【Location】

【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】Y.Murata,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	1	
	1	
	1	
	1	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Radiochemistry, Adv.

放射化学特論

【Code】10H238 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Thu 2nd

【Location】A2-303 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】T.Ohtsuki,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Seminar on Energy & Hydrocarbon Chemistry (A)

物質エネルギー化学特別セミナー A

【Code】10H208 【Course Year】Master 2nd 【Term】1st term 【Class day & Period】 【Location】 【Credits】

【Restriction】 【Lecture Form(s)】Intensive Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	6	
	5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Organic Chemistry

先端有機化学

【Code】10H818 【Course Year】Master Course 【Term】 【Class day & Period】Tue 1st 【Location】A2-306

【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Professor Jun-ichi Yoshida and other professors

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Chemoselectivity	2	Introduction and chemoselectivity
Regioselectivity	2	Controlled Aldol Reactions
Stereoselectivity	2	Stereoselective Aldol Reactions
Strategies	2	Alternative Strategies for Enone Synthesis
Choosing a Strategy	2	The Synthesis of Cyclopentenones
Summary	2	Summary and outlook

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Organotransition Metal Chemistry 1

有機金属化学 1

【Code】 10H041 【Course Year】 Master Course 【Term】 【Class day & Period】 Fri 1st 【Location】 A2-306

【Credits】 1.5 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Nakamura, Matsubara, Suginome, Tsuji, Kurahashi, Omura, Murakami

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Organomagnesium compounds	1	Synthesis, structure, and reaction of organomagnesium compounds
Organolithium compounds	1	Synthesis, structure, and reaction of organolithium compounds
Organozinc compounds	1	Synthesis, structure, and reaction of organozinc compounds
Organoboron compounds	1	Synthesis, structure, and reaction of organoboron compounds
Organosilicon compounds	1	Synthesis, structure, and reaction of organosilicon compounds
Organocopper compounds	1	Synthesis, structure, and reaction of organocopper compounds
Rare earth metals	1	Synthesis, structure, and reaction of rare earth metals
Other transition-metal compounds	1	Synthesis, structure, and reaction of other transition-metal compounds such as Ti, Zr, Cr, and Fe
Basic reaction of organotransition-metal compounds	1	Ligand substitution reaction, oxidative addition, oxidative cyclization, reductive elimination, transmetallation, carbonyl insertion
Catalytic enantioselective reaction	1	Enantioselective hydrogenation, enantioselective oxidation (Sharpless reactions), enantioselective C-C bond formation
Coupling reaction	1	C-C Bond forming reactions (cross coupling reactions)

【Textbook】 none

【Textbook(supplemental)】 J. F. Hartwig, Organotransition metal chemistry. From bonding to catalysis., University Science Books, Mill Valley, CA, 2010.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Organotransition Metal Chemistry 2

有機金属化学 2

【Code】10H042 【Course Year】Master Course 【Term】 【Class day & Period】 【Location】 【Credits】1.5

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Ozawa, Murakami, Kondo, Nakao, Ohuchi, Kurahashi, Miki

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	2	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Energy and Hydrocarbon Chemistry, Adv. I

物質エネルギー化学特論第一

【Code】 10D228 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Atsushi Wakamiya, Takafumi Yamamoto, and Ken-ichi Amano

【Course Description】 (A): Lecture of x-ray diffraction on powder

(B): Lecture of translational entropy

【Grading】 Attendance and report

【Course Goals】 (A): Understanding of x-ray diffraction on powder

(B): Understanding of translational entropy

【Course Topics】

Theme	Class number of times	Description
Crystal structure analysis	4	Explanation of crystal structure analysis
Translational entropy	3	Explanation of translational entropy
	1	

【Textbook】 No textbooks are used.

【Textbook(supplemental)】

【Prerequisite(s)】 Basic knowledge in chemistry is requisite.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Energy and Hydrocarbon Chemistry, Adv. II

物質エネルギー化学特論第二

【Code】 10D229 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】
 Atsushi Takamiya
 Takafumi Yamamoto
 Ken-ichi Amano

【Course Description】 Lecture for developments of functional materials (e.g., Solar cell, Organic LED).

【Grading】 Attendance and Report (short test)

【Course Goals】 Understanding of mechanisms of the functional materials.

【Course Topics】

Theme	Class number of times	Description
Inorganic and organic functional materials	7	Explanation of the inorganic and organic functional materials
Feedback	1	

【Textbook】 There is no mandatory textbook.

【Textbook(supplemental)】

【Prerequisite(s)】 A basic inorganic/organic chemistry background is necessary.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Energy and Hydrocarbon Chemistry, Adv. III

物質エネルギー化学特論第三

【Code】10D230 【Course Year】Master Course 【Term】1st term 【Class day & Period】Tue 2nd

【Location】A2-303 【Credits】1 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Fujihara, Tomita, (KUICR) Hashikawa

【Course Description】 This course will provide the overview of some of the Nobel Prize in Chemistry as well as the Nobel Prize in Physics, in the scientific points of view. In the latter part of the course, group works will be provided to have some knowledge for presentation and discussion.

【Grading】 This course will be evaluated on texts, reports and group works.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Guidance	1	Overview of this course.
Lecture (1)	1	Frontier orbit theory and Diels-Alder reaction (Fujihara)
Lecture (2)	1	Olefin metathesis (Fujihara)
Lecture (3)	1	Cross coupling reactions (Fujihara)
Lecture (4)	1	Catalytic Asymmetric reactions (Fujihara)
Lecture (5)	1	Structures of proteins: X-ray analysis and Mass spectroscopy (Fujihara)
Lecture (6)	1	Semiconductors (Tomita)
Lecture (7)	1	Scanning electron microscope (Tomita)
Lecture (8)	1	Fullerenes and graphenes (Hashikawa)
Lecture (9)	1	Nuclear magnetic resonances (Hashikawa)
Exercise	4	Group Works (Fujihara, Tomita, Hashikawa)
Feedback	1	Feedback of this course (Fujihara)

【Textbook】 No textbooks. Handouts will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】 Fundamental knowledge in organic, physical, and inorganic chemistry at the undergraduate level.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Energy and Hydrocarbon Chemistry, Adv. IV

物質エネルギー化学特論第四

【Code】10D231 【Course Year】Master Course 【Term】1st term 【Class day & Period】Tue 2nd

【Location】A2-303 【Credits】1 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Fujihara, Tomita, (KUICR) Hashikawa

【Course Description】Equivalent to Energy and Hydrocarbon Chemistry, Adv. III

【Grading】Equivalent to Energy and Hydrocarbon Chemistry, Adv. III

【Course Goals】Equivalent to Energy and Hydrocarbon Chemistry, Adv. III

【Course Topics】

Theme	Class number of times	Description
Guidance	1	Overview of this course.
Lecture (1)	1	Frontier orbit theory and Diels-Alder reaction (Fujihara)
Lecture (2)	1	Olefin metathesis (Fujihara)
Lecture (3)	1	Cross coupling reactions (Fujihara)
Lecture (4)	1	Catalytic Asymmetric reactions (Fujihara)
Lecture (5)	1	Structures of proteins: X-ray analysis and Mass spectroscopy (Fujihara)
Lecture (6)	1	Semiconductors (Tomita)
Lecture (7)	1	Scanning electron microscope (Tomita)
Lecture (8)	1	Fullerenes (Hashikawa)
Lecture (9)	1	Nuclear magnetic resonances (Hashikawa)
Exercise	4	Group Works (Fujihara, Tomita, Hashikawa)
Feedback	1	Feedback of this course (Fujihara)

【Textbook】Equivalent to Energy and Hydrocarbon Chemistry, Adv. III

【Textbook(supplemental)】Equivalent to Energy and Hydrocarbon Chemistry, Adv. III

【Prerequisite(s)】Equivalent to Energy and Hydrocarbon Chemistry, Adv. III

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Energy and Hydrocarbon Chemistry, Adv. V

物質エネルギー化学特論第五

【Code】10D232 【Course Year】Master Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】H.Masuda,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	4	
	4	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Energy and Hydrocarbon Chemistry, Adv. IV

物質エネルギー化学特論第六

【Code】10D233 【Course Year】Master Course 【Term】 【Class day & Period】 【Location】 【Credits】2

【Restriction】 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	4	
	3	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Energy and Hydrocarbon Chemistry, Adv. VII

物質エネルギー化学特論第七

【Code】 10D235 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Intensive Lecture 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Energy and Hydrocarbon Chemistry, Adv. VIII

物質エネルギー化学特論第八

【Code】 10D236 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Intensive Lecture 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Advanced Material Science and Technology (11 times course)**(English lecture)**

先端マテリアルサイエンス通論 (11 回コース) (英語科目)

【Code】 10i053 【Course Year】 Master and Doctor Course 【Term】 Spring term 【Class day & Period】 Fri 5th 【Location】 A2-306 【Credits】 1.5

【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 ER Center, J. Assoc. Prof., Ryuichi Ashida

Related professors

【Course Description】 The various technologies used in the field of material science serve as bases for so-called high technologies, and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】 The average score of the best four reports is employed.

Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Tumor Imaging and Therapy through Photoirradiation	1	The overview of current modalities through photoirradiation as well as the preparation of tumor imaging probes is given. Tumor therapy through photoirradiation is also shown in the lecture. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Carbon Nanorings	1	The preparation of carbon nanorings is outlined in the lecture. The supramolecular interaction as well as the photophysical properties of carbon nanorings is summarized. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Crystal Structure Analysis by Powder X-ray Diffraction Measurement	1	Chemical and physical properties of a material is strongly related with the structure of the material. So, structure analysis is one of the most important part in material researches. Powder X-ray diffraction analysis is powerful way to analyze the crystal structure of solid materials. We study how to use powder X-ray diffraction analysis for material researches. (T. Yamamoto: Dept. of Energy and Hydrocarbon Chemistry)
Principles and Applications of Fluorescence Spectroscopy	1	Fluorescence spectroscopy is applied to various disciplines of science and engineering, and provides unique information of a system upon photo-illumination. This course aims to introduce the background of fluorescence spectroscopy and practical knowledge in fluorescence experiments. (J. Park: Dept. of Molecular Engineering)
Synthesis of Novel -Conjugated Molecules with Main Group Elements	1	The lecture will show synthesis and properties of novel -conjugated molecules with main group elements, and their application as functional materials. (T. Higashino: Dept. of Molecular Engineering)
Chemistry of Asymmetric Catalysis Stereoselective Synthesis of Optically Active Pharmaceutical Compounds	1	This class will outline the progress on enantioselective catalysis for the asymmetric synthesis of optically active pharmaceutical compounds such as Herbesser, which is a blockbuster drug developed in a Japanese pharmaceutical company. (K. Asano: Dept. of Material Chemistry)
Electrical Conductivity of Conjugated Polymers and Application to Organic Electronics	1	In this class, structure and property of conjugated polymers are introduced and discussed. The discussion topics include the brief history of the discovery of electrical conductivity of conjugated polymers, mechanism of electrical conductivity in polymer chains, representative evaluation methods of conductivity for conjugated polymers, relationship between molecular and self-assembled structures of conjugated polymers, and recent examples of device applications using conjugated polymers. (I. Sakurai: Dept. of Molecular Engineering)
An Introduction to Smart Shape Changing Materials	1	This course will briefly introduce smart materials as a whole and will then focus specifically on the recent and very active field of smart shape changing materials. We will explore how the design and stimuli-sensitivity of various materials can allow for materials to have planned and useful motion. (K. Landenberger: Dept. of Polymer Chemistry)
Properties of Cementitious Materials and the Future	2	CEMENT may not necessarily be an advanced material, but must surely be a forefront material for human life and society, in the past, present and future. Then, what are your demands to cement? (A. Hattori: Dept. of Urban Management)
Application of Electrical Discharge to Material and Environmental Technology	1	(N. Sano: Dept. of Chemical Engineering)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Advanced Material Science and Technology (15 times course)

(English lecture)

先端マテリアルサイエンス通論 (15 回コース) (英語科目)

【Code】10i054 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 5th 【Location】A2-306 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture

【Language】English

【Instructor】ER Center, J. Assoc. Prof., Ryuichi Ashida
Related professors

【Course Description】The various technologies used in the field of material science serve as bases for so-called high technologies, and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】The average score of the best five reports is employed.
Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Tumor Imaging and Therapy through Photoirradiation	1	The overview of current modalities through photoirradiation as well as the preparation of tumor imaging probes is given. Tumor therapy through photoirradiation is also shown in the lecture. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Carbon Nanorings	1	The preparation of carbon nanorings is outlined in the lecture. The supramolecular interaction as well as the photophysical properties of carbon nanorings is summarized. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Crystal Structure Analysis by Powder X-ray Diffraction Measurement	1	Chemical and physical properties of a material is strongly related with the structure of the material. So, structure analysis is one of the most important part in material researches. Powder X-ray diffraction analysis is powerful way to analyze the crystal structure of solid materials. We study how to use powder X-ray diffraction analysis for material researches. (T. Yamamoto: Dept. of Energy and Hydrocarbon Chemistry)
Principles and Applications of Fluorescence Spectroscopy	1	Fluorescence spectroscopy is applied to various disciplines of science and engineering, and provides unique information of a system upon photo-illumination. This course aims to introduce the background of fluorescence spectroscopy and practical knowledge in fluorescence experiments. (J. Park: Dept. of Molecular Engineering)
Synthesis of Novel π -Conjugated Molecules with Main Group Elements	1	The lecture will show synthesis and properties of novel π -conjugated molecules with main group elements, and their application as functional materials. (T. Higashino: Dept. of Molecular Engineering)
Chemistry of Asymmetric Catalysis Stereoselective Synthesis of Optically Active Pharmaceutical Compounds	1	This class will outline the progress on enantioselective catalysis for the asymmetric synthesis of optically active pharmaceutical compounds such as Herbesser, which is a blockbuster drug developed in a Japanese pharmaceutical company. (K. Asano: Dept. of Material Chemistry)
Electrical Conductivity of Conjugated Polymers and Application to Organic Electronics	1	In this class, structure and property of conjugated polymers are introduced and discussed. The discussion topics include the brief history of the discovery of electrical conductivity of conjugated polymers, mechanism of electrical conductivity in polymer chains, representative evaluation methods of conductivity for conjugated polymers, relationship between molecular and self-assembled structures of conjugated polymers, and recent examples of device applications using conjugated polymers. (I. Sakurai: Dept. of Molecular Engineering)
An Introduction to Smart Shape Changing Materials	1	This course will briefly introduce smart materials as a whole and will then focus specifically on the recent and very active field of smart shape changing materials. We will explore how the design and stimuli-sensitivity of various materials can allow for materials to have planned and useful motion. (K. Landenberger: Dept. of Polymer Chemistry)
Properties of Cementitious Materials and the Future	2	CEMENT may not necessarily be an advanced material, but must surely be a forefront material for human life and society, in the past, present and future. Then, what are your demands to cement? (A. Hattori: Dept. of Urban Management)
Application of Electrical Discharge to Material and Environmental Technology	1	(N. Sano: Dept. of Chemical Engineering)
Theory of Precision Cutting, Grinding, Polishing and Related Properties of Materials	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Metrology and Control Theory for Precision Manufacturing, and Applications	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Fabrication of Inorganic Nanofiber by Electrospinning	1	When a high voltage is applied to a polymer solution, the solution is sprayed as thread-like droplets, and turns to polymer nanofibers. This fiber forming technique is called electrospinning. This lecture will give a brief introduction on the fabrication of nanofibers of inorganic materials including metal oxide and carbon by electrospinning. (S. Nagamine: Dept. of Chemical Engineering)
Solid Surface Analysis, Including a Potential Method: Tip-Enhanced Raman Spectroscopy	1	Surface analytical techniques each have their own analytical volume. The students learn about the volume, and look at an issue for tip-enhanced Raman spectroscopy, a nanoscale Raman spectroscopy, as a potential surface analytical technique. (M. Nishi: Dept. of Material Chemistry)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Modern Science and Technology (4 times course) (English lecture)

現代科学技術特論 (4回コース) (英語科目)

【Code】10i055 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 5th

【Location】A2-306 【Credits】0.5 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】English

【Instructor】 ER Center, J. Assoc. Prof., Ashida
ER Center, J. Assoc. Prof., Matsumoto
ER Center, J. Assoc. Prof., Maeda
ER Center, J. Assoc. Prof., Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '4 times course' should select one of the topics and attend the lectures. (Students who take '8 times course' should attend the lectures of the both topics.) Attend a course orientation held before the first lecture (Nov. 1) even if you take only the second topic.

Advanced Modern Science and Technology (8 times course) (English lecture)

現代科学技術特論 (8 回コース) (英語科目)

【Code】 10i056 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 5th

【Location】 A2-306 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】	ER	Center,	J.	Assoc.	Prof.,	Ashida
	ER	Center,	J.	Assoc.	Prof.,	Matsumoto
	ER	Center,	J.	Assoc.	Prof.,	Maeda
	ER	Center,	J.	Assoc.	Prof.,	Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '8 times course' should attend the lectures of the both topics. (Students who take '4 times course' should select one of the topics and attend the lectures.)

Instrumental Analysis, Adv.

先端科学機器分析及び実習

【Code】 10D043 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】

【Location】 A2-307 【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Instrumental Analysis, Adv.

先端科学機器分析及び実習

【Code】 10D046 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】

【Location】 A2-307 【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (6H course)

現代科学技術の巨人セミナー「知のひらめき」(6Hコース)

【Code】10i051 【Course Year】Doctor Course 【Term】First term, intensive

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】0.5

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 6H course, students have to select two classes and will earn 0.5 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (12H course)

現代科学技術の巨人セミナー「知のひらめき」(12Hコース)

【Code】10i052 【Course Year】Doctor Course 【Term】First term/Spring term

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】1

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 12H course, students have to complete all four classes and will earn 1 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later
Topic 3	2	Detail will be announced later
Topic 4	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Exercise in Practical Scientific English

実践的科学英語演習

【Code】 10i045 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Thu 4th or 5th 【Location】 A2-304

【Credits】 1 【Restriction】 Up to 20 students for each class 【Lecture Form(s)】 Seminar 【Language】 English (Japanese)

【Instructor】 M. Nishikawa, R. Matsumoto, R. Ashida, M. Maeda,

【Course Description】 This course is open to all master and doctoral engineering students. It is designed to help students understand how to write a research paper step by step. In this course, the students will write a short research paper (i.e. Extended Research Abstract for Proceeding, approx. 1000 -1500 words) on a topic drawn from assigned readings.

【Grading】 Evaluation based on 30% participation, 40% reports, 30% final paper *More than twice unexcused absence can result in course failure

【Course Goals】 The primary goal of this course is to deepen an understanding of the main features of each part of a scientific paper (IMRaD). Throughout the course, students will develop the core competencies required for language, grammar, and style to produce a research manuscript in English.

【Course Topics】

Theme	Class number of times	Description
Unit 1: Course Overview	1	Course Overview: Introduction to writing scientific research articles
Unit 2: Introduction	1	Raising awareness of the register of science research articles (genre, audience, purpose)
Unit 3: Preparing to Write	1	Writing a proposal for a research paper, using corpus-based approach (Exercise: Creating own Corpus)
Unit 4: Preparing to Write	1	Paraphrasing ideas from source texts, using citations and references in formal writing
Unit 5: Writing Processes	1	Identifying the “ moves ” for an Abstract section by hint expressions
Unit 6: Writing Processes	1	Writing an Abstract (Title) & peer feedback
Unit 7: Writing Processes	1	Identifying the “ moves ” for an Introduction section by hint expressions
Unit 8: Writing Processes	1	Writing an Introduction section & peer feedback
Unit 9: Writing Processes	1	Writing a Method section & peer feedback
Unit 10: Writing Processes	1	Writing a Result section & peer feedback
Unit 11: Writing Processes	1	Writing a Discussion and a Conclusion section
Unit 12: Writing Processes	1	Writing a cover letter to reviewers and how to respond to reviewers
Unit 13: Monitoring and Revising	1	Online feedback
Unit 14: Monitoring and Revising	1	Revising a paper based on peer feedback
Unit 15: Submission	1	Final Paper Due, August 6.

【Textbook】 Handout materials will be supplied by the instructor.

【Textbook(supplemental)】 ALESS (2012). Active English for Science- 英語で科学する - レポート、論文、プレゼンテーション . The University of Tokyo Press. Cargill, M., & O'Connor, P. (2013). Writing scientific research articles: Strategy and steps. John Wiley & Sons. Cowell, R., & She, L. (2015). Mastering the Basics of Technical English 『技術英語の基礎』 . 2nd Ed., Corona Publishing. 野口ジュディー・深山晶子・岡本真由美 . (2007) . 『理系英語のライティング』 . アルク

【Prerequisite(s)】 Students who intend to join this course must attend the first class.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 We may restrict the class size to enhance students ' learning. Students who intend to join the course are required to attend the first-day guidance. Office Hours: (by appointment) nishikawa.mikako7w@kyoto-u.ac.jp (Ext. 2052)

Experiments & Exercises in Energy and Hydrocarbon Chemistry, Adv.

物質エネルギー化学特別実験及演習

【Code】 10D234 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 8 【Restriction】 No Restriction 【Lecture Form(s)】 Seminar and Exercise 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	30	
	10	
	10	
	10	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Energy and Hydrocarbon Chemistry Special Seminar 1

物質エネルギー化学特別セミナー 1

【Code】 10S204 【Course Year】 Doctor 1st 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Energy and Hydrocarbon Chemistry Special Seminar 2

物質エネルギー化学特別セミナー 2

【Code】 10S205 【Course Year】 Doctor 2nd 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Energy and Hydrocarbon Chemistry Special Seminar 3

物質エネルギー化学特別セミナー 3

【Code】 10S206 【Course Year】 Doctor 2nd 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Statistical Thermodynamics

統計熱力学

【Code】10H401 【Course Year】Master Course 【Term】 【Class day & Period】Thu 2nd 【Location】A2-306

【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Hirofumu Sato

【Course Description】Many of the substances around us are condensed systems where countless molecules gather. In this lecture, we aim to understand the behavior of various condensing systems from the viewpoint of statistical mechanics. Starting from the basics of statistical mechanics, we will learn statistical mechanics dealing with realistic systems of countless molecules.

【Grading】Class participation and attendance + final report/examination

【Course Goals】Confirm the fundamentals of thermodynamics and statistical mechanics, as well as acquire the idea of statistical mechanics to understand various phenomena.

【Course Topics】

Theme	Class number of times	Description
Fundamentals of statistical mechanics	2	Fundamentals of statistical mechanics, Phase space, Micro canonical ensemble, Grand canonical ensemble, Partition function
Fundamentals of statistical mechanics for quantum system	4	Fermi statistics, Bose statistics
Systems consisting of interacting molecules	5	Imperfect gas, Cluster expansion, Distribution function

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】basics of thermodynamics and statistical mechanics in undergraduate course

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantum Chemistry

量子化学

【Code】10H405 【Course Year】Master Course 【Term】 【Class day & Period】 【Location】 【Credits】1.5

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】Tohru Sato

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	2	
	1	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantum Chemistry

量子化学

【Code】10H406 【Course Year】Master Course 【Term】 【Class day & Period】Mon 1st 【Location】A2-304

【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Hirofumi Sato

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	2	
	2	
	1	
	2	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Molecular Spectroscopy

分子分光学

【Code】 10H408 【Course Year】 Master and Doctor Course 【Term】 【Class day & Period】 【Location】

【Credits】 1.5 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 Japanese

【Instructor】 Itoh, Watanabe, Mizuochi, related faculty

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	4	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Biomolecular Function Chemistry

生体分子機能化学

【Code】 10H448 【Course Year】 Master and Doctor Course 【Term】 (not held; biennially)

【Class day & Period】 Mon 2nd 【Location】 A2-304 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Shirakawa, Sugase

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	3	
	2	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Molecular Materials

分子機能材料

【Code】 10H413 【Course Year】 Master and Doctor Course 【Term】 (not held; biennially)

【Class day & Period】 Wed 2nd 【Location】 A2-304 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 A. Ito

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	3	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Catalysis Science at Molecular Level

分子触媒学

【Code】 10H416 【Course Year】 Master and Doctor Course 【Term】 【Class day & Period】 Fri 2nd

【Location】 A2-304 【Credits】 1.5 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Tsunehiro Tanaka, Kentaro Teramura

【Course Description】 Fourier Transform for XAFS Analysis ; Introduction to Catalytic Science

【Grading】 Reports

【Course Goals】 Learning and acquiring fundamentals of catalytic chemistry and XAFS

【Course Topics】

Theme	Class number of times	Description
Four transform in solid state mechanics	1	X-ray scattering, Reciprocal lattice vector, Quantum well, Fourier Transform, Delta function
Application of Fourier transform and Crystallography	2	Fick's solid diffusion, Green function, Lattice Fourier expansion, Crystal lattice, Reciprocal lattice, Classification of crystals, diffraction by crystallite, Laue factor, Laue & Bragg condition
Hydrogen-like in two dimension	1	self learning
EXAFS Analysis	1	EXAFS analysis
Application of EXAFS	1	Examples and Recent topics
Introduction to catalytic science	3	Phenomena and basic concepts in catalysis
Catalysis and photocatalysis	2	Examples of catalysis and photocatalysis
confirmation of achievement	1	Report

【Textbook】 No text book.

【Textbook(supplemental)】

【Prerequisite(s)】 Knowledge of physical chemistry like quantum chemistry, thermodynamics and spectroscopy is preferred.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Catalysis Science at Molecular Level 2

分子触媒学統論

【Code】 10P416 【Course Year】 Master and Doctor Course 【Term】 【Class day & Period】 【Location】

【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Hosokawa

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Molecular Photochemistry 2

分子光化学統論

【Code】 10P417 【Course Year】 Master and Doctor Course 【Term】 【Class day & Period】 【Location】

【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Hiroshi Imahori, Tomokazu Umeyama, Jaehong Park

【Course Description】 We will discuss the photoinduced energy and electron transfer dynamics in molecular systems

【Grading】 By the final report (95%) + class participation and attendance (5%)

【Course Goals】 To understand the photoinduced energy and electron transfer dynamics in molecular systems

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction to excited-state dynamics in molecular systems
Laser spectroscopic methods	1	Description to steady-state and time-resolved laser spectroscopic methods to study excited-state dynamics
Photoinduced Energy Transfer	1	Description of photoinduced energy transfer dynamics, case studies of photoinduced energy transfer processes
Photoinduced Energy Transfer	1	Description of photoinduced electron transfer dynamics, case studies of photoinduced electron transfer processes

【Textbook】 No textbook

【Textbook(supplemental)】 Modern Molecular Photochemistry (by N. Turro)

【Prerequisite(s)】 Undergraduate level of Physical Chemistry and English

【Independent Study Outside of Class】 It will be given doing the course.

【Web Sites】 <https://park-group.wixsite.com/park-group>

【Additional Information】 This course will be opened every two years and will not be available in 2017 fiscal year.

Office hour: (Location and Time: Katsura campus, A4-205, appointment by email) Instructor: Jaehong Park

(email: j.park@moleng.kyoto-u.ac.jp)

Condensed Matter Physical Chemistry

物性物理化学

【Code】 10H423 【Course Year】 Master and Doctor Course 【Term】 (not held; biennially)

【Class day & Period】 Fri 2nd 【Location】 A2-304 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Seki, related faculty

【Course Description】 First Half: Statistical physics of macromolecular configurations and their correlation to the macroscopic properties including opto-electronic properties of conjugated polymer materials. Second Half: Classical and Quantum mechanical aspects on interaction of light, electromagnetic waves and ionizing radiations with matters, leading to the sophisticated spectroscopic techniques to probe electronic structures of molecular materials in their condensed phases and aggregates

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Statistical physics of chain molecules	3	Starting from the classical statistical mechanics of chain molecules, we discuss on the sophisticated Flory-Huggins theory of macromolecules, Ising models, as well as worm-like chain molecules.
Backbone configuration and properties	3	Macroscopic physical properties of macromolecules including opto-electronic properties of conjugated polymer chains are discussed in terms of backbone configuration and their modulations.
Interaction of light and electromagnetic waves with matters	2	Starting from the classical theory of electronic transition of molecules, the overall aspects of electromagnetic wave interaction with matters are discussed leading to classical and quantum mechanical pictures of Fermi golden rule.
Theory of interaction cross sections	2	Elastic and inelastic interaction (collision) is discussed in terms of generalized cross sectional view of the interaction starting from Bethe theory.
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Quantum Materials Science

量子物質科学

【Code】 10H427 【Course Year】 Master and Doctor Course 【Term】 【Class day & Period】 Wed 3rd

【Location】 ICR N-338C 【Credits】 1.5 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】 Tokuda

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Molecular Rheology

分子レオロジー

【Code】 10H428 【Course Year】 Master and Doctor Course 【Term】 spring semester

【Class day & Period】 Wed 2nd 【Location】 ICR N-338C 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 mostly Japanese (occasionally English)

【Instructor】 H. Watanabe, Y. Matsumiya

【Course Description】 Lecture is given for the rheology and dynamics of polymeric liquids and their molecular basis.

【Grading】 Mainly with report

【Course Goals】 Understanding phenomenological aspect of rheology in general and molecular aspect of polymer rheology.

【Course Topics】

Theme	Class number of times	Description
Basics of Rheology	1	Rheology and its role in science and engineering, flow / deformation/ stress, viscosity, modulus
Rheological behavior of matter	1	Rheological behavior of matter and classification, viscoelasticity, non-Newtonian flow, plastic flow
Viscoelastic relaxations	2	Boltzmann's principle, relaxation functions, relaxation time, conversion among response functions, complex modulus
Viscoelasticity and temperature	1	Glass transition, time-temperature superposition, WLF equation
Stress expression of polymers	2	Stress expression, tension / free-energy / distribution-function of subchains
Rouse/Zimm model	1	Model description, model equation, derivation of stress and relaxation modulus, discussion on the relaxation behavior
tube model	2	Model description, model equation, derivation of stress and relaxation modulus, discussion on the relaxation behavior, comparison to Rouse dynamics
feedback of evaluation and confirmation of level of understanding	1	Feedback of evaluation of report etc, and confirmation of level of understanding

【Textbook】 Original text will be distributed in the class

【Textbook(supplemental)】 Y Matsushita ed, Structure and Property of Polymers (Kodansha)

M Doi & S F Edwards The Theory of Polymer Dynamics (Oxford press)

W Graessley Polymeric Liquids & Networks: Dynamics and Rheology (Garland Science)

【Prerequisite(s)】 Some basics on differential equations and statistical physics of polymers

【Independent Study Outside of Class】

【Web Sites】 <http://rheology.minority.jp>

【Additional Information】

Molecular Porous Physical Chemistry

分子細孔物理化学

【Code】 10H430 【Course Year】 Master and Doctor Course 【Term】 Fall 【Class day & Period】 【Location】

【Credits】 1.5 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 Easan Sivaniah

【Course Description】 This course will discuss the physical chemistry and engineering application of porous materials in the areas of adsorption and membrane separation processes.

【Grading】 The course grade will be determined based on in class tests and a final report.

【Course Goals】 The intention of this course is to allow students to become familiar with a range of porous materials, and the practical ways such materials are used. Although the course is not intended to be exhaustive in covering all porous materials and all applications, examples will be followed that are relevant to socially important problems, such as global warming, or water shortage.

【Course Topics】

Theme	Class number of times	Description
Overview	1	Introduction to course, and broad overview of porous materials
Thermodynamics of Mixing	2	Phase equilibria and structure formation processes
Adsorptive processes	2	Physical chemistry of adsorptive processes in porous materials
Diffusive processes	2	Physical chemistry of diffusion limited processes in porous materials
Case Study: Membrane Processes for liquid separation	2	Liquid filtration systems for nanofiltration, desalination
Case Study: Membrane Processes for gas separation	2	Membrane separation processes for carbon dioxide capture

【Textbook】

【Textbook(supplemental)】 Suggested text book lists will be provided during the course

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】 <http://pureosity.org/en/>

【Additional Information】

Laboratory and Exercises in Molecular Engineering I

分子工学特別実験及演習

【Code】 10D432 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 4 【Restriction】 【Lecture Form(s)】 Experiment and Exercise 【Language】 Japanese

【Instructor】 related faculty

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	7	
	16	
	7	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Laboratory and Exercises in Molecular Engineering I I

分子工学特別実験及演習

【Code】10D433 【Course Year】Master Course 【Term】1st+2nd term 【Class day & Period】 【Location】

【Credits】4 【Restriction】 【Lecture Form(s)】Experiment and Exercise 【Language】Japanese

【Instructor】related faculty

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	7	
	16	
	7	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Molecular Engineering, Adv. IA

分子工学特論第一 A

【Code】 10D439 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Molecular Engineering, Adv. IB

分子工学特論第一 B

【Code】 10D445 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Molecular Engineering, Adv. IIA

分子工学特論第二 A

【Code】 10D440 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Molecular Engineering, Adv. IIB

分子工学特論第二 B

【Code】 10D447 【Course Year】 Master Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	8	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Molecular Engineering, Adv.

分子工学特論第三

【Code】10H436 【Course Year】Master Course 【Term】2nd term 【Class day & Period】 【Location】 【Credits】

【Restriction】 【Lecture Form(s)】 Intensive Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	5.5	
	5.5	
	5.5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Molecular Engineering, Adv. V

分子工学特論第五

【Code】10D438 【Course Year】Master and Doctor Course 【Term】1st+2nd term 【Class day & Period】 【Location】 【Credits】2 【Restriction】No Restriction

【Lecture Form(s)】Lecture 【Language】 【Instructor】Ravi Subramanian

【Course Description】 This course is designed to provide a comprehensive and general overview of all aspects related to solar energy utilization. The course begins with a basic discussion on the science of solar energy and a historical perspective of this topic. This is followed by a discussion on subjects related to materials development, technological advancement, and future potential.

【Grading】 One final exam will be conducted at the end of the course. It will be for 100 points.

¹ All lecture content would be supported with PowerPoint presentations. ² Prof. Imahori Lab demonstration. ³ Open notes allowed for Part B. only.

【Course Goals】 The goals of the course are to i) demonstrate to the students that solar energy is an evolving and interdisciplinary topic, ii) emphasize that a collaborative understanding of the concepts related to the traditional topics of physics, chemistry, and biology are required, and iii) indicate that several approaches are required to be considered to harvest the full potential of the sun.

【Course Topics】

Theme	Class number of times	Description
Fundamentals ¹	1	Fundamental of solar energy processes. Properties of light, atomic structure and light-matter interaction at the atomic level, fundamental problems related to light
History	1	Historical aspects and earlier attempts to solar energy utilization. Here we will discuss pre-historic and preliminary approaches to solar energy conversion, the timelines, evolution of the concepts, and current trends
Materials	1	Photocatalyst: Types and synthesis approach. The common types of photoactive materials, the various generic approaches to the synthesis of these materials including composites
Materials characteristics	1	Photocatalyst: Characterization. The methods used to characterize the optical, surface, electronic, and photocatalytic properties of the photoactive materials
Concepts (PV)	1	Solar-to-electric conversion. Mechanism of solar-to-electric conversion, materials properties, types of solar cells, concept of efficiency measurements
Concepts (Eco)	1	Environmental remediation. Photocatalytic process applied to various types of liquid and gas phase pollutant conversion to less toxic and benign products
Concept (Fuel)	1	Solar-assisted water splitting. Special case of clean fuel production from water using solar ? based technologies, some representative configurations for designing photocatalyst for improving the splitting processes
Concept (Eco)	1	CO ₂ conversion. CO ₂ activation processes, interaction between CO ₂ and H-source to produce hydrocarbon, challenge and importance of catalyst design
Biological system	1	Solar-driven biochemical processes. Biological processes that use solar energy for value added product formation limited to algae and bacteria ? based processes for biofuel production
High temperature solar system	1	Solar thermal processes. The principle of operation and focus on the concentrated solar power approach with a little discussion on value-added product formation using emerging technologies at the interface of CSPs
Applications	1	Laboratory demonstration of assembly of a solar cell and testing of the device. An integrated video demonstration of the assembly of a state-of-the-art solar cell using current research grade materials and measuring efficiency ²
Applications	1	Examples of commercial systems operating on solar energy utilization. Identifying various solar energy utilizing facilities throughout the world, its main objective, and impact on the local communities
Future	1	Advantages and challenges to solar energy utilization. Comparison of solar energy with other technology areas and determining its similarity and differences (limitations) with those of other green technologies
Reminiscence	1	Question answer session. On this day the students can participate in a discussion on any concept related to the topics discussed in the last 12 weeks.
Exam	1	Final Exam. On this day the students will be tested on the content presented over the last 12 weeks. The exam will be in 2 part (A+B) & open notes. ³ Structure: a) objectives (Fill in blanks, True/False, Matching, 1 line and 3-4 lines questions)
Outcomes	16	Results and Feedback. The exam results will be provided to each student within 3 days. They will have an opportunity to meet with me to discuss any modifications/concerns. Final results will then be posted. Feedback accepted.

【Textbook】 Class notes and power point presentation

【Textbook(supplemental)】 None

【Prerequisite(s)】 1st year chemistry, physics, biology, and mathematics

【Independent Study Outside of Class】

【Web Sites】 None

【Additional Information】 Meeting time can be scheduled on an as required basis. Please email ravisv@unr.edu

Vaidyanathan (Ravi) Subramanian Associate Professor Director, SOLAR Lab Chemical and Materials Engineering Department University of Nevada, Reno LME 309, MS 388 89557-NV, USA Ph (775) 784 4686, Fax (775) 327 5059 <http://wolfweb.unr.edu/homepage/ravisv/>

Copyright: Elsevier Publications, All rights Reserved? [Take notes only please] Currently this course is unavailable.

Molecular Engineering, Adv.

分子工学特論第六

【Code】10P439 【Course Year】Master Course 【Term】 【Class day & Period】 【Location】 【Credits】0.5

【Restriction】 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】Tsunehiro Tanaka, related faculty

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Molecular Engineering, Adv.

分子工学特論第七

【Code】 10P440 【Course Year】 Master Course 【Term】 【Class day & Period】 【Location】 【Credits】 0.5

【Restriction】 【Lecture Form(s)】 Relay Lecture 【Language】 Japanese

【Instructor】 Higashino, Sakurai, related faculty

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Japan Gateway Project Seminar

JGP セミナー

【Code】 10P448 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day & Period】 Announced before opening the course 【Location】 Announced before opening the course

【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Intensive Lecture 【Language】 English

【Instructor】 C-PIER, Distinguished visiting project professor
6 chemistry-related departments, Professors related to the subjects

【Course Description】 This is a series of lectures which are carried out by the professors who are invited with Japan Gateway: Kyoto University Top Global Program (JGP). By attending a lecture from the world top level professors, this course aims to grasping the newest trend of the specific field and extending the view of thinking.

【Grading】 Attendance at a series of four lectures or more is requested. The report assigned in the lecture and/or the result of final examination are used for evaluation.

【Course Goals】 Understand the fundamental and/or latest contents of a field of chemistry or chemical engineering in English, and obtain the skill of discussing the related contents in English.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】 A copy of related contents is offered.

【Textbook(supplemental)】 Announced in the lecture.

【Prerequisite(s)】 The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Professors of the faculty of engineering who are doing similar research support a student's study. In some cases, this course consists of a series of lectures by two or more researchers.

Japan Gateway Project Seminar

JGP セミナー

【Code】 10P450 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day & Period】 Announced before opening the course 【Location】 Announced before opening the course

【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Intensive Lecture 【Language】 English

【Instructor】 C-PIER, Distinguished visiting project professor
6 chemistry-related departments, Professors related to the subjects

【Course Description】 This is a series of lectures which are carried out by the professors who are invited with Japan Gateway: Kyoto University Top Global Program (JGP). By attending a lecture from the world top level professors, this course aims to grasping the newest trend of the specific field and extending the view of thinking.

【Grading】 Attendance at a series of four lectures or more is requested. The report assigned in the lecture and/or the result of final examination are used for evaluation.

【Course Goals】 Understand the fundamental and/or latest contents of a field of chemistry or chemical engineering in English, and obtain the skill of discussing the related contents in English.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】 A copy of related contents is offered.

【Textbook(supplemental)】 Announced in the lecture.

【Prerequisite(s)】 The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Professors of the faculty of engineering who are doing similar research support a student's study. In some cases, this course consists of a series of lectures by two or more researchers.

Japan Gateway Project Seminar

JGP セミナー

【Code】 10P452 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day & Period】 Announced before opening the course 【Location】 Announced before opening the course

【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Intensive Lecture 【Language】 English

【Instructor】 C-PIER, Distinguished visiting project professor
6 chemistry-related departments, Professors related to the subjects

【Course Description】 This is a series of lectures which are carried out by the professors who are invited with Japan Gateway: Kyoto University Top Global Program (JGP). By attending a lecture from the world top level professors, this course aims to grasping the newest trend of the specific field and extending the view of thinking.

【Grading】 Attendance at a series of four lectures or more is requested. The report assigned in the lecture and/or the result of final examination are used for evaluation.

【Course Goals】 Understand the fundamental and/or latest contents of a field of chemistry or chemical engineering in English, and obtain the skill of discussing the related contents in English.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】 A copy of related contents is offered.

【Textbook(supplemental)】 Announced in the lecture.

【Prerequisite(s)】 The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Professors of the faculty of engineering who are doing similar research support a student's study. In some cases, this course consists of a series of lectures by two or more researchers.

Japan Gateway Project Seminar

JGP セミナー

【Code】 10P454 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day & Period】 Announced before opening the course 【Location】 Announced before opening the course

【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Intensive Lecture 【Language】 English

【Instructor】 C-PIER, Distinguished visiting project professor
6 chemistry-related departments, Professors related to the subjects

【Course Description】 This is a series of lectures which are carried out by the professors who are invited with Japan Gateway: Kyoto University Top Global Program (JGP). By attending a lecture from the world top level professors, this course aims to grasping the newest trend of the specific field and extending the view of thinking.

【Grading】 Attendance at a series of four lectures or more is requested. The report assigned in the lecture and/or the result of final examination are used for evaluation.

【Course Goals】 Understand the fundamental and/or latest contents of a field of chemistry or chemical engineering in English, and obtain the skill of discussing the related contents in English.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】 A copy of related contents is offered.

【Textbook(supplemental)】 Announced in the lecture.

【Prerequisite(s)】 The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Professors of the faculty of engineering who are doing similar research support a student's study. In some cases, this course consists of a series of lectures by two or more researchers.

Japan Gateway Project Seminar

JGP セミナー

【Code】 10P456 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day & Period】 Announced before opening the course 【Location】 Announced before opening the course

【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Intensive Lecture 【Language】 English

【Instructor】 C-PIER, Distinguished visiting project professor
6 chemistry-related departments, Professors related to the subjects

【Course Description】 This is a series of lectures which are carried out by the professors who are invited with Japan Gateway: Kyoto University Top Global Program (JGP). By attending a lecture from the world top level professors, this course aims to grasping the newest trend of the specific field and extending the view of thinking.

【Grading】 Attendance at a series of four lectures or more is requested. The report assigned in the lecture and/or the result of final examination are used for evaluation.

【Course Goals】 Understand the fundamental and/or latest contents of a field of chemistry or chemical engineering in English, and obtain the skill of discussing the related contents in English.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】 A copy of related contents is offered.

【Textbook(supplemental)】 Announced in the lecture.

【Prerequisite(s)】 The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Professors of the faculty of engineering who are doing similar research support a student's study. In some cases, this course consists of a series of lectures by two or more researchers.

Japan Gateway Project Seminar

JGP セミナー

【Code】 10P457 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day & Period】 Announced before opening the course 【Location】 Announced before opening the course

【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Intensive Lecture 【Language】 English

【Instructor】C-PIER, Distinguished visiting project professor 6 chemistry-related departments, Professors related to the subjects

【Course Description】 This is a series of lectures which are carried out by the professors who are invited with Japan Gateway: Kyoto University Top Global Program (JGP). By attending a lecture from the world top level professors, this course aims to grasping the newest trend of the specific field and extending the view of thinking.

【Grading】 Attendance at a series of four lectures or more is requested. The report assigned in the lecture and/or the result of final examination are used for evaluation.

【Course Goals】 Understand the fundamental and/or latest contents of a field of chemistry or chemical engineering in English, and obtain the skill of discussing the related contents in English.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】 A copy of related contents is offered.

【Textbook(supplemental)】 Announced in the lecture.

【Prerequisite(s)】 The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Professors of the faculty of engineering who are doing similar research support a student's study. In some cases, this course consists of a series of lectures by two or more researchers.

Japan Gateway Project Seminar

JGP セミナー

【Code】 10P459 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day & Period】 Announced before opening the course 【Location】 Announced before opening the course

【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】C-PIER, Distinguished visiting project professor 6 chemistry-related departments, Professors related to the subjects

【Course Description】 This is a series of lectures which are carried out by the professors who are invited with Japan Gateway: Kyoto University Top Global Program (JGP). By attending a lecture from the world top level professors, this course aims to grasping the newest trend of the specific field and extending the view of thinking.

【Grading】 Attendance at a series of four lectures or more is requested. The report assigned in the lecture and/or the result of final examination are used for evaluation.

【Course Goals】 Understand the fundamental and/or latest contents of a field of chemistry or chemical engineering in English, and obtain the skill of discussing the related contents in English.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】 A copy of related contents is offered.

【Textbook(supplemental)】 Announced in the lecture.

【Prerequisite(s)】 The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Professors of the faculty of engineering who are doing similar research support a student's study. In some cases, this course consists of a series of lectures by two or more researchers.

Japan Gateway Project Seminar

JGP セミナー

【Code】 10P461 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day & Period】 Announced before opening the course 【Location】 Announced before opening the course

【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】C-PIER, Distinguished visiting project professor 6 chemistry-related departments, Professors related to the subjects

【Course Description】 This is a series of lectures which are carried out by the professors who are invited with Japan Gateway: Kyoto University Top Global Program (JGP). By attending a lecture from the world top level professors, this course aims to grasping the newest trend of the specific field and extending the view of thinking.

【Grading】 Attendance at a series of four lectures or more is requested. The report assigned in the lecture and/or the result of final examination are used for evaluation.

【Course Goals】 Understand the fundamental and/or latest contents of a field of chemistry or chemical engineering in English, and obtain the skill of discussing the related contents in English.

【Course Topics】

Theme	<small>Class number of times</small>	Description
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】 A copy of related contents is offered.

【Textbook(supplemental)】 Announced in the lecture.

【Prerequisite(s)】 The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Professors of the faculty of engineering who are doing similar research support a student's study. In some cases, this course consists of a series of lectures by two or more researchers.

Japan Gateway Project Seminar

JGP セミナー

【Code】 10P463 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day & Period】 Announced before opening the course 【Location】 Announced before opening the course

【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】C-PIER, Distinguished visiting project professor 6 chemistry-related departments, Professors related to the subjects

【Course Description】 This is a series of lectures which are carried out by the professors who are invited with Japan Gateway: Kyoto University Top Global Program (JGP). By attending a lecture from the world top level professors, this course aims to grasping the newest trend of the specific field and extending the view of thinking.

【Grading】 Attendance at a series of four lectures or more is requested. The report assigned in the lecture and/or the result of final examination are used for evaluation.

【Course Goals】 Understand the fundamental and/or latest contents of a field of chemistry or chemical engineering in English, and obtain the skill of discussing the related contents in English.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】 A copy of related contents is offered.

【Textbook(supplemental)】 Announced in the lecture.

【Prerequisite(s)】 The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Professors of the faculty of engineering who are doing similar research support a student's study. In some cases, this course consists of a series of lectures by two or more researchers.

Japan Gateway Project Seminar

JGP セミナー

【Code】 10P465 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day & Period】 Announced before opening the course 【Location】 Announced before opening the course

【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】C-PIER, Distinguished visiting project professor 6 chemistry-related departments, Professors related to the subjects

【Course Description】 This is a series of lectures which are carried out by the professors who are invited with Japan Gateway: Kyoto University Top Global Program (JGP). By attending a lecture from the world top level professors, this course aims to grasping the newest trend of the specific field and extending the view of thinking.

【Grading】 Attendance at a series of four lectures or more is requested. The report assigned in the lecture and/or the result of final examination are used for evaluation.

【Course Goals】 Understand the fundamental and/or latest contents of a field of chemistry or chemical engineering in English, and obtain the skill of discussing the related contents in English.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】 A copy of related contents is offered.

【Textbook(supplemental)】 Announced in the lecture.

【Prerequisite(s)】 The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Professors of the faculty of engineering who are doing similar research support a student's study. In some cases, this course consists of a series of lectures by two or more researchers.

Japan Gateway Project Seminar ?

JGP セミナー

【Code】 10P467 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day & Period】 Announced before opening the course 【Location】 Announced before opening the course

【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】C-PIER, Distinguished visiting project professor 6 chemistry-related departments, Professors related to the subjects

【Course Description】 This is a series of lectures which are carried out by the professors who are invited with Japan Gateway: Kyoto University Top Global Program (JGP). By attending a lecture from the world top level professors, this course aims to grasping the newest trend of the specific field and extending the view of thinking.

【Grading】 Attendance at a series of four lectures or more is requested. The report assigned in the lecture and/or the result of final examination are used for evaluation.

【Course Goals】 Understand the fundamental and/or latest contents of a field of chemistry or chemical engineering in English, and obtain the skill of discussing the related contents in English.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】 A copy of related contents is offered.

【Textbook(supplemental)】 Announced in the lecture.

【Prerequisite(s)】 The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Professors of the faculty of engineering who are doing similar research support a student's study. In some cases, this course consists of a series of lectures by two or more researchers.

Japan Gateway Project Seminar ?

JGP セミナー

【Code】 10P469 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day & Period】 Announced before opening the course 【Location】 Announced before opening the course

【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 C-PIER, Distinguished visiting project professor
6 chemistry-related departments, Professors related to the subjects

【Course Description】 This is a series of lectures which are carried out by the professors who are invited with Japan Gateway: Kyoto University Top Global Program (JGP). By attending a lecture from the world top level professors, this course aims to grasping the newest trend of the specific field and extending the view of thinking.

【Grading】 Attendance at a series of four lectures or more is requested. The report assigned in the lecture and/or the result of final examination are used for evaluation.

【Course Goals】 Understand the fundamental and/or latest contents of a field of chemistry or chemical engineering in English, and obtain the skill of discussing the related contents in English.

【Course Topics】

Theme	<small>Class number of times</small>	Description
Introduction	1	The contents of a series of seminar are explained.
Intensive lectures of the specific theme	2	For a given theme, a series of lectures is executed.
Summary	1	The contents of a series of seminar are summarized, and the exercise for evaluating the level of understanding is executed.

【Textbook】 A copy of related contents is offered.

【Textbook(supplemental)】 Announced in the lecture.

【Prerequisite(s)】 The basic knowledge for understanding the specific theme and the ability of understanding the lecture in English are requested.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Professors of the faculty of engineering who are doing similar research support a student's study. In some cases, this course consists of a series of lectures by two or more researchers.

JGP 計算実習 (MO)

【Code】10P471 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Advanced Material Science and Technology (11 times course)

(English lecture)

先端マテリアルサイエンス通論 (11 回コース) (英語科目)

【Code】 10i053 【Course Year】 Master and Doctor Course 【Term】 Spring term 【Class day & Period】 Fri 5th 【Location】 A2-306 【Credits】 1.5

【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 ER Center, J. Assoc. Prof., Ryuichi Ashida

Related professors

【Course Description】 The various technologies used in the field of material science serve as bases for so-called high technologies, and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】 The average score of the best four reports is employed.

Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Tumor Imaging and Therapy through Photoirradiation	1	The overview of current modalities through photoirradiation as well as the preparation of tumor imaging probes is given. Tumor therapy through photoirradiation is also shown in the lecture. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Carbon Nanorings	1	The preparation of carbon nanorings is outlined in the lecture. The supramolecular interaction as well as the photophysical properties of carbon nanorings is summarized. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Crystal Structure Analysis by Powder X-ray Diffraction Measurement	1	Chemical and physical properties of a material is strongly related with the structure of the material. So, structure analysis is one of the most important part in material researches. Powder X-ray diffraction analysis is powerful way to analyze the crystal structure of solid materials. We study how to use powder X-ray diffraction analysis for material researches. (T. Yamamoto: Dept. of Energy and Hydrocarbon Chemistry)
Principles and Applications of Fluorescence Spectroscopy	1	Fluorescence spectroscopy is applied to various disciplines of science and engineering, and provides unique information of a system upon photo-illumination. This course aims to introduce the background of fluorescence spectroscopy and practical knowledge in fluorescence experiments. (J. Park: Dept. of Molecular Engineering)
Synthesis of Novel -Conjugated Molecules with Main Group Elements	1	The lecture will show synthesis and properties of novel -conjugated molecules with main group elements, and their application as functional materials. (T. Higashino: Dept. of Molecular Engineering)
Chemistry of Asymmetric Catalysis Stereoselective Synthesis of Optically Active Pharmaceutical Compounds	1	This class will outline the progress on enantioselective catalysis for the asymmetric synthesis of optically active pharmaceutical compounds such as Herbesser, which is a blockbuster drug developed in a Japanese pharmaceutical company. (K. Asano: Dept. of Material Chemistry)
Electrical Conductivity of Conjugated Polymers and Application to Organic Electronics	1	In this class, structure and property of conjugated polymers are introduced and discussed. The discussion topics include the brief history of the discovery of electrical conductivity of conjugated polymers, mechanism of electrical conductivity in polymer chains, representative evaluation methods of conductivity for conjugated polymers, relationship between molecular and self-assembled structures of conjugated polymers, and recent examples of device applications using conjugated polymers. (I. Sakurai: Dept. of Molecular Engineering)
An Introduction to Smart Shape Changing Materials	1	This course will briefly introduce smart materials as a whole and will then focus specifically on the recent and very active field of smart shape changing materials. We will explore how the design and stimuli-sensitivity of various materials can allow for materials to have planned and useful motion. (K. Landenberger: Dept. of Polymer Chemistry)
Properties of Cementitious Materials and the Future	2	CEMENT may not necessarily be an advanced material, but must surely be a forefront material for human life and society, in the past, present and future. Then, what are your demands to cement? (A. Hattori: Dept. of Urban Management)
Application of Electrical Discharge to Material and Environmental Technology	1	(N. Sano: Dept. of Chemical Engineering)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Advanced Material Science and Technology (15 times course)

(English lecture)

先端マテリアルサイエンス通論 (15 回コース) (英語科目)

【Code】10i054 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 5th 【Location】A2-306 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture

【Language】English

【Instructor】ER Center, J. Assoc. Prof., Ryuichi Ashida
Related professors

【Course Description】The various technologies used in the field of material science serve as bases for so-called high technologies, and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】The average score of the best five reports is employed.
Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Tumor Imaging and Therapy through Photoirradiation	1	The overview of current modalities through photoirradiation as well as the preparation of tumor imaging probes is given. Tumor therapy through photoirradiation is also shown in the lecture. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Carbon Nanorings	1	The preparation of carbon nanorings is outlined in the lecture. The supramolecular interaction as well as the photophysical properties of carbon nanorings is summarized. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Crystal Structure Analysis by Powder X-ray Diffraction Measurement	1	Chemical and physical properties of a material is strongly related with the structure of the material. So, structure analysis is one of the most important part in material researches. Powder X-ray diffraction analysis is powerful way to analyze the crystal structure of solid materials. We study how to use powder X-ray diffraction analysis for material researches. (T. Yamamoto: Dept. of Energy and Hydrocarbon Chemistry)
Principles and Applications of Fluorescence Spectroscopy	1	Fluorescence spectroscopy is applied to various disciplines of science and engineering, and provides unique information of a system upon photo-illumination. This course aims to introduce the background of fluorescence spectroscopy and practical knowledge in fluorescence experiments. (J. Park: Dept. of Molecular Engineering)
Synthesis of Novel π -Conjugated Molecules with Main Group Elements	1	The lecture will show synthesis and properties of novel π -conjugated molecules with main group elements, and their application as functional materials. (T. Higashino: Dept. of Molecular Engineering)
Chemistry of Asymmetric Catalysis Stereoselective Synthesis of Optically Active Pharmaceutical Compounds	1	This class will outline the progress on enantioselective catalysis for the asymmetric synthesis of optically active pharmaceutical compounds such as Herbesser, which is a blockbuster drug developed in a Japanese pharmaceutical company. (K. Asano: Dept. of Material Chemistry)
Electrical Conductivity of Conjugated Polymers and Application to Organic Electronics	1	In this class, structure and property of conjugated polymers are introduced and discussed. The discussion topics include the brief history of the discovery of electrical conductivity of conjugated polymers, mechanism of electrical conductivity in polymer chains, representative evaluation methods of conductivity for conjugated polymers, relationship between molecular and self-assembled structures of conjugated polymers, and recent examples of device applications using conjugated polymers. (I. Sakurai: Dept. of Molecular Engineering)
An Introduction to Smart Shape Changing Materials	1	This course will briefly introduce smart materials as a whole and will then focus specifically on the recent and very active field of smart shape changing materials. We will explore how the design and stimuli-sensitivity of various materials can allow for materials to have planned and useful motion. (K. Landenberger: Dept. of Polymer Chemistry)
Properties of Cementitious Materials and the Future	2	CEMENT may not necessarily be an advanced material, but must surely be a forefront material for human life and society, in the past, present and future. Then, what are your demands to cement? (A. Hattori: Dept. of Urban Management)
Application of Electrical Discharge to Material and Environmental Technology	1	(N. Sano: Dept. of Chemical Engineering)
Theory of Precision Cutting, Grinding, Polishing and Related Properties of Materials	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Metrology and Control Theory for Precision Manufacturing, and Applications	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Fabrication of Inorganic Nanofiber by Electrospinning	1	When a high voltage is applied to a polymer solution, the solution is sprayed as thread-like droplets, and turns to polymer nanofibers. This fiber forming technique is called electrospinning. This lecture will give a brief introduction on the fabrication of nanofibers of inorganic materials including metal oxide and carbon by electrospinning. (S. Nagamine: Dept. of Chemical Engineering)
Solid Surface Analysis, Including a Potential Method: Tip-Enhanced Raman Spectroscopy	1	Surface analytical techniques each have their own analytical volume. The students learn about the volume, and look at an issue for tip-enhanced Raman spectroscopy, a nanoscale Raman spectroscopy, as a potential surface analytical technique. (M. Nishi: Dept. of Material Chemistry)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Modern Science and Technology (4 times course) (English lecture)

現代科学技術特論 (4 回コース) (英語科目)

【Code】 10i055 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 5th

【Location】 A2-306 【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 ER Center, J. Assoc. Prof., Ashida
ER Center, J. Assoc. Prof., Matsumoto
ER Center, J. Assoc. Prof., Maeda
ER Center, J. Assoc. Prof., Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '4 times course' should select one of the topics and attend the lectures. (Students who take '8 times course' should attend the lectures of the both topics.) Attend a course orientation held before the first lecture (Nov. 1) even if you take only the second topic.

Advanced Modern Science and Technology (8 times course) (English lecture)

現代科学技術特論（8回コース）（英語科目）

【Code】10i056 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 5th

【Location】A2-306 【Credits】1 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】English

【Instructor】 ER Center, J. Assoc. Prof., Ashida
ER Center, J. Assoc. Prof., Matsumoto
ER Center, J. Assoc. Prof., Maeda
ER Center, J. Assoc. Prof., Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '8 times course' should attend the lectures of the both topics. (Students who take '4 times course' should select one of the topics and attend the lectures.)

Exercise in Practical Scientific English

実践的科学英語演習

【Code】 10i045 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Thu 4th or 5th 【Location】 A2-304

【Credits】 1 【Restriction】 Up to 20 students for each class 【Lecture Form(s)】 Seminar 【Language】 English (Japanese)

【Instructor】 M. Nishikawa, R. Matsumoto, R. Ashida, M. Maeda,

【Course Description】 This course is open to all master and doctoral engineering students. It is designed to help students understand how to write a research paper step by step. In this course, the students will write a short research paper (i.e. Extended Research Abstract for Proceeding, approx. 1000 -1500 words) on a topic drawn from assigned readings.

【Grading】 Evaluation based on 30% participation, 40% reports, 30% final paper *More than twice unexcused absence can result in course failure

【Course Goals】 The primary goal of this course is to deepen an understanding of the main features of each part of a scientific paper (IMRaD). Throughout the course, students will develop the core competencies required for language, grammar, and style to produce a research manuscript in English.

【Course Topics】

Theme	Class number of times	Description
Unit 1: Course Overview	1	Course Overview: Introduction to writing scientific research articles
Unit 2: Introduction	1	Raising awareness of the register of science research articles (genre, audience, purpose)
Unit 3: Preparing to Write	1	Writing a proposal for a research paper, using corpus-based approach (Exercise: Creating own Corpus)
Unit 4: Preparing to Write	1	Paraphrasing ideas from source texts, using citations and references in formal writing
Unit 5: Writing Processes	1	Identifying the “ moves ” for an Abstract section by hint expressions
Unit 6: Writing Processes	1	Writing an Abstract (Title) & peer feedback
Unit 7: Writing Processes	1	Identifying the “ moves ” for an Introduction section by hint expressions
Unit 8: Writing Processes	1	Writing an Introduction section & peer feedback
Unit 9: Writing Processes	1	Writing a Method section & peer feedback
Unit 10: Writing Processes	1	Writing a Result section & peer feedback
Unit 11: Writing Processes	1	Writing a Discussion and a Conclusion section
Unit 12: Writing Processes	1	Writing a cover letter to reviewers and how to respond to reviewers
Unit 13: Monitoring and Revising	1	Online feedback
Unit 14: Monitoring and Revising	1	Revising a paper based on peer feedback
Unit 15: Submission	1	Final Paper Due, August 6.

【Textbook】 Handout materials will be supplied by the instructor.

【Textbook(supplemental)】 ALESS (2012). Active English for Science- 英語で科学する - レポート、論文、プレゼンテーション . The University of Tokyo Press. Cargill, M., & O'Connor, P. (2013). Writing scientific research articles: Strategy and steps. John Wiley & Sons. Cowell, R., & She, L. (2015). Mastering the Basics of Technical English 『技術英語の基礎』 . 2nd Ed., Corona Publishing. 野口ジュディー・深山晶子・岡本真由美 . (2007) . 『理系英語のライティング』 . アルク

【Prerequisite(s)】 Students who intend to join this course must attend the first class.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 We may restrict the class size to enhance students ’ learning. Students who intend to join the course are required to attend the first-day guidance. Office Hours: (by appointment) nishikawa.mikako7w@kyoto-u.ac.jp (Ext. 2052)

Instrumental Analysis, Adv.

先端科学機器分析及び実習

【Code】 10D043 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】

【Location】 A2-307 【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Instrumental Analysis, Adv.

先端科学機器分析及び実習

【Code】 10D046 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】

【Location】 A2-307 【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (6H course)

現代科学技術の巨人セミナー「知のひらめき」(6Hコース)

【Code】10i051 【Course Year】Doctor Course 【Term】First term, intensive

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】0.5

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 6H course, students have to select two classes and will earn 0.5 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (12H course)

現代科学技術の巨人セミナー「知のひらめき」(12Hコース)

【Code】10i052 【Course Year】Doctor Course 【Term】First term/Spring term

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】1

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 12H course, students have to complete all four classes and will earn 1 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later
Topic 3	2	Detail will be announced later
Topic 4	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Molecular Engineering

分子工学特論

【Code】 10S401 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Seminar on Molecular Engineering 1

分子工学特別セミナー 1

【Code】 10S404 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Seminar on Molecular Engineering 2

分子工学特別セミナー 2

【Code】 10S405 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Polymer Physical Properties

高分子物性

【Code】 10D652 【Course Year】 Master Course 【Term】 【Class day & Period】 【Location】 A2-307

【Credits】 3 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Hirokazu Hasegawa, Takenao Yoshizaki, Tsuyoshi Koga, Mikihiro Takenaka, Hiroyuki Aoki,

【Course Description】 A concise explanation is given of physical properties of polymer solutions and polymeric solids along with relevant basic theories.

【Grading】 Final grades will be evaluated in a comprehensive manner on the basis of attendance, reports, and examinations.

【Course Goals】 Fundamental knowledge of physical properties of polymer materials.

【Course Topics】

Theme	Class number of times	Description
Polymer Chain Conformation in Dilute Solutions	4	After a clarification of basic factors which determine the conformations of real polymer chains in dilute solutions, some polymer chain models are introduced to describe the equilibrium conformational behavior of the real chains. Further, behavior of average chain dimensions as a functions of molecular weight is considered based on the chain models.
Thermodynamics and Phase Behavior of Polymer Solutions	4	Various phase transition phenomena in polymer solutions (phase separation, hydration, association, gelation, etc.) are systematically explained from thermodynamic and statistical-mechanical viewpoints. Phase separation of polymer solutions, Aqueous polymer solutions, and Association and gelation of polymers are discussed in the lectures.
Exercise	1	Exercise in polymer solutions.
Structure and Mechanical Properties of Polymeric Solids	5	Polymeric solids such as rubber and plastics, especially thermodynamics of rubber elasticity, polymer crystallization and crystalline/amorphous higher-order structures, are discussed. Moreover, fundamentals of viscoelastic properties of polymers are introduced to provide the understandings of relaxation phenomena such as glass transition.
Electronic and Optical Properties of Polymeric Solids	5	The electronic and optical properties of polymers is reviewed. The application of polymer materials in the opto-electronics and display devices is also presented.
Exercise	1	Exercise in polymeric solids.

【Textbook】 Lecture notes distributed in the class.

【Textbook(supplemental)】

【Prerequisite(s)】 Fundamental knowledge of physical chemistry.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Seminar on Polymer Chemistry 1

高分子化学特別セミナー 1

【Code】 10S604 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Seminar on Polymer Chemistry 2

高分子化学特別セミナー 2

【Code】 10S605 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

先端機能高分子

【Code】10H662 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Mon 4th

【Location】A2-307 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	2	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Polymer Functional Chemistry

高分子機能化学

【Code】10H645 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	2	
	2	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Design of Polymerization Reactions

高分子生成論

【Code】 10H607 【Course Year】 Master and Doctor Course 【Term】 【Class day & Period】 Wed 3rd

【Location】 A2-307 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Mitsuo Sawamoto and Makoto Ouchi,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	2	
	2	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Biomacromolecular Science

生体機能高分子

【Code】10H611 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Tue 2nd

【Location】A2-306 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Polymer Structure and Function

高分子機能学

【Code】10H613 【Course Year】Master Course 【Term】 【Class day & Period】Thu 2nd 【Location】A2-307

【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】H. Ohkita

【Course Description】In this class, optoelectronic functions of polymeric materials are discussed on the basis of photochemistry and photophysics. In particular, the importance of designing nanostructures of polymer assembly is highlighted by explaining examples of state-of-the-art applications, which include optical fibers, organic light-emitting diode, and organic solar cells.

【Grading】Evaluated with the grade on the final test or the quality of report submitted after the final class.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction	1	
Conductive Polymers	3	
Photofunctional Polymers	3	
Optoelectronic Polymers	4	

【Textbook】None: Some handouts will be dealt in the class of every lecture.

【Textbook(supplemental)】None:

【Prerequisite(s)】Students are expected to have knowledge of Physical Chemistry and Polymer Chemistry provided in chemistry course for undergraduate.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Polymer Solution Science

高分子溶液学

【Code】 10H643 【Course Year】 Master and Doctor Course 【Term】 【Class day & Period】 Fri 2nd

【Location】 A2-307 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Takenao Yoshizaki, Yo Nakamura,

【Course Description】 Effects of stiffness and local conformations of polymer chains on polymer solution properties observed in the light scattering and viscosity experiments are considered based on appropriate polymer chain models.

【Grading】 Term-end examination.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Review	1	Definitions of physical quantities determined from the light scattering and viscosity measurements and the theoretical formulations of those quantities.
Experiments in dilute polymer solutions	2	Principles of the light scattering and viscosity experiments.
Polymer chain models and their statistics	2	Static models for polymer chains: the Gaussian chain, the wormlike chain, and the helical wormlike chain. A comparison of experimental data for the mean-square radius of gyration with relevant theories.
Excluded-volume effects	2	Intra- and intermolecular excluded-volume effects represented by the expansion factors and the second virial coefficient, respectively.
Steady-state transport properties	2	A comparison of experimental data for the intrinsic viscosity and diffusion coefficient with relevant theories.
Dynamic properties	2	Dynamic models for polymer chains: the Rouse-Zimm spring-bead model and the dynamic helical wormlike chain. A comparison of experimental data for the first cumulant of the dynamic structure factor with relevant theories.

【Textbook】 Lecture note distributed in the class.

【Textbook(supplemental)】

【Prerequisite(s)】 Basic knowledge of polymer solutions given in the lecture Polymer Physical Properties (10D651).

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Physical Chemistry of Polymers

高分子基礎物理化学

【Code】10H622 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Fri 2nd

【Location】A2-307 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】lecture 【Language】Japanese

【Instructor】Tsuyoshi Koga, Koji Nishida

【Course Description】Molecular mechanism of characteristic physical properties of polymeric systems is lectured on the basis of the equilibrium and non-equilibrium statistical mechanics. Main topics are phase separation of polymer solutions and mixtures, microphase separation of block copolymers, gelation, rubber elasticity, and rheology of physical gels.

【Grading】

【Course Goals】Understanding the molecular mechanism of characteristic physical properties of polymeric systems based on the equilibrium and non-equilibrium statistical mechanics.

【Course Topics】

Theme	Class number of times	Description
phase separation of polymer solutions and mixtures	3	phase diagram, Flory-Huggins theory, mean-field theory, phase separation, spinodal decomposition
microphase separation of block copolymers	3	microphase separation, density functional theory, directed self-assembly
structure and property of polyelectrolyte solution	2	electrostatic interaction between polyions, screening effects, dilute and semi-dilute solutions
vibrational mode and spectroscopy of polymer solid	2	vibration of continuous medium, vibration of polymer chain, spectroscopic experiment

【Textbook】

【Textbook(supplemental)】P.J. Flory, Principles of Polymer Chemistry (Cornell Univ. Press, New York, 1955)
M. Rubinstein, R.H. Colby, Polymer Physics (Oxford Univ. Press, New York, 2003)

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Polymer Spectroscopy

高分子分光学

【Code】10H625 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Outline of Polymer Spectroscopy	2	
Basic Mathematics for Spectroscopy	2	
Neutron Spectroscopy	2	
Infrared, Raman, Brillouin Spectroscopy	3	
Photon Correlation Spectroscopy	1	
Verification of Understanding	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Polymer Supermolecular Structure

高分子集合体構造

【Code】10H616 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Tue 3rd 【Location】

【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Hirokazu Hasegawa, Mikihiro Takenaka,

【Course Description】Polymers self-assemble or self-organize by intra- and/or intermolecular interaction to form assembled structures of polymer molecules. Such structures are closely related to the properties of the polymeric materials, it is necessary to control the assembled structures of the constituent polymer molecules in order to control the properties of polymeric materials, especially solid materials. In this lecture particularly, formation mechanisms, analytical techniques, and elucidated structures of crystalline polymers, phase-separated structures of polymer mixtures, microphase-separated structures of block and graft copolymers will be discussed.

【Grading】The grading is based on the short tests and report assignments.

【Course Goals】This course aims for the development of the faculty to infer the properties of polymeric materials from their morphology based on the knowledge of structure-property relationships of higher-order structures of crystalline polymers, phase-separated structures of polymer mixtures (blends), microdomain structures of block copolymers, etc.

【Course Topics】

Theme	Class number of times	Description
Self-assembly and Self-organization	1	The differences between self-assembly and self-organization will be discussed by referring the examples in natural phenomena and polymeric systems.
Crystalline Polymers	3	In the lectures, unit cell structures and hierarchical higher-order structures of polymer crystals such as folded-chain lamellar crystals and spherulites, as well as deformation and thermal behavior of polymer crystals will be discussed.
Polymer Blends	3	Miscibility, phase-diagrams, mechanisms and dynamics of phase transitions, relationships between phase-separated structures and properties, methods to control the phase-separated structures will be discussed.
Block and Graft Copolymers	3	The lectures include nano-scale domain formation of block copolymers by microphase-separation, miscibility and phase diagrams, order-disorder and order-order transitions, bicontinuous structures, structure formation in thin films, blends with homopolymers or other block copolymers, multi-component multi-block copolymers, miktoarm star block copolymers, and more.
Evaluation of Degree of Understandings	1	Degree of understandings of the lectures will be evaluated by means of a short test and group discussions.

【Textbook】Not used.

【Textbook(supplemental)】Introduced in the lectures.

【Prerequisite(s)】Thermodynamics preferable.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Design of Polymer Materials

高分子材料設計

【Code】10H628 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Tue 2nd

【Location】(Uji campus) ICR Seminar Room 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】Yoshinobu TSUJII, Kohji OHNO

【Course Description】 This course aims at better understanding of fundamentals on living radical polymerization and describes its application to graft polymerization for novel surface modification as well as its related matters.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction to radical polymerization	1	radical polymerization, mechanism, kinetics, elementary reaction
Fundamentals on living radical polymerization and its application to material design	2	living radical polymerization, mechanism, kinetics, functional polymer, material design
Physical chemistry on surfaces and polymer brushes	2	Surface, interface, physical chemistry, polymer brush, theory, structure, property
Living radical polymerization and polymer particles	2	Living radical polymerization, surface-initiated polymerization, polymer brush, hairy particle, star polymer
Synthesis of polymer particles by radical polymerizations	2	Emulsion polymerization, suspension polymerization, dispersion polymerization, precipitation polymerization, self-organized precipitation, nonspherical particle
Applications of polymer particles	2	Self-assembly, dispersion and aggregation, depletion force, pickering emulsion, composites, biochemical and biomedical applications

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Polymer Controlled Synthesis

高分子制御合成

【Code】10H647 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Tue 4th 【Location】

【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	1	
	1	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Polymer Design for Biomedical and Pharmaceutical Applications

医薬用高分子設計学

【Code】10H636 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	1	
	1	
	1	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

生命医科学

【Code】10H663 【Course Year】Master Course 【Term】First semester 【Class day & Period】Mon 2nd

【Location】A2-307 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Mototsugu Eiraku Professor Institute for Frontier Life and Medical Sciences Masatoshi Ohgushi
Associate Professor Institute for Frontier Life and Medical Sciences

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	4	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

先端機能高分子特論

【Code】10H664 【Course Year】Doctor Course 【Term】 【Class day & Period】Mon 4th 【Location】A2-307

【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	2	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Polymer Functional Chemistry

高分子機能化学特論

【Code】 10H650 【Course Year】 Doctor Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	2	
	2	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Design of Polymerization Reactions

高分子生成論特論

【Code】10H651 【Course Year】Doctor Course 【Term】 【Class day & Period】Wed 3rd 【Location】A2-307

【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Mitsuo Sawamoto and Makoto Ouchi,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	2	
	2	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Reactive Polymers

反応性高分子特論

【Code】10H652 【Course Year】Doctor Course 【Term】 【Class day & Period】Wed 4th 【Location】A2-307

【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Biomacromolecular Science

生体機能高分子特論

【Code】10H653 【Course Year】Doctor Course 【Term】 【Class day & Period】Tue 2nd 【Location】A2-306

【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Polymer Structure and Function

高分子機能学特論

【Code】10H654 【Course Year】Doctor Course 【Term】 【Class day & Period】Thu 2nd 【Location】A2-307

【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】H. Ohkita

【Course Description】In this class, optoelectronic functions of polymeric materials are discussed on the basis of photochemistry and photophysics. In particular, the importance of designing nanostructures of polymer assembly is highlighted by explaining examples of state-of-the-art applications, which include optical fibers, organic light-emitting diode, and organic solar cells.

【Grading】Evaluated with the grade on the final test or the quality of report submitted after the final class.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction	1	
Conductive Polymers	3	
Photofunctional Polymers	3	
Optoelectronic Polymers	4	

【Textbook】None: Some handouts will be dealt in the class of every lecture.

【Textbook(supplemental)】None:

【Prerequisite(s)】Students are expected to have knowledge of Physical Chemistry and Polymer Chemistry provided in chemistry course for undergraduate.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Polymer Solution Science

高分子溶液学特論

【Code】 10H655 【Course Year】 Doctor Course 【Term】 【Class day & Period】 Fri 2nd 【Location】 A2-307

【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Takenao Yoshizaki, Yo Nakamura,

【Course Description】 Effects of stiffness and local conformations of polymer chains on polymer solution properties observed in the light scattering and viscosity experiments are considered based on appropriate polymer chain models.

【Grading】 Term-end examination.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Review	1	Definitions of physical quantities determined from the light scattering and viscosity measurements and the theoretical formulations of those quantities.
Experiments in dilute polymer solutions	2	Principles of the light scattering and viscosity experiments.
Polymer chain models and their statistics	2	Static models for polymer chains: the Gaussian chain, the wormlike chain, and the helical wormlike chain. A comparison of experimental data for the mean-square radius of gyration with relevant theories.
Excluded-volume effects	2	Intra- and intermolecular excluded-volume effects represented by the expansion factors and the second virial coefficient, respectively.
Steady-state transport properties	2	A comparison of experimental data for the intrinsic viscosity and diffusion coefficient with relevant theories.
Dynamic properties	2	Dynamic models for polymer chains: the Rouse-Zimm spring-bead model and the dynamic helical wormlike chain. A comparison of experimental data for the first cumulant of the dynamic structure factor with relevant theories.

【Textbook】 Lecture note distributed in the class.

【Textbook(supplemental)】

【Prerequisite(s)】 Basic knowledge of polymer solutions given in the lecture Polymer Physical Properties (10D651).

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Physical Chemistry of Polymers

高分子基礎物理化学特論

【Code】10H656 【Course Year】Doctor Course 【Term】 【Class day & Period】Fri 2nd 【Location】A2-307

【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】lecture 【Language】Japanese

【Instructor】Tsuyoshi Koga

【Course Description】Molecular mechanism of characteristic physical properties of polymeric systems is lectured on the basis of the equilibrium and non-equilibrium statistical mechanics. Main topics are phase separation of polymer solutions and mixtures, microphase separation of block copolymers, gelation, rubber elasticity, and rheology of physical gels.

【Grading】

【Course Goals】Understanding the molecular mechanism of characteristic physical properties of polymeric systems based on the equilibrium and non-equilibrium statistical mechanics.

【Course Topics】

Theme	Class number of times	Description
phase separation of polymer solutions and mixtures	2	phase diagram, Flory-Huggins theory, mean-field theory, phase separation, spinodal decomposition
microphase separation of block copolymers	1	microphase separation, density functional theory, directed self-assembly
gelation	1	definition of gels, classification of gels, classical theory of gels, sol-gel transition, elastically effective chains
rubber elasticity	3	affine network theory, phantom network theory, tetra-PEG gel, slide-ring gel
rheology of associating polymers	3	telechelic associating polymers, linear viscoelasticity, Maxwell model, shear thickening, transient network theory, colloid/polymer mixture, shear-induced gel
verification of understanding	1	

【Textbook】

【Textbook(supplemental)】P.J. Flory, Principles of Polymer Chemistry (Cornell Univ. Press, New York, 1955)
M. Rubinstein, R.H. Colby, Polymer Physics (Oxford Univ. Press, New York, 2003)

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Polymer Spectroscopy

高分子分光光学特論

【Code】 10H657 【Course Year】 Doctor Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 K. Nishida

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Outline of Polymer Spectroscopy	2	
Basic Mathematics for Spectroscopy	2	
Neutron Spectroscopy	2	
Infrared, Raman, Brillouin Spectroscopy	3	
Photon Correlation Spectroscopy	1	
Verification of Understanding	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Polymer Supermolecular Structure

高分子集合体構造特論

【Code】10H658 【Course Year】Doctor Course 【Term】 【Class day & Period】Tue 3rd 【Location】 【Credits】

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Hirokazu Hasegawa, Mikihiro Takenaka,

【Course Description】Polymers self-assemble or self-organize by intra- and/or intermolecular interaction to form assembled structures of polymer molecules. Such structures are closely related to the properties of the polymeric materials, it is necessary to control the assembled structures of the constituent polymer molecules in order to control the properties of polymeric materials, especially solid materials. In this lecture particularly, formation mechanisms, analytical techniques, and elucidated structures of crystalline polymers, phase-separated structures of polymer mixtures, microphase-separated structures of block and graft copolymers will be discussed.

【Grading】The grading is based on the short tests and report assignments.

【Course Goals】This course aims for the development of the faculty to infer the properties of polymeric materials from their morphology based on the knowledge of structure-property relationships of higher-order structures of crystalline polymers, phase-separated structures of polymer mixtures (blends), microdomain structures of block copolymers, etc.

【Course Topics】

Theme	Class number of times	Description
Self-assembly and Self-organization	1	The differences between self-assembly and self-organization will be discussed by referring the examples in natural phenomena and polymeric systems.
Crystalline Polymers	3	In the lectures, unit cell structures and hierarchical higher-order structures of polymer crystals such as folded-chain lamellar crystals and spherulites, as well as deformation and thermal behavior of polymer crystals will be discussed.
Polymer Blends	3	Miscibility, phase-diagrams, mechanisms and dynamics of phase transitions, relationships between phase-separated structures and properties, methods to control the phase-separated structures will be discussed.
Block and Graft Copolymers	3	The lectures include nano-scale domain formation of block copolymers by microphase-separation, miscibility and phase diagrams, order-disorder and order-order transitions, bicontinuous structures, structure formation in thin films, blends with homopolymers or other block copolymers, multi-component multi-block copolymers, miktoarm star block copolymers, and more.
Evaluation of Degree of Understandings	1	Degree of understandings of the lectures will be evaluated by means of a short test and group discussions.

【Textbook】Not used.

【Textbook(supplemental)】Introduced in the lectures.

【Prerequisite(s)】Thermodynamics preferable.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Design of Polymer Materials

高分子材料設計特論

【Code】10H659 【Course Year】Doctor Course 【Term】 【Class day & Period】Tue 2nd

【Location】(Uji campus) ICR Seminar Room 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture

【Language】Japanese 【Instructor】Yoshinobu TSUJII, Kohji OHNO

【Course Description】 This course aims at better understanding of fundamentals on living radical polymerization and describes its application to graft polymerization for novel surface modification as well as its related matters.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction to radical polymerization	1	radical polymerization, mechanism, kinetics, elementary reaction
Fundamentals on living radical polymerization and its application to material design	2	living radical polymerization, mechanism, kinetics, functional polymer, material design
Physical chemistry on surfaces and polymer brushes	2	Surface, interface, physical chemistry, polymer brush, theory, structure, property
Living radical polymerization and polymer particles	2	Living radical polymerization, surface-initiated polymerization, polymer brush, hairy particle, star polymer
Synthesis of polymer particles by radical polymerizations	2	Emulsion polymerization, suspension polymerization, dispersion polymerization, precipitation polymerization, self-organized precipitation, nonspherical particle
Applications of polymer particles	2	Self-assembly, dispersion and aggregation, depletion force, pickering emulsion, composites, biochemical and biomedical applications

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Polymer Controlled Synthesis

高分子制御合成特論

【Code】10H660 【Course Year】Doctor Course 【Term】 【Class day & Period】Tue 4th 【Location】 【Credits】

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	1	
	1	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Polymer Design for Biomedical and Pharmaceutical Applications

医薬用高分子設計学特論

【Code】 10H661 【Course Year】 Doctor Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	1	
	1	
	1	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

生命医科学特論

【Code】10H665 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】Mon 2nd

【Location】A2-307 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	4	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Polymer Chemistry Laboratory & Exercise

高分子化学特別実験及演習

【Code】 10D640 【Course Year】 Master Course 【Term】 1st+2nd term 【Class day & Period】 【Location】

【Credits】 8 【Restriction】 【Lecture Form(s)】 Experiment and Exercise 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	60	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Advanced Material Science and Technology (11 times course)

(English lecture)

先端マテリアルサイエンス通論 (11 回コース) (英語科目)

【Code】 10i053 【Course Year】 Master and Doctor Course 【Term】 Spring term 【Class day & Period】 Fri 5th 【Location】 A2-306 【Credits】 1.5

【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 ER Center, J. Assoc. Prof., Ryuichi Ashida

Related professors

【Course Description】 The various technologies used in the field of material science serve as bases for so-called high technologies, and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】 The average score of the best four reports is employed.

Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Tumor Imaging and Therapy through Photoirradiation	1	The overview of current modalities through photoirradiation as well as the preparation of tumor imaging probes is given. Tumor therapy through photoirradiation is also shown in the lecture. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Carbon Nanorings	1	The preparation of carbon nanorings is outlined in the lecture. The supramolecular interaction as well as the photophysical properties of carbon nanorings is summarized. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Crystal Structure Analysis by Powder X-ray Diffraction Measurement	1	Chemical and physical properties of a material is strongly related with the structure of the material. So, structure analysis is one of the most important part in material researches. Powder X-ray diffraction analysis is powerful way to analyze the crystal structure of solid materials. We study how to use powder X-ray diffraction analysis for material researches. (T. Yamamoto: Dept. of Energy and Hydrocarbon Chemistry)
Principles and Applications of Fluorescence Spectroscopy	1	Fluorescence spectroscopy is applied to various disciplines of science and engineering, and provides unique information of a system upon photo-illumination. This course aims to introduce the background of fluorescence spectroscopy and practical knowledge in fluorescence experiments. (J. Park: Dept. of Molecular Engineering)
Synthesis of Novel π -Conjugated Molecules with Main Group Elements	1	The lecture will show synthesis and properties of novel π -conjugated molecules with main group elements, and their application as functional materials. (T. Higashino: Dept. of Molecular Engineering)
Chemistry of Asymmetric Catalysis Stereoselective Synthesis of Optically Active Pharmaceutical Compounds	1	This class will outline the progress on enantioselective catalysis for the asymmetric synthesis of optically active pharmaceutical compounds such as Herbesser, which is a blockbuster drug developed in a Japanese pharmaceutical company. (K. Asano: Dept. of Material Chemistry)
Electrical Conductivity of Conjugated Polymers and Application to Organic Electronics	1	In this class, structure and property of conjugated polymers are introduced and discussed. The discussion topics include the brief history of the discovery of electrical conductivity of conjugated polymers, mechanism of electrical conductivity in polymer chains, representative evaluation methods of conductivity for conjugated polymers, relationship between molecular and self-assembled structures of conjugated polymers, and recent examples of device applications using conjugated polymers. (I. Sakurai: Dept. of Molecular Engineering)
An Introduction to Smart Shape Changing Materials	1	This course will briefly introduce smart materials as a whole and will then focus specifically on the recent and very active field of smart shape changing materials. We will explore how the design and stimuli-sensitivity of various materials can allow for materials to have planned and useful motion. (K. Landenberger: Dept. of Polymer Chemistry)
Properties of Cementitious Materials and the Future	2	CEMENT may not necessarily be an advanced material, but must surely be a forefront material for human life and society, in the past, present and future. Then, what are your demands to cement? (A. Hattori: Dept. of Urban Management)
Application of Electrical Discharge to Material and Environmental Technology	1	(N. Sano: Dept. of Chemical Engineering)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Advanced Material Science and Technology (15 times course)

(English lecture)

先端マテリアルサイエンス通論 (15 回コース) (英語科目)

【Code】10i054 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 5th 【Location】A2-306 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture

【Language】English

【Instructor】ER Center, J. Assoc. Prof., Ryuichi Ashida
Related professors

【Course Description】The various technologies used in the field of material science serve as bases for so-called high technologies, and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】The average score of the best five reports is employed.
Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Tumor Imaging and Therapy through Photoirradiation	1	The overview of current modalities through photoirradiation as well as the preparation of tumor imaging probes is given. Tumor therapy through photoirradiation is also shown in the lecture. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Carbon Nanorings	1	The preparation of carbon nanorings is outlined in the lecture. The supramolecular interaction as well as the photophysical properties of carbon nanorings is summarized. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Crystal Structure Analysis by Powder X-ray Diffraction Measurement	1	Chemical and physical properties of a material is strongly related with the structure of the material. So, structure analysis is one of the most important part in material researches. Powder X-ray diffraction analysis is powerful way to analyze the crystal structure of solid materials. We study how to use powder X-ray diffraction analysis for material researches. (T. Yamamoto: Dept. of Energy and Hydrocarbon Chemistry)
Principles and Applications of Fluorescence Spectroscopy	1	Fluorescence spectroscopy is applied to various disciplines of science and engineering, and provides unique information of a system upon photo-illumination. This course aims to introduce the background of fluorescence spectroscopy and practical knowledge in fluorescence experiments. (J. Park: Dept. of Molecular Engineering)
Synthesis of Novel π -Conjugated Molecules with Main Group Elements	1	The lecture will show synthesis and properties of novel π -conjugated molecules with main group elements, and their application as functional materials. (T. Higashino: Dept. of Molecular Engineering)
Chemistry of Asymmetric Catalysis Stereoselective Synthesis of Optically Active Pharmaceutical Compounds	1	This class will outline the progress on enantioselective catalysis for the asymmetric synthesis of optically active pharmaceutical compounds such as Herbesser, which is a blockbuster drug developed in a Japanese pharmaceutical company. (K. Asano: Dept. of Material Chemistry)
Electrical Conductivity of Conjugated Polymers and Application to Organic Electronics	1	In this class, structure and property of conjugated polymers are introduced and discussed. The discussion topics include the brief history of the discovery of electrical conductivity of conjugated polymers, mechanism of electrical conductivity in polymer chains, representative evaluation methods of conductivity for conjugated polymers, relationship between molecular and self-assembled structures of conjugated polymers, and recent examples of device applications using conjugated polymers. (I. Sakurai: Dept. of Molecular Engineering)
An Introduction to Smart Shape Changing Materials	1	This course will briefly introduce smart materials as a whole and will then focus specifically on the recent and very active field of smart shape changing materials. We will explore how the design and stimuli-sensitivity of various materials can allow for materials to have planned and useful motion. (K. Landenberger: Dept. of Polymer Chemistry)
Properties of Cementitious Materials and the Future	2	CEMENT may not necessarily be an advanced material, but must surely be a forefront material for human life and society, in the past, present and future. Then, what are your demands to cement? (A. Hattori: Dept. of Urban Management)
Application of Electrical Discharge to Material and Environmental Technology	1	(N. Sano: Dept. of Chemical Engineering)
Theory of Precision Cutting, Grinding, Polishing and Related Properties of Materials	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Metrology and Control Theory for Precision Manufacturing, and Applications	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Fabrication of Inorganic Nanofiber by Electrospinning	1	When a high voltage is applied to a polymer solution, the solution is sprayed as thread-like droplets, and turns to polymer nanofibers. This fiber forming technique is called electrospinning. This lecture will give a brief introduction on the fabrication of nanofibers of inorganic materials including metal oxide and carbon by electrospinning. (S. Nagamine: Dept. of Chemical Engineering)
Solid Surface Analysis, Including a Potential Method: Tip-Enhanced Raman Spectroscopy	1	Surface analytical techniques each have their own analytical volume. The students learn about the volume, and look at an issue for tip-enhanced Raman spectroscopy, a nanoscale Raman spectroscopy, as a potential surface analytical technique. (M. Nishi: Dept. of Material Chemistry)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Modern Science and Technology (4 times course) (English lecture)

現代科学技術特論 (4 回コース) (英語科目)

【Code】 10i055 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 5th

【Location】 A2-306 【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 ER Center, J. Assoc. Prof., Ashida
ER Center, J. Assoc. Prof., Matsumoto
ER Center, J. Assoc. Prof., Maeda
ER Center, J. Assoc. Prof., Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '4 times course' should select one of the topics and attend the lectures. (Students who take '8 times course' should attend the lectures of the both topics.) Attend a course orientation held before the first lecture (Nov. 1) even if you take only the second topic.

Advanced Modern Science and Technology (8 times course) (English lecture)

現代科学技術特論 (8 回コース) (英語科目)

【Code】 10i056 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 5th

【Location】 A2-306 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】	ER	Center,	J.	Assoc.	Prof.,	Ashida
	ER	Center,	J.	Assoc.	Prof.,	Matsumoto
	ER	Center,	J.	Assoc.	Prof.,	Maeda
	ER	Center,	J.	Assoc.	Prof.,	Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '8 times course' should attend the lectures of the both topics. (Students who take '4 times course' should select one of the topics and attend the lectures.)

Organotransition Metal Chemistry 1

有機金属化学 1

【Code】10H041 【Course Year】Master Course 【Term】 【Class day & Period】Fri 1st 【Location】A2-306

【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Nakamura,Matsubara,Suginome,Tsuji,Kurahashi,Omura,Murakami

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Organomagnesium compounds	1	Synthesis, structure, and reaction of organomagnesium compounds
Organolithium compounds	1	Synthesis, structure, and reaction of organolithium compounds
Organozinc compounds	1	Synthesis, structure, and reaction of organozinc compounds
Organoboron compounds	1	Synthesis, structure, and reaction of organoboron compounds
Organosilicon compounds	1	Synthesis, structure, and reaction of organosilicon compounds
Organocopper compounds	1	Synthesis, structure, and reaction of organocopper compounds
Rare earth metals	1	Synthesis, structure, and reaction of rare earth metals
Other transition-metal compounds	1	Synthesis, structure, and reaction of other transition-metal compounds such as Ti, Zr, Cr, and Fe
Basic reaction of organotransition-metal compounds	1	Ligand substitution reaction, oxidative addition, oxidative cyclization, reductive elimination, transmetallation, carbonyl insertion
Catalytic enantioselective reaction	1	Enantioselective hydrogenation, enantioselective oxidation (Sharpless reactions), enantioselective C-C bond formation
Coupling reaction	1	C-C Bond forming reactions (cross coupling reactions)

【Textbook】none

【Textbook(supplemental)】J. F. Hartwig, Organotransition metal chemistry. From bonding to catalysis., University Science Books, Mill Valley, CA, 2010.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Organotransition Metal Chemistry 2

有機金属化学 2

【Code】10H042 【Course Year】Master Course 【Term】 【Class day & Period】 【Location】 【Credits】1.5

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Ozawa, Murakami, Kondo, Nakao, Ohuchi, Kurahashi, Miki

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	2	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Organic Chemistry

先端有機化学

【Code】10H818 【Course Year】Master Course 【Term】 【Class day & Period】Tue 1st 【Location】A2-306

【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Professor Jun-ichi Yoshida and other professors

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Chemoselectivity	2	Introduction and chemoselectivity
Regioselectivity	2	Controlled Aldol Reactions
Stereoselectivity	2	Stereoselective Aldol Reactions
Strategies	2	Alternative Strategies for Enone Synthesis
Choosing a Strategy	2	The Synthesis of Cyclopentenones
Summary	2	Summary and outlook

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Instrumental Analysis, Adv.

先端科学機器分析及び実習

【Code】 10D043 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】

【Location】 A2-307 【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Instrumental Analysis, Adv.

先端科学機器分析及び実習

【Code】 10D046 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】

【Location】 A2-307 【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (6H course)

現代科学技術の巨人セミナー「知のひらめき」(6Hコース)

【Code】10i051 【Course Year】Doctor Course 【Term】First term, intensive

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】0.5

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 6H course, students have to select two classes and will earn 0.5 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (12H course)

現代科学技術の巨人セミナー「知のひらめき」(12Hコース)

【Code】10i052 【Course Year】Doctor Course 【Term】First term/Spring term

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】1

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 12H course, students have to complete all four classes and will earn 1 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later
Topic 3	2	Detail will be announced later
Topic 4	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Exercise in Practical Scientific English

実践的科学英語演習

【Code】 10i045 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Thu 4th or 5th 【Location】 A2-304

【Credits】 1 【Restriction】 Up to 20 students for each class 【Lecture Form(s)】 Seminar 【Language】 English (Japanese)

【Instructor】 M. Nishikawa, R. Matsumoto, R. Ashida, M. Maeda,

【Course Description】 This course is open to all master and doctoral engineering students. It is designed to help students understand how to write a research paper step by step. In this course, the students will write a short research paper (i.e. Extended Research Abstract for Proceeding, approx. 1000 -1500 words) on a topic drawn from assigned readings.

【Grading】 Evaluation based on 30% participation, 40% reports, 30% final paper *More than twice unexcused absence can result in course failure

【Course Goals】 The primary goal of this course is to deepen an understanding of the main features of each part of a scientific paper (IMRaD). Throughout the course, students will develop the core competencies required for language, grammar, and style to produce a research manuscript in English.

【Course Topics】

Theme	Class number of times	Description
Unit 1: Course Overview	1	Course Overview: Introduction to writing scientific research articles
Unit 2: Introduction	1	Raising awareness of the register of science research articles (genre, audience, purpose)
Unit 3: Preparing to Write	1	Writing a proposal for a research paper, using corpus-based approach (Exercise: Creating own Corpus)
Unit 4: Preparing to Write	1	Paraphrasing ideas from source texts, using citations and references in formal writing
Unit 5: Writing Processes	1	Identifying the “ moves ” for an Abstract section by hint expressions
Unit 6: Writing Processes	1	Writing an Abstract (Title) & peer feedback
Unit 7: Writing Processes	1	Identifying the “ moves ” for an Introduction section by hint expressions
Unit 8: Writing Processes	1	Writing an Introduction section & peer feedback
Unit 9: Writing Processes	1	Writing a Method section & peer feedback
Unit 10: Writing Processes	1	Writing a Result section & peer feedback
Unit 11: Writing Processes	1	Writing a Discussion and a Conclusion section
Unit 12: Writing Processes	1	Writing a cover letter to reviewers and how to respond to reviewers
Unit 13: Monitoring and Revising	1	Online feedback
Unit 14: Monitoring and Revising	1	Revising a paper based on peer feedback
Unit 15: Submission	1	Final Paper Due, August 6.

【Textbook】 Handout materials will be supplied by the instructor.

【Textbook(supplemental)】 ALESS (2012). Active English for Science- 英語で科学する - レポート、論文、プレゼンテーション . The University of Tokyo Press. Cargill, M., & O'Connor, P. (2013). Writing scientific research articles: Strategy and steps. John Wiley & Sons. Cowell, R., & She, L. (2015). Mastering the Basics of Technical English 『技術英語の基礎』 . 2nd Ed., Corona Publishing. 野口ジュディー・深山晶子・岡本真由美 . (2007) . 『理系英語のライティング』 . アルク

【Prerequisite(s)】 Students who intend to join this course must attend the first class.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 We may restrict the class size to enhance students ' learning. Students who intend to join the course are required to attend the first-day guidance. Office Hours: (by appointment) nishikawa.mikako7w@kyoto-u.ac.jp (Ext. 2052)

Professional Scientific Presentation Exercises (English lecture)

科学技術者のためのプレゼンテーション演習 (英語科目)

【Code】 10i041 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Thu 5th

【Location】 B-Cluster 2F Seminar Room 【Credits】 1

【Restriction】 The number of students might be limited if too many students will get enrolled.

【Lecture Form(s)】 Seminar 【Language】 English

【Instructor】 Juha Lintuluoto, Associate Professor, Department of Synthetic Chemistry and Biological Chemistry

【Course Description】 It is imperative for future engineers to be able to communicate and deliver effectively scientific information to large variety of audiences. This skill enables engineers to share and absorb information to more extended audiences, and facilitates success in selling ideas and products, publishing and team working. The purpose of this course is to teach the basic rules needed for successful professional scientific presentation, both orally and written. The course also prepares students to deliver scientific information presentations to wide audiences. The course is consisted of excessive exercises, of which the student should complete seven (7) tasks. The course holds 3-4 tasks for oral presentation exercises, and 3-4 tasks for professional scientific writing exercises. The exact number of both exercises is adjusted for each student ' s needs. The course is aimed for doctor course (DC) students, both Japanese and Foreign nationals

【Grading】 Reports, class activity, presentation

【Course Goals】 This course is aimed to foster engineering students ' scientific presentation skills. The successfully course completed students will be able to express and present complicated and specific scientific information at more generally understandable level. The students will also be able to pose relevant questions and effectively answer to the wide variety of questions.

【Course Topics】

Theme	Class number of times	Description
	1	Guidance and Professional presentation rules and etiquette
	3	Oral presentations & questioning I, Written report I
	3	Oral presentations & questioning I, Written report I
	3	Oral presentations & questioning II, Written report II
	3	Oral presentations & questioning II, Written report II
	2	Oral presentations & questioning III, Written report III
		Oral presentations & questioning III, Written report III
		Oral presentations & questioning IV, Written report IV
		Oral presentations & questioning IV, Written report IV I
		Course summary and discussion

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 -Fundamental skills about scientific presentation

-Advanced English skills

-Sufficient personal research results

【Independent Study Outside of Class】

【Web Sites】 The web-site is listed in the home page of the GL education center.

【Additional Information】 Students are requested to check in advance whether the credit of this course is counted as the unit for graduation requirement at department level. Course starts at April 12th, and the 1st lesson is repeated on April 19th. The course schedule is irregular. Most classes are biweekly, the detailed schedule is provided at the 1st lecture.

International Internship in Engineering 1

工学研究科国際インターンシップ 1

【Code】10i010 【Course Year】Master and Doctor Course 【Term】1st+2nd term

【Class day & Period】Intensive course 【Location】 【Credits】1 【Restriction】Defined by each internship program

【Lecture Form(s)】Exercise 【Language】English

【Instructor】Faculty members in charge of educational affairs of the Global Leadership Engineering Education Center and of the department the registrant belongs to.

【Course Description】Acquisition of international skills with the training of foreign language through the internship programs hosted by the University, the Graduate School of Engineering, or The Department the registrant belongs to.

【Grading】Merit rating is performed based on the presentation or the report(s) after the participation in each internship program. Each department is responsible to identify the number of credits to be granted to the student of the department, if the credits are included in the mandatory ones. The Global Leadership Engineering Education Center takes the role to evaluate the credits if the department the student belongs to deals the credits as optional ones. The number of credits to be earned is 1 and 2, respectively to the subjects International Internship in Engineering 1 and 2 depending on the period and the contents of the internship program the students has participated in.

【Course Goals】Acquisition of international skills with the training of foreign language.

【Course Topics】

Theme	Class number of times	Description
Overseas Internship	1	The contents to be acquired should be described in the brochure of each internship program.
Final Presentation	1	A presentation by the student is required followed by discussion among participants.

【Textbook】Not Applicable

【Textbook(supplemental)】Not Applicable

【Prerequisite(s)】Described in the application booklet for each internship program. The registrant is requested to have enough language skills for the participation.

【Independent Study Outside of Class】Not Applicable

【Web Sites】Not Applicable

【Additional Information】It is required for students to check if the internship program to participate in could be evaluated as part of mandatory credits or not and could earn how many credits before the participation to the department or educational program the student in enrolled. If the credit could not be treated as mandatory ones, get in touch with the Global Leadership Engineering Education Center.

International Internship in Engineering 2

工学研究科国際インターンシップ2

【Code】10i011 【Course Year】Master and Doctor Course 【Term】1st+2nd term

【Class day & Period】Intensive course 【Location】 【Credits】2 【Restriction】Defined by each internship program

【Lecture Form(s)】Exercise 【Language】English

【Instructor】Faculty members in charge of educational affairs of the Global Leadership Engineering Education Center and of the department the registrant belongs to.

【Course Description】Acquisition of international skills with the training of foreign language through the internship programs hosted by the University, the Graduate School of Engineering, or The Department the registrant belongs to.

【Grading】Merit rating is performed based on the presentation or the report(s) after the participation in each internship program. Each department is responsible to identify the number of credits to be granted to the student of the department, if the credits are included in the mandatory ones. The Global Leadership Engineering Education Center takes the role to evaluate the credits if the department the student belongs to deals the credits as optional ones. The number of credits to be earned is 1 and 2, respectively to the subjects International Internship in Engineering 1 and 2 depending on the period and the contents of the internship program the students has participated in.

【Course Goals】Acquisition of international skills with the training of foreign language. Detailed objectives should be described in each program.

【Course Topics】

Theme	Class number of times	Description
Overseas Internship	1	The contents to be acquired should be described in the brochure of each internship program.
Final Presentation	1	A presentation by the student is required followed by discussion among participants.

【Textbook】Not Applicable.

【Textbook(supplemental)】Not Applicable.

【Prerequisite(s)】Described in the application booklet for each internship program. The registrant is requested to have enough language skills for the participation.

【Independent Study Outside of Class】Not Applicable.

【Web Sites】Not Applicable.

【Additional Information】It is required for students to check if the internship program to participate in could be evaluated as part of mandatory credits or not and could earn how many credits before the participation to the department or educational program the student in enrolled. If the credit could not be treated as mandatory ones, get in touch with the Global Leadership Engineering Education Center.

Project Management in Engineering

エンジニアリングプロジェクトマネジメント

【Code】 10i049 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 4th 【Location】 A2-308 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu

Assoc.Prof. Lintuluoto, J. Assoc. Prof. Tanaka

【Course Description】 This course provides a basic knowledge required for the project management in various engineering fields such as process design, plant design, construction, and R&D projects. Also, visiting lecturers from industry and public works provide management insights of actual engineering projects.

【Grading】 Evaluated by assignments (project report exercise) and class contribution

【Course Goals】 This course will help students gain a fundamental knowledge of what project management in engineering is. Throughout the course, students will learn various tools applied in project management. Students will also understand the importance of costs and money, risks, leadership, and environmental assessment in managing engineering projects. This course is followed with the course Seminar on Project Management in Engineering. in the second semester.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	4/13 (Matsumoto) Course guidance
Special lecture by extramural instructor 1	1	4/20 (Inaoka(JICA))@A2-306 Project management in the case of Japanese ODA
Introduction to project management	1	4/27 (Maeda) Introduction to project management Project phases
Tools for project management I	1	5/11 (Lintuluoto) Tools for project management, cost, and cash flows I
Tools for project management II	1	5/18 (Lintuluoto) Tools for project management, cost, and cash flows II
Tools for project management III	1	5/25 (Lintuluoto) Tools for project management, cost, and cash flows III
Project scheduling I	1	6/1 (Ashida) Project scheduling I
Project scheduling II	1	6/8 (Ashida) Project scheduling II
Leadership I	1	6/15 (Tanaka) Leadership I
Leadership II	1	6/22 (Tanaka) Leadership II
Risk management I	1	6/29 (Matsumoto) Risk management I
Risk management II	1	7/6 (Matsumoto) Risk management II
Environmental Impact Assessment	1	7/13 (Yorozu) Environmental Impact Assessment
Special lecture by extramural instructor 2	1	7/20 (Kumagai(JGC CORPORATION)) To be announced
Feedback	1	7/27 (Matsumoto) Feedback

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 1. Lock, Dennis. Project Management. 10th edition. Gower Publishing Ltd.

2. Cleland, David L., and Lewis R. Ireland. Project Management. 5th edition. McGraw-Hill Professional

3. Roger Miller and Donald R. Lessard. The strategic management of large engineering projects, Shaping Institutions, Risks, and Governance, The MIT Press

【Prerequisite(s)】 No pre-requisite

【Independent Study Outside of Class】

【Web Sites】 The web-site is opened in the home page of the GL education center.

【Additional Information】

Exercise on Project Management in Engineering

エンジニアリングプロジェクトマネジメント演習

【Code】 10i059 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day & Period】 Friday 4th period and 5th period 【Location】 B-Cluster 2F Seminar Room 【Credits】 2

【Restriction】 Student number will be limited. 【Lecture Form(s)】 Seminar 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu
Assoc.Prof. Lintuluoto

【Course Description】 In this course, students will apply the engineering know-how and the skills of management, and group leadership which they learned in the course of Project Management in Engineering to build and carry out a virtual inter-engineering project. This course provides a forum where students' team-plan based on ideas and theories, decision making, and leadership should produce realistic engineering project outcomes. The course consists of intensive group work, presentations, and a few intermediate discussions. A written report will be required.

【Grading】 Report, class activity, presentation

【Course Goals】 This course prepares engineering students to work with other engineers within a large international engineering project. In particular this course will focus on leadership and management of projects along with applied engineering skills where the students learn various compromises, co-operation, responsibility, and ethics.

【Course Topics】

Theme	Class number of times	Description
	10/5	
Guidance	1	Introduction to Exercise on Project Management in Engineering Lecture on tools for the Project management in engineering Practice
Teamwork	7	Each project team may freely schedule the group works within given time frame. The course instructors are available if any need is required.
Mid-term presentation	1	Each project team will have a mid-term presentation.
Lecture & Teamwork	2	Some lectures will be provided, such as Leadership structuring, Risk Management, and Environmental Impact Assessment, depending on projects you propose.
Presentation	1	Each project team will have a presentation based on its proposed project.

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 Fundamental skills about group leading and communication, scientific presentation.

【Independent Study Outside of Class】

【Web Sites】 The web-site will be opened in the home page of the GL education center.

【Additional Information】 The number of students may be restricted. Students are requested to check in advance whether the credit from this course will be accepted as a graduation requirement for their department.

Organic System Design

有機設計学

【Code】 10H802 【Course Year】 Master and Doctor Course 【Term】 【Class day & Period】 Tue 2nd

【Location】 A2-308 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	2	
	2	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Synthetic Organic Chemistry

有機合成化学

【Code】10H804 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Mon 2nd

【Location】A2-308 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】Japanese

【Instructor】Department of Synthetic Chemistry and Biological Chemistry, Professor, Jun-ichi Yoshida

Department of Synthetic Chemistry and Biological Chemistry, Lecturer, Aiichioro Nagaki

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction	1	
oxidation	3	
reduction	2	
carbon-carbon bond formation	3	
new methods in organic synthesis	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Functional Coordination Chemistry

機能性錯体化学

【Code】 10H805 【Course Year】 Master and Doctor Course 【Term】 【Class day & Period】 Wed 2nd

【Location】 A2-308 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Satoshi Horike, Shuhei Furukawa

【Course Description】 The chemistry, physics and function of metal complexes and coordination polymers are explained. The lecture also introduces supramolecular complexes and metal organic frameworks (MOF) for energy-related materials and biological applications.

【Grading】 Evaluate in the report.

【Course Goals】 Understand the synthesis, structure, and physical properties and functions of metal complexes and coordination polymers.

【Course Topics】

Theme	Class number of times	Description
Fundamental coordination chemistry	2	Structure and properties of metal complexes
Chemistry of coordination polymers and metal organic framework (MOF)	3	Structure and function of coordination polymer and metal-organic framework (MOF)
Coordination chemistry and solid state chemistry	3	Relationship of coordination chemistry and solid state chemistry
Supramolecular complexes and biological applications	3	Design and application of supramolecular complexes related to bio-technology

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 Lecture of every other year

Physical Organic Chemistry

物理有機化学

【Code】 10H808 【Course Year】 Master and Doctor Course 【Term】 【Class day & Period】 Thu 2nd

【Location】 A2-308 【Credits】 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Kenji Matsuda

【Course Description】 Properties of organic compounds, such as electric conductivity, magnetism, photophysical properties, are discussed in terms of molecular structure and electronic structure

【Grading】 Report

【Course Goals】 To understand principles of photochemistry

【Course Topics】

Theme	Class number of times	Description
Photochemical Reaction	1	Photochemistry, Photophysics, einstein (unit), Jablonski diagram, Excitation, Internal conversion, Intersystem crossing, Fluorescence, Phosphorescence, Photochemical reaction
Excited States in Molecular Orbital Theory	2	Born-Oppenheimer approximation, Franck-Condon principle, Singlet, Triplet, Energy gap, n-pi*, pi-pi*, Potential energy surface, Conical intersection, Solvatochromism
Electronic Transition	2	Transition probability, Fermi's golden rule, Transition moment, Oscillator strength, Polarized light, Stimulated emission, Einstein coefficient, Beer-Lambert law, Selection rule, Spin-orbit coupling
Radiative Transition	2	Fluorescence, Phosphorescence, Fluorescence excitation spectrum, Mirror relationship, Vibrational structure, Fluorescence quantum yield, Emission rate constant
Behavior of	2	Energy Transfer, Quenching, Trivial, Foerster, Dexter, FRET, Stern-Volmer plot, Excimer, Exciplex, Triplet sensitization
Photochemical reaction, Photoisomerization	2	Quantum yield, Photochromism, Conversion in photoisomerization

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Fine Synthetic Chemistry

精密合成化学

【Code】10H834 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Wed 2nd

【Location】A2-308 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Masahiro Murakami, Tomoya Miura,

【Course Description】

【Grading】Paper test

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
principle and examples of selective reaction	4	1. Hammond Postulate and Curtin-Hammett Principle 2. Chemo- and Stereoselectivities of Hydride Reduction 3. Cram Model and Felkin-Anh Model (Basic Rule) 4. Cram Model and Felkin-Anh Model (Application)
total synthesis of natural products	6	5. (+)-Himbacine (Chackalamannil 1999) (key point: Diels-Alder) 6. ZK-EPO (Schering AG 2006) (key point: Macrolactonization) 7. (-)-Dactylolide (McLeod 2006) (key point: Ireland-Claisen) 8. (-)-Scopadulcic Acid (Overman 1999) (key point: Heck Reaction) 9. (+)-Paniculatine (Sha 1999) (key point: Radical Cyclization) 10. Hirsutine (Tietze 1999) (key point: Domino Reaction)
	1	11. Confirmation of achievement degree: The synthesis of target molecules using selective reaction is proposed by students, and then, we discuss it.

【Textbook】nothing

【Textbook(supplemental)】Organic Synthesis Workbook II (Wiley-VCH), Organic Synthesis Workbook III (Wiley-VCH)

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Bioorganic Chemistry

生物有機化学

【Code】10H813 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Thu 2nd

【Location】A2-308 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Molecular Biology

分子生物化学

【Code】10H812 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Thu 2nd

【Location】A2-308 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,,

【Course Description】 Biological responses are elicited at the interface of intrinsic genetic information and extrinsic environmental factors. This course discusses on molecular aspects of brain function and immunity. Experimental tools such as fluorescent probes for second messenger molecules are also explained through performance of experiments using the probes.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Basics	1	
Principles of neurotransmission	3	
Immunity and inflammation	2	
Gaseous bioactive molecules	2	
Experiments to observe cellular responses	3	

【Textbook】 Provided in the course

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Biorecognics

生体認識化学

【Code】10H815 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Thu 2nd

【Location】A2-308 【Credits】 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Microbiology and Biotechnology

生物学

【Code】10H816 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Wed 2nd

【Location】A2-308 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English

【Instructor】Haruyuki Atomi, Tamotsu Kanai

【Course Description】 This lecture will introduce the various forms of life that are present on our planet as well as the mechanisms involved in sustaining their life. Commonly used tools in the fields of biochemistry, molecular biology and genetics will also be discussed. In addition, methods to utilize cells and their enzymes in biotechnology will be introduced. Lectures will be given in English, with the aim to improve communication/discussion skills.

【Grading】 Grading will be based on presentations (60%) and attendance (40%).

【Course Goals】 Basic knowledge on the various forms of life that are present on our planet as well as the mechanisms involved in sustaining their life. An understanding of the commonly used tools in the fields of biochemistry, molecular biology and genetics as well as methods to utilize cells and their enzymes in biotechnology. Lectures will be given in English, with the aim to improve communication/discussion skills.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Diversity of life, classification of organisms, structure and function of fundamental biomolecules.
Basic mechanisms to sustain life	3	Strategies to conserve energy, biosynthesis, cell division, cell differentiation.
Strategies to adapt to environmental conditions	2	Effect of environmental conditions on cells and biomolecules, thermophiles, acidophiles and their enzymes.
Protein engineering	2	Methods to study enzymes and enzyme reactions, methods to enhance their performance.
Cell engineering	2	Methods utilized in metabolic engineering, cell surface engineering, synthetic biology.
Topic discussion	1	Particular topics will be chosen for discussion

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Organic Chemistry

先端有機化学

【Code】10H818 【Course Year】Master Course 【Term】 【Class day & Period】Tue 1st 【Location】A2-306

【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Professor Jun-ichi Yoshida and other professors

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Chemoselectivity	2	Introduction and chemoselectivity
Regioselectivity	2	Controlled Aldol Reactions
Stereoselectivity	2	Stereoselective Aldol Reactions
Strategies	2	Alternative Strategies for Enone Synthesis
Choosing a Strategy	2	The Synthesis of Cyclopentenones
Summary	2	Summary and outlook

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Biological Chemistry

先端生物化学

【Code】 10H836 【Course Year】 Master Course 【Term】 【Class day & Period】 【Location】 A2-308

【Credits】 3 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	4	
	3	
	4	
	2	
	2	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Biological Chemistry 2 Continued

先端生物化学続論

【Code】 10P836 【Course Year】 Master Course 【Term】 【Class day & Period】 【Location】 【Credits】 1

【Restriction】 【Lecture Form(s)】 Intensive Lecture 【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Organotransition Metal Chemistry 1

有機金属化学 1

【Code】10H041 【Course Year】Master Course 【Term】 【Class day & Period】Fri 1st 【Location】A2-306

【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Nakamura,Matsubara,Suginome,Tsuji,Kurahashi,Omura,Murakami

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Organomagnesium compounds	1	Synthesis, structure, and reaction of organomagnesium compounds
Organolithium compounds	1	Synthesis, structure, and reaction of organolithium compounds
Organozinc compounds	1	Synthesis, structure, and reaction of organozinc compounds
Organoboron compounds	1	Synthesis, structure, and reaction of organoboron compounds
Organosilicon compounds	1	Synthesis, structure, and reaction of organosilicon compounds
Organocopper compounds	1	Synthesis, structure, and reaction of organocopper compounds
Rare earth metals	1	Synthesis, structure, and reaction of rare earth metals
Other transition-metal compounds	1	Synthesis, structure, and reaction of other transition-metal compounds such as Ti, Zr, Cr, and Fe
Basic reaction of organotransition-metal compounds	1	Ligand substitution reaction, oxidative addition, oxidative cyclization, reductive elimination, transmetallation, carbonyl insertion
Catalytic enantioselective reaction	1	Enantioselective hydrogenation, enantioselective oxidation (Sharpless reactions), enantioselective C-C bond formation
Coupling reaction	1	C-C Bond forming reactions (cross coupling reactions)

【Textbook】none

【Textbook(supplemental)】J. F. Hartwig, Organotransition metal chemistry. From bonding to catalysis., University Science Books, Mill Valley, CA, 2010.

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Organotransition Metal Chemistry 2

有機金属化学 2

【Code】10H042 【Course Year】Master Course 【Term】 【Class day & Period】 【Location】 【Credits】1.5

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Ozawa, Murakami, Kondo, Nakao, Ohuchi, Kurahashi, Miki

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	2	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Synthetic Chemistry and Biological Chemistry, Adv,A

合成・生物化学特論 A

【Code】10D839 【Course Year】Master Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Synthetic Chemistry and Biological Chemistry, Adv,B

合成・生物化学特論B

【Code】10D840 【Course Year】Master Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Synthetic Chemistry and Biological Chemistry, Adv,C

合成・生物化学特論C

【Code】10D841 【Course Year】Master Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】1 【Restriction】No Restriction 【Lecture Form(s)】Intensive Lecture 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	7.5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Synthetic Chemistry and Biological Chemistry, Adv,D

合成・生物化学特論D

【Code】10D842 【Course Year】Master Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】1 【Restriction】No Restriction 【Lecture Form(s)】Intensive Lecture 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	7.5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Synthetic Chemistry and Biological Chemistry, Adv,E

合成・生物化学特論 E

【Code】10D843 【Course Year】Master Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】1 【Restriction】No Restriction 【Lecture Form(s)】Intensive Lecture 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	7.5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Synthetic Chemistry and Biological Chemistry, Adv,F

合成・生物化学特論F

【Code】10D844 【Course Year】Master Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】1 【Restriction】No Restriction 【Lecture Form(s)】Intensive Lecture 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	7.5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Special Experiments and Exercises in Synthetic Chemistry and Biological Chemistry

合成・生物化学特別実験及演習

【Code】10D828 【Course Year】Master Course 【Term】1st+2nd term 【Class day & Period】 【Location】

【Credits】8 【Restriction】No Restriction 【Lecture Form(s)】Experiment and Exercise 【Language】Japanese

【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	30	
	15	
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Advanced Material Science and Technology (11 times course)**(English lecture)**

先端マテリアルサイエンス通論 (11 回コース) (英語科目)

【Code】 10i053 【Course Year】 Master and Doctor Course 【Term】 Spring term 【Class day & Period】 Fri 5th 【Location】 A2-306 【Credits】 1.5

【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 ER Center, J. Assoc. Prof., Ryuichi Ashida

Related professors

【Course Description】 The various technologies used in the field of material science serve as bases for so-called high technologies, and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】 The average score of the best four reports is employed.

Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Tumor Imaging and Therapy through Photoirradiation	1	The overview of current modalities through photoirradiation as well as the preparation of tumor imaging probes is given. Tumor therapy through photoirradiation is also shown in the lecture. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Carbon Nanorings	1	The preparation of carbon nanorings is outlined in the lecture. The supramolecular interaction as well as the photophysical properties of carbon nanorings is summarized. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Crystal Structure Analysis by Powder X-ray Diffraction Measurement	1	Chemical and physical properties of a material is strongly related with the structure of the material. So, structure analysis is one of the most important part in material researches. Powder X-ray diffraction analysis is powerful way to analyze the crystal structure of solid materials. We study how to use powder X-ray diffraction analysis for material researches. (T. Yamamoto: Dept. of Energy and Hydrocarbon Chemistry)
Principles and Applications of Fluorescence Spectroscopy	1	Fluorescence spectroscopy is applied to various disciplines of science and engineering, and provides unique information of a system upon photo-illumination. This course aims to introduce the background of fluorescence spectroscopy and practical knowledge in fluorescence experiments. (J. Park: Dept. of Molecular Engineering)
Synthesis of Novel π -Conjugated Molecules with Main Group Elements	1	The lecture will show synthesis and properties of novel π -conjugated molecules with main group elements, and their application as functional materials. (T. Higashino: Dept. of Molecular Engineering)
Chemistry of Asymmetric Catalysis Stereoselective Synthesis of Optically Active Pharmaceutical Compounds	1	This class will outline the progress on enantioselective catalysis for the asymmetric synthesis of optically active pharmaceutical compounds such as Herbesser, which is a blockbuster drug developed in a Japanese pharmaceutical company. (K. Asano: Dept. of Material Chemistry)
Electrical Conductivity of Conjugated Polymers and Application to Organic Electronics	1	In this class, structure and property of conjugated polymers are introduced and discussed. The discussion topics include the brief history of the discovery of electrical conductivity of conjugated polymers, mechanism of electrical conductivity in polymer chains, representative evaluation methods of conductivity for conjugated polymers, relationship between molecular and self-assembled structures of conjugated polymers, and recent examples of device applications using conjugated polymers. (I. Sakurai: Dept. of Molecular Engineering)
An Introduction to Smart Shape Changing Materials	1	This course will briefly introduce smart materials as a whole and will then focus specifically on the recent and very active field of smart shape changing materials. We will explore how the design and stimuli-sensitivity of various materials can allow for materials to have planned and useful motion. (K. Landenberger: Dept. of Polymer Chemistry)
Properties of Cementitious Materials and the Future	2	CEMENT may not necessarily be an advanced material, but must surely be a forefront material for human life and society, in the past, present and future. Then, what are your demands to cement? (A. Hattori: Dept. of Urban Management)
Application of Electrical Discharge to Material and Environmental Technology	1	(N. Sano: Dept. of Chemical Engineering)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Advanced Material Science and Technology (15 times course)

(English lecture)

先端マテリアルサイエンス通論 (15 回コース) (英語科目)

【Code】10i054 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 5th 【Location】A2-306 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture

【Language】English

【Instructor】ER Center, J. Assoc. Prof., Ryuichi Ashida
Related professors

【Course Description】The various technologies used in the field of material science serve as bases for so-called high technologies, and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】The average score of the best five reports is employed.
Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Tumor Imaging and Therapy through Photoirradiation	1	The overview of current modalities through photoirradiation as well as the preparation of tumor imaging probes is given. Tumor therapy through photoirradiation is also shown in the lecture. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Carbon Nanorings	1	The preparation of carbon nanorings is outlined in the lecture. The supramolecular interaction as well as the photophysical properties of carbon nanorings is summarized. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Crystal Structure Analysis by Powder X-ray Diffraction Measurement	1	Chemical and physical properties of a material is strongly related with the structure of the material. So, structure analysis is one of the most important part in material researches. Powder X-ray diffraction analysis is powerful way to analyze the crystal structure of solid materials. We study how to use powder X-ray diffraction analysis for material researches. (T. Yamamoto: Dept. of Energy and Hydrocarbon Chemistry)
Principles and Applications of Fluorescence Spectroscopy	1	Fluorescence spectroscopy is applied to various disciplines of science and engineering, and provides unique information of a system upon photo-illumination. This course aims to introduce the background of fluorescence spectroscopy and practical knowledge in fluorescence experiments. (J. Park: Dept. of Molecular Engineering)
Synthesis of Novel π -Conjugated Molecules with Main Group Elements	1	The lecture will show synthesis and properties of novel π -conjugated molecules with main group elements, and their application as functional materials. (T. Higashino: Dept. of Molecular Engineering)
Chemistry of Asymmetric Catalysis Stereoselective Synthesis of Optically Active Pharmaceutical Compounds	1	This class will outline the progress on enantioselective catalysis for the asymmetric synthesis of optically active pharmaceutical compounds such as Herbesser, which is a blockbuster drug developed in a Japanese pharmaceutical company. (K. Asano: Dept. of Material Chemistry)
Electrical Conductivity of Conjugated Polymers and Application to Organic Electronics	1	In this class, structure and property of conjugated polymers are introduced and discussed. The discussion topics include the brief history of the discovery of electrical conductivity of conjugated polymers, mechanism of electrical conductivity in polymer chains, representative evaluation methods of conductivity for conjugated polymers, relationship between molecular and self-assembled structures of conjugated polymers, and recent examples of device applications using conjugated polymers. (I. Sakurai: Dept. of Molecular Engineering)
An Introduction to Smart Shape Changing Materials	1	This course will briefly introduce smart materials as a whole and will then focus specifically on the recent and very active field of smart shape changing materials. We will explore how the design and stimuli-sensitivity of various materials can allow for materials to have planned and useful motion. (K. Landenberger: Dept. of Polymer Chemistry)
Properties of Cementitious Materials and the Future	2	CEMENT may not necessarily be an advanced material, but must surely be a forefront material for human life and society, in the past, present and future. Then, what are your demands to cement? (A. Hattori: Dept. of Urban Management)
Application of Electrical Discharge to Material and Environmental Technology	1	(N. Sano: Dept. of Chemical Engineering)
Theory of Precision Cutting, Grinding, Polishing and Related Properties of Materials	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Metrology and Control Theory for Precision Manufacturing, and Applications	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Fabrication of Inorganic Nanofiber by Electrospinning	1	When a high voltage is applied to a polymer solution, the solution is sprayed as thread-like droplets, and turns to polymer nanofibers. This fiber forming technique is called electrospinning. This lecture will give a brief introduction on the fabrication of nanofibers of inorganic materials including metal oxide and carbon by electrospinning. (S. Nagamine: Dept. of Chemical Engineering)
Solid Surface Analysis, Including a Potential Method: Tip-Enhanced Raman Spectroscopy	1	Surface analytical techniques each have their own analytical volume. The students learn about the volume, and look at an issue for tip-enhanced Raman spectroscopy, a nanoscale Raman spectroscopy, as a potential surface analytical technique. (M. Nishi: Dept. of Material Chemistry)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Modern Science and Technology (4 times course) (English lecture)

現代科学技術特論 (4回コース) (英語科目)

【Code】10i055 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 5th

【Location】A2-306 【Credits】0.5 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】English

【Instructor】 ER Center, J. Assoc. Prof., Ashida
ER Center, J. Assoc. Prof., Matsumoto
ER Center, J. Assoc. Prof., Maeda
ER Center, J. Assoc. Prof., Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '4 times course' should select one of the topics and attend the lectures. (Students who take '8 times course' should attend the lectures of the both topics.) Attend a course orientation held before the first lecture (Nov. 1) even if you take only the second topic.

Advanced Modern Science and Technology (8 times course) (English lecture)

現代科学技術特論 (8 回コース) (英語科目)

【Code】 10i056 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 5th

【Location】 A2-306 【Credits】 1 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】	ER	Center,	J.	Assoc.	Prof.,	Ashida
	ER	Center,	J.	Assoc.	Prof.,	Matsumoto
	ER	Center,	J.	Assoc.	Prof.,	Maeda
	ER	Center,	J.	Assoc.	Prof.,	Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '8 times course' should attend the lectures of the both topics. (Students who take '4 times course' should select one of the topics and attend the lectures.)

Instrumental Analysis, Adv.

先端科学機器分析及び実習

【Code】 10D043 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】

【Location】 A2-307 【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Instrumental Analysis, Adv.

先端科学機器分析及び実習

【Code】 10D046 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】

【Location】 A2-307 【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (6H course)

現代科学技術の巨人セミナー「知のひらめき」(6Hコース)

【Code】10i051 【Course Year】Doctor Course 【Term】First term, intensive

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】0.5

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 6H course, students have to select two classes and will earn 0.5 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (12H course)

現代科学技術の巨人セミナー「知のひらめき」(12Hコース)

【Code】10i052 【Course Year】Doctor Course 【Term】First term/Spring term

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】1

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 12H course, students have to complete all four classes and will earn 1 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later
Topic 3	2	Detail will be announced later
Topic 4	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Exercise in Practical Scientific English

実践的科学英語演習

【Code】 10i045 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Thu 4th or 5th 【Location】 A2-304

【Credits】 1 【Restriction】 Up to 20 students for each class 【Lecture Form(s)】 Seminar 【Language】 English (Japanese)

【Instructor】 M. Nishikawa, R. Matsumoto, R. Ashida, M. Maeda,

【Course Description】 This course is open to all master and doctoral engineering students. It is designed to help students understand how to write a research paper step by step. In this course, the students will write a short research paper (i.e. Extended Research Abstract for Proceeding, approx. 1000 -1500 words) on a topic drawn from assigned readings.

【Grading】 Evaluation based on 30% participation, 40% reports, 30% final paper *More than twice unexcused absence can result in course failure

【Course Goals】 The primary goal of this course is to deepen an understanding of the main features of each part of a scientific paper (IMRaD). Throughout the course, students will develop the core competencies required for language, grammar, and style to produce a research manuscript in English.

【Course Topics】

Theme	Class number of times	Description
Unit 1: Course Overview	1	Course Overview: Introduction to writing scientific research articles
Unit 2: Introduction	1	Raising awareness of the register of science research articles (genre, audience, purpose)
Unit 3: Preparing to Write	1	Writing a proposal for a research paper, using corpus-based approach (Exercise: Creating own Corpus)
Unit 4: Preparing to Write	1	Paraphrasing ideas from source texts, using citations and references in formal writing
Unit 5: Writing Processes	1	Identifying the “ moves ” for an Abstract section by hint expressions
Unit 6: Writing Processes	1	Writing an Abstract (Title) & peer feedback
Unit 7: Writing Processes	1	Identifying the “ moves ” for an Introduction section by hint expressions
Unit 8: Writing Processes	1	Writing an Introduction section & peer feedback
Unit 9: Writing Processes	1	Writing a Method section & peer feedback
Unit 10: Writing Processes	1	Writing a Result section & peer feedback
Unit 11: Writing Processes	1	Writing a Discussion and a Conclusion section
Unit 12: Writing Processes	1	Writing a cover letter to reviewers and how to respond to reviewers
Unit 13: Monitoring and Revising	1	Online feedback
Unit 14: Monitoring and Revising	1	Revising a paper based on peer feedback
Unit 15: Submission	1	Final Paper Due, August 6.

【Textbook】 Handout materials will be supplied by the instructor.

【Textbook(supplemental)】 ALESS (2012). Active English for Science- 英語で科学する - レポート、論文、プレゼンテーション . The University of Tokyo Press. Cargill, M., & O'Connor, P. (2013). Writing scientific research articles: Strategy and steps. John Wiley & Sons. Cowell, R., & She, L. (2015). Mastering the Basics of Technical English 『技術英語の基礎』 . 2nd Ed., Corona Publishing. 野口ジュディー・深山晶子・岡本真由美 . (2007) . 『理系英語のライティング』 . アルク

【Prerequisite(s)】 Students who intend to join this course must attend the first class.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 We may restrict the class size to enhance students ' learning. Students who intend to join the course are required to attend the first-day guidance. Office Hours: (by appointment) nishikawa.mikako7w@kyoto-u.ac.jp (Ext. 2052)

Professional Scientific Presentation Exercises (English lecture)

科学技術者のためのプレゼンテーション演習 (英語科目)

【Code】10i041 【Course Year】Doctor Course 【Term】1st term 【Class day & Period】Thu 5th

【Location】B-Cluster 2F Seminar Room 【Credits】1

【Restriction】The number of students might be limited if too many students will get enrolled.

【Lecture Form(s)】Seminar 【Language】English

【Instructor】Juha Lintuluoto, Associate Professor, Department of Synthetic Chemistry and Biological Chemistry

【Course Description】It is imperative for future engineers to be able to communicate and deliver effectively scientific information to large variety of audiences. This skill enables engineers to share and absorb information to more extended audiences, and facilitates success in selling ideas and products, publishing and team working. The purpose of this course is to teach the basic rules needed for successful professional scientific presentation, both orally and written. The course also prepares students to deliver scientific information presentations to wide audiences. The course is consisted of excessive exercises, of which the student should complete seven (7) tasks. The course holds 3-4 tasks for oral presentation exercises, and 3-4 tasks for professional scientific writing exercises. The exact number of both exercises is adjusted for each student ' s needs. The course is aimed for doctor course (DC) students, both Japanese and Foreign nationals

【Grading】Reports, class activity, presentation

【Course Goals】This course is aimed to foster engineering students ' scientific presentation skills. The successfully course completed students will be able to express and present complicated and specific scientific information at more generally understandable level. The students will also be able to pose relevant questions and effectively answer to the wide variety of questions.

【Course Topics】

Theme	Class number of times	Description
	1	Guidance and Professional presentation rules and etiquette
	3	Oral presentations & questioning I, Written report I
	3	Oral presentations & questioning I, Written report I
	3	Oral presentations & questioning II, Written report II
	3	Oral presentations & questioning II, Written report II
	2	Oral presentations & questioning III, Written report III
		Oral presentations & questioning III, Written report III
		Oral presentations & questioning IV, Written report IV
		Oral presentations & questioning IV, Written report IV I
		Course summary and discussion

【Textbook】Course materials will be provided.

【Textbook(supplemental)】Will be informed if necessary.

【Prerequisite(s)】-Fundamental skills about scientific presentation

-Advanced English skills

-Sufficient personal research results

【Independent Study Outside of Class】

【Web Sites】The web-site is listed in the home page of the GL education center.

【Additional Information】Students are requested to check in advance whether the credit of this course is counted as the unit for graduation requirement at department level. Course starts at April 12th, and the 1st lesson is repeated on April 19th. The course schedule is irregular. Most classes are biweekly, the detailed schedule is provided at the 1st lecture.

Advanced Engineering and Economy (English lecture)

工学と経済 (上級)(英語科目)

【Code】 10i042 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Tue 5th 【Location】 B-Cluster 2F Seminar Room

【Credits】 2 【Restriction】 The number of students might be limited if too many students will get enrolled. 【Lecture Form(s)】 Lectures, Group works&tasks

【Language】 English 【Instructor】 Juha Lintuluoto, Associate Professor, Department of Synthetic Chemistry and Biological Chemistry

【Course Description】 Engineering economics plays central role in any industrial engineering project. For an engineer, it is important to apply the engineering know-how with the economic analysis skills to obtain the best available materials, methods, devices, etc. in the most economical way. This course is aimed to teach engineering students the basic economic methods to manage economically an engineering project. In addition, the report writing on various engineering economic issues prepares to write reports in a professional form. The lab sessions are meant for the verbal skills improvement as well as improvement of analytical thinking. The topics are of current relevant topics Small-group brain-storming method is used. The exercise sessions cover the use of Ms-Excel for various quantitative economic analyses.

【Grading】 Final test, reports, class activity

【Course Goals】 This course is aimed to strengthen engineering students' skills in economics. The course concept is to teach students selectively those subjects which serve as major tools to solve economic tasks in engineering environment. The reports and lab sessions provide students stimulating and analytical thinking requiring tasks, and presentation skills training is an important part of this course.

【Course Topics】

Theme	Class number of times	Description
Student orientation and Introduction to engineering economy	1	Course contents, goals
Cost concepts and design economics	1	Cost terminology and classification
Cost estimation techniques	1	WBS for cost estimation, estimation techniques (indexes, unit, factor, power-sizing, learning curve, CER, top down, bottom up), target costing
The time value of money	1	Simple interest, compound interest, economic equivalence concept, cash-flow diagrams, PW, FW, AW
Evaluating a single project	1	MARR, present worth method, bond value, capitalized worth, internal rate of return, external rate of return, payback method
Comparison and selection among alternatives	1	Investment and cost alternatives, study period, equal and unequal useful lives, rate-of-return method, imputed market value
Depreciation and income taxes	1	SL and DB depreciation methods, book value, after-tax MARR, marginal income tax rate, gain(loss) on asset disposal, after-tax economic analysis general procedure, EVA,
Price changes and exchange rates	1	Actual dollars, real dollars, inflation, fixed and responsive annuities, exchange rates, purchasing power
Replacement analysis	1	Determining economic life of challenger, determining economic life of defender, abandonment, after-tax replacement study
Evaluating projects with the benefit-cost ratio method	1	Benefits, costs, dis-benefits, self-liquidating projects, multi-purpose projects, interest rate vs. public project, conventional B-C ratio PW and AW method, modified B-C ratio PW and AW method
Breakeven and sensitivity analysis	1	Breakeven analysis, sensitivity analysis, spider plot
Probabilistic risk analysis	1	Sources of uncertainty, discrete and continuous variables, probability trees, Monte Carlo simulation example, decision trees, real options analysis
The capital budgeting process	1	Capital financing and allocation, equity capital and CAPM, WACC, WACC relation to MARR, opportunity cost
Decision making considering multiattributes	1	Non-compensatory models (dominance, satisficing, disjunctive resolution, lexicography), compensatory models (non-dimensional scaling, additive weight)
Final test	1	90 minutes, concept questions, calculation task (option of choice)

Additionally, students will submit three reports during the course on given engineering economy subjects. Also, required are the five lab participations (ca.60 min/each) for each student. Additionally, three exercise sessions (ca.60 min/each), where use of Ms-Excel will be practiced for solving various engineering economy tasks, should be completed

【Textbook】 Engineering Economy 15th ed. William G. Sullivan (2011)

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 -This course is highly recommended for those who attend " Project Management in Engineering course , Small group working method

【Independent Study Outside of Class】

【Web Sites】 The web-site is listed in the home page of the GL education center.

【Additional Information】 Students are requested to check in advance whether the credits of this course are counted as the units for graduation requirement at department level. The course starts on Oct.2nd.

International Internship in Engineering 1

工学研究科国際インターンシップ 1

【Code】 10i010 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term

【Class day & Period】 Intensive course 【Location】 【Credits】 1 【Restriction】 Defined by each internship program

【Lecture Form(s)】 Exercise 【Language】 English

【Instructor】 Faculty members in charge of educational affairs of the Global Leadership Engineering Education Center and of the department the registrant belongs to.

【Course Description】 Acquisition of international skills with the training of foreign language through the internship programs hosted by the University, the Graduate School of Engineering, or The Department the registrant belongs to.

【Grading】 Merit rating is performed based on the presentation or the report(s) after the participation in each internship program. Each department is responsible to identify the number of credits to be granted to the student of the department, if the credits are included in the mandatory ones. The Global Leadership Engineering Education Center takes the role to evaluate the credits if the department the student belongs to deals the credits as optional ones. The number of credits to be earned is 1 and 2, respectively to the subjects International Internship in Engineering 1 and 2 depending on the period and the contents of the internship program the students has participated in.

【Course Goals】 Acquisition of international skills with the training of foreign language.

【Course Topics】

Theme	Class number of times	Description
Overseas Internship	1	The contents to be acquired should be described in the brochure of each internship program.
Final Presentation	1	A presentation by the student is required followed by discussion among participants.

【Textbook】 Not Applicable

【Textbook(supplemental)】 Not Applicable

【Prerequisite(s)】 Described in the application booklet for each internship program. The registrant is requested to have enough language skills for the participation.

【Independent Study Outside of Class】 Not Applicable

【Web Sites】 Not Applicable

【Additional Information】 It is required for students to check if the internship program to participate in could be evaluated as part of mandatory credits or not and could earn how many credits before the participation to the department or educational program the student is enrolled. If the credit could not be treated as mandatory ones, get in touch with the Global Leadership Engineering Education Center.

International Internship in Engineering 2

工学研究科国際インターンシップ 2

【Code】10i011 【Course Year】Master and Doctor Course 【Term】1st+2nd term

【Class day & Period】Intensive course 【Location】 【Credits】2 【Restriction】Defined by each internship program

【Lecture Form(s)】Exercise 【Language】English

【Instructor】Faculty members in charge of educational affairs of the Global Leadership Engineering Education Center and of the department the registrant belongs to.

【Course Description】Acquisition of international skills with the training of foreign language through the internship programs hosted by the University, the Graduate School of Engineering, or The Department the registrant belongs to.

【Grading】Merit rating is performed based on the presentation or the report(s) after the participation in each internship program. Each department is responsible to identify the number of credits to be granted to the student of the department, if the credits are included in the mandatory ones. The Global Leadership Engineering Education Center takes the role to evaluate the credits if the department the student belongs to deals the credits as optional ones. The number of credits to be earned is 1 and 2, respectively to the subjects International Internship in Engineering 1 and 2 depending on the period and the contents of the internship program the students has participated in.

【Course Goals】Acquisition of international skills with the training of foreign language. Detailed objectives should be described in each program.

【Course Topics】

Theme	Class number of times	Description
Overseas Internship	1	The contents to be acquired should be described in the brochure of each internship program.
Final Presentation	1	A presentation by the student is required followed by discussion among participants.

【Textbook】Not Applicable.

【Textbook(supplemental)】Not Applicable.

【Prerequisite(s)】Described in the application booklet for each internship program. The registrant is requested to have enough language skills for the participation.

【Independent Study Outside of Class】Not Applicable.

【Web Sites】Not Applicable.

【Additional Information】It is required for students to check if the internship program to participate in could be evaluated as part of mandatory credits or not and could earn how many credits before the participation to the department or educational program the student is enrolled. If the credit could not be treated as mandatory ones, get in touch with the Global Leadership Engineering Education Center.

Project Management in Engineering

エンジニアリングプロジェクトマネジメント

【Code】 10i049 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 4th 【Location】 A2-308 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu

Assoc.Prof. Lintuluoto, J. Assoc. Prof. Tanaka

【Course Description】 This course provides a basic knowledge required for the project management in various engineering fields such as process design, plant design, construction, and R&D projects. Also, visiting lecturers from industry and public works provide management insights of actual engineering projects.

【Grading】 Evaluated by assignments (project report exercise) and class contribution

【Course Goals】 This course will help students gain a fundamental knowledge of what project management in engineering is. Throughout the course, students will learn various tools applied in project management. Students will also understand the importance of costs and money, risks, leadership, and environmental assessment in managing engineering projects. This course is followed with the course Seminar on Project Management in Engineering. in the second semester.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	4/13 (Matsumoto) Course guidance
Special lecture by extramural instructor 1	1	4/20 (Inaoka(JICA))@A2-306 Project management in the case of Japanese ODA
Introduction to project management	1	4/27 (Maeda) Introduction to project management Project phases
Tools for project management I	1	5/11 (Lintuluoto) Tools for project management, cost, and cash flows I
Tools for project management II	1	5/18 (Lintuluoto) Tools for project management, cost, and cash flows II
Tools for project management III	1	5/25 (Lintuluoto) Tools for project management, cost, and cash flows III
Project scheduling I	1	6/1 (Ashida) Project scheduling I
Project scheduling II	1	6/8 (Ashida) Project scheduling II
Leadership I	1	6/15 (Tanaka) Leadership I
Leadership II	1	6/22 (Tanaka) Leadership II
Risk management I	1	6/29 (Matsumoto) Risk management I
Risk management II	1	7/6 (Matsumoto) Risk management II
Environmental Impact Assessment	1	7/13 (Yorozu) Environmental Impact Assessment
Special lecture by extramural instructor 2	1	7/20 (Kumagai(JGC CORPORATION)) To be announced
Feedback	1	7/27 (Matsumoto) Feedback

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 1. Lock, Dennis. Project Management. 10th edition. Gower Publishing Ltd.

2. Cleland, David L., and Lewis R. Ireland. Project Management. 5th edition. McGraw-Hill Professional

3. Roger Miller and Donald R. Lessard. The strategic management of large engineering projects, Shaping Institutions, Risks, and Governance, The MIT Press

【Prerequisite(s)】 No pre-requisite

【Independent Study Outside of Class】

【Web Sites】 The web-site is opened in the home page of the GL education center.

【Additional Information】

Exercise on Project Management in Engineering

エンジニアリングプロジェクトマネジメント演習

【Code】 10i059 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day & Period】 Friday 4th period and 5th period 【Location】 B-Cluster 2F Seminar Room 【Credits】 2

【Restriction】 Student number will be limited. 【Lecture Form(s)】 Seminar 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu
Assoc.Prof. Lintuluoto

【Course Description】 In this course, students will apply the engineering know-how and the skills of management, and group leadership which they learned in the course of Project Management in Engineering to build and carry out a virtual inter-engineering project. This course provides a forum where students' team-plan based on ideas and theories, decision making, and leadership should produce realistic engineering project outcomes. The course consists of intensive group work, presentations, and a few intermediate discussions. A written report will be required.

【Grading】 Report, class activity, presentation

【Course Goals】 This course prepares engineering students to work with other engineers within a large international engineering project. In particular this course will focus on leadership and management of projects along with applied engineering skills where the students learn various compromises, co-operation, responsibility, and ethics.

【Course Topics】

Theme	Class number of times	Description
	10/5	
Guidance	1	Introduction to Exercise on Project Management in Engineering Lecture on tools for the Project management in engineering Practice
Teamwork	7	Each project team may freely schedule the group works within given time frame. The course instructors are available if any need is required.
Mid-term presentation	1	Each project team will have a mid-term presentation.
Lecture & Teamwork	2	Some lectures will be provided, such as Leadership structuring, Risk Management, and Environmental Impact Assessment, depending on projects you propose.
Presentation	1	Each project team will have a presentation based on its proposed project.

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 Fundamental skills about group leading and communication, scientific presentation.

【Independent Study Outside of Class】

【Web Sites】 The web-site will be opened in the home page of the GL education center.

【Additional Information】 The number of students may be restricted. Students are requested to check in advance whether the credit from this course will be accepted as a graduation requirement for their department.

Special Seminar 1 in Synthetic Chemistry and Biological Chemistry

合成・生物化学特別セミナー 1

【Code】 10S807 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Special Seminar 2in Synthetic Chemistry and Biological Chemistry

合成・生物化学特別セミナー 2

【Code】10S808 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Special Seminar 3 in Synthetic Chemistry and Biological Chemistry

合成・生物化学特別セミナー 3

【Code】 10S809 【Course Year】 Doctor Course 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Special Topics in Transport Phenomena

移動現象特論

【Code】10H002 【Course Year】Master and Doctor Course 【Term】Spring term 【Class day & Period】 【Location】

【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Department of Chemical Engineering, Professor, Ryoichi Yamamoto

【Course Description】After general introductions on the flow properties (Rheology) of polymeric liquids as typical examples of non-Newtonian fluids, the relationship (known as the constitutive equation) between strain rate and stress is explained. In addition to classical phenomenological approaches, molecular approaches based on statistical mechanics will be taught in this course. To this end, basic lectures on “Langevin Equation”, “Hydrodynamic Interaction”, and “Linear Response Theory” will also be given.

【Grading】Answers to several questions and exercises, which will be given during the course, are used to judge.

【Course Goals】To understand strength and weakness of both phenomenological and molecular approaches to formulate general behaviors of non-Newtonian fluids mathematically as forms of constitutive equations. Also to learn mathematical and physical methodologies necessarily to achieve this.

【Course Topics】

Theme	Class number of times	Description
- Polymeric Liquids / Rheology	6	Shedding lights on the nature of polymeric liquids in comparisons with simple Newtonian liquids. Various formulations on the characteristic behaviors of polymeric liquids based on both empirical and molecular approaches are lectured.
- Stochastic Process / Langevin Equation	3	To deal with Brownian motions of particles in solvents, a lecture on Langevin equation is given after some basic tutorials on stochastic process.
- Green Function / Hydrodynamic Interaction	2	To deal with motions of interacting particles in solvents, a lecture on the hydrodynamic interaction is given after some basic tutorials on Green function and Poisson equation.
Understanding Check	1	

【Textbook】Transport Phenomena 2nd Ed., Bird, Stewart, Lightfoot, (Wiley)

【Textbook(supplemental)】Introduction to Polymer Physics, Doi, (Oxford) Theory of Simple Liquids 4th Ed., Hansen, McDonald, (Academic Press) Colloidal Dispersions, Russel, Saville, and Schowalter, (Cambridge)

【Prerequisite(s)】Under graduate level basic knowledge on “Fluid Mechanics / Transport Phenomena” and basic mathematics including “Vector Analyses” are required.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】This is an biennial course taught in Japanese (2019, 2021, 2023, ...) or in English (2018, 2020, 2022, ...).

Code:

10H002 Japanese (Present Syllabus)

10H003 English

Advanced Topics in Transport Phenomena (English lecture)

Advanced Topics in Transport Phenomena

【Code】 10H003 **【Course Year】** Master and Doctor Course **【Term】** Spring term**【Class day & Period】** Tue 4th **【Location】** A2-305 **【Credits】** 1.5 **【Restriction】** No Restriction**【Lecture Form(s)】** Lecture **【Language】** English**【Instructor】** Department of Chemical Engineering, Professor, Ryoichi Yamamoto

【Course Description】 After general introductions on the flow properties (Rheology) of polymeric liquids as typical examples of non-Newtonian fluids, the relationship (known as the constitutive equation) between strain rate and stress is explained. In addition to classical phenomenological approaches, molecular approaches based on statistical mechanics will be taught in this course. To this end, basic lectures on “ Langevin Equation ” , “ Hydrodynamic Interaction ” , and “ Linear Response Theory ” will also be given.

【Grading】 Answers to several questions and exercises, which will be given during the course, are used to judge.

【Course Goals】 To understand strength and weakness of both phenomenological and molecular approaches to formulate general behaviors of non-Newtonian fluids mathematically as forms of constitutive equations. Also to learn mathematical and physical methodologies necessarily to achieve this.

【Course Topics】

Theme	Class number of times	Description
- Polymeric Liquids / Rheology	6	Shedding lights on the nature of polymeric liquids in comparisons with simple Newtonian liquids. Various formulations on the characteristic behaviors of polymeric liquids based on both empirical and molecular approaches are lectured.
- Stochastic Process / Langevin Equation	3	To deal with Brownian motions of particles in solvents, a lecture on Langevin equation is given after some basic tutorials on stochastic process.
- Green Function / Hydrodynamic Interaction	2	To deal with motions of interacting particles in solvents, a lecture on the hydrodynamic interaction is given after some basic tutorials on Green function and Poisson equation.
Understanding Check	1	

【Textbook】 Transport Phenomena 2nd Ed., Bird, Stewart, Lightfoot, (Wiley)

【Textbook(supplemental)】 Introduction to Polymer Physics, Doi, (Oxford) Theory of Simple Liquids 4th Ed., Hansen, McDonald, (Academic Press) Colloidal Dispersions, Russel, Saville, and Schowltzer, (Cambridge)

【Prerequisite(s)】 Under graduate level basic knowledge on “ Fluid Mechanics / Transport Phenomena ” and basic mathematics including “ Vector Analyses ” are required.

【Independent Study Outside of Class】**【Web Sites】**

【Additional Information】 This is an biennial course taught in Japanese (2019, 2021, 2023, ...) or in English (2018, 2020, 2022, ...).

Code:

10H002 Japanese

10H003 English (Present Syllabus)

Separation Process Engineering, Adv.

分離操作特論

【Code】 10H005 【Course Year】 Master and Doctor Course 【Term】 Spring term

【Class day & Period】 Mon 2nd 【Location】 A2-305 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 N.Sano,

【Course Description】 The separation related with transport phenomena of heat and mass and particles will be lectured. Adsorption, drying, distillation will be explained. In addition, new separation methods will be explained.

【Grading】 Reports submitted from students and exams will be evaluated.

【Course Goals】 This course will deepen the students' understanding on multiphase transport phenomena by lecturing separation operations, and the students will know how to develop effective separation methods. Also they will know recent developments of separation techniques in chemical engineering.

【Course Topics】

Theme	Class number of times	Description
Separation using electric field	2	Purification of gas and water using electric discharges and particle separation using dielectrophoresis are explained.
Distillation	3	Distillation is used commonly in chemical industries. Here, advanced knowledge on distillation about multi-component distillation, equipment design using enthalpy-component diagram, extraction distillation, etc. will be explained.
Adsorption	3	Analysis using adsorption is used for structural analysis of porous materials, and it is important to evaluate adsorbents. Here, basic knowledge about these analysis will be explained. When one wants to select appropriate adsorbents, features and properties of typical adsorbents should be known. These points will be lectured. Also, some methods to synthesize adsorbents from waste materials are explained.
Drying mechanism and preservation of product quality	2	Drying is a typical operation utilizing phase transformation and simultaneous transport of heat and mass. A variety of drying units are explained, and the points to designing these units will be lectured. Many examples of troubles seen in drying operations will be explained.
Other separation operations	1	Other separation operations, for example liquid-liquid extraction, membrane separation, etc. will be lectured.

【Textbook】 Gendai Kagaku Kogaku Hashimoto and Ogino, Sangyo Tosho; Kanso Gijustu Jitsumu Nyumon Tamon, Nikkan Kogyo Shinbun

【Textbook(supplemental)】

【Prerequisite(s)】 Basic knowledge about transport phenomena and separation engineering should be required.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Chemical Reaction Engineering, Adv.

反応工学特論

【Code】10H008 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】Wed 3rd 【Location】A2-302 【Credits】

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Prof. Motoaki Kawase, Department of Chemical Engineering; Assoc. Prof. Hiroyuki Nakagawa, Department of Chemical Engineering

【Course Description】The following contents are covered:

- Kinetic analysis of gas-solid-catalyst reaction, gas-solid reaction, CVD reaction, and enzymatic reaction,
- Operation and design of reactors for gas-solid-catalyst and gas-solid reactions, and
- Industrial reactors including fixed bed, fluidized bed, moving bed, simulated moving bed, and stirred tank types.

【Grading】Based on the result of examination at the end of term and the results of quizzes and reports imposed every week

【Course Goals】To understand kinetic analysis of chemical reactions utilized in the industry and procedure to design and operate industrial reactors.

【Course Topics】

Theme	Class number of times	Description
Gas-solid-catalyst reaction (1) Overview	1	Commercial catalysts and industrial gas-solid-catalyst reactions are overviewed. Chemical reaction engineering fundamentals of the gas-solid-catalyst reaction is explained.
Gas-solid-catalyst reaction (2) Generalized effectiveness factor and selectivity in complex reactions	1	The generalized effectiveness factor and the selectivity affected by mass transfer are explained.
Gas-solid-catalyst reaction (3) Deactivation and regeneration of catalyst	2	Deactivation mechanisms of solid catalysts are overviewed. The deactivation and consequent change in selectivity are explained in terms of the decay function and specific activity.
Gas-solid-catalyst reaction (4) Design and operation of industrial catalytic reactors	1	Industrial catalytic reactors including fixed-bed and fluidized-bed reactors are overviewed. Design and operation of these reactors including thermal stability are explained.
Liquid-solid-catalyst reaction -- Simulated moving bed reactor	1	Concepts and theories of simulated moving bed is explained. Its application to catalytic reactions are reviewed.
CVD reaction (1) Fundamentals	1	Thermal and plasma chemical vapor deposition reactions and processes are overviewed. Fundamentals from chemical reaction engineering view point are explained.
CVD reaction (2) Kinetic analysis and modeling	1	Kinetic analysis of CVD is described from CRE viewpoint. Reaction models including elementary reaction model and overall reaction model are derived and applied to some examples.
Gas-solid reaction (1) Kinetic analysis	2	Kinetic measurement and analysis of complicated gas-solid reactions, particularly coal pyrolysis, are explained with the first-order reaction model to the distributed activation energy model (DAEM).
Gas-solid reaction (2) Kinetic analysis of gas-solid reaction	1	Concepts and derivation of the reaction models including the grain model and the random-pore model are explained. Application of the models to coal gasification is overviewed.

【Textbook】Prints are distributed.

【Textbook(supplemental)】

【Prerequisite(s)】Needs knowledge of chemical reaction engineering including heterogeneous reactions.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Chemical Reaction Engineering, Adv. (English lecture)

Chemical Reaction Engineering, Adv.

【Code】10H009 【Course Year】Master and Doctor Course 【Term】 【Class day & Period】 【Location】 【Credits】 【Restriction】

【Lecture Form(s)】 【Language】 English

【Instructor】 Prof. Motoaki Kawase, Department of Chemical Engineering; Assoc. Prof. Hiroyuki Nakagawa, Department of Chemical Engineering; Junior Assoc. Prof. Ryuichi Ashida, Department of Chemical Engineering

【Course Description】 This lecture is given in English. The following contents are covered: - Kinetic analysis of gas-solid-catalyst reaction, gas-solid reaction, and CVD reaction, - Operation and design of reactors for gas-solid-catalyst and gas-solid reactions, and - Industrial reactors including fixed bed, fluidized bed, moving bed, simulated moving bed, and stirred tank types.

【Grading】 Based on the result of examination at the end of term and the results of quizzes and reports imposed every week.

【Course Goals】 To understand kinetic analysis of chemical reactions utilized in the industry and procedure to design and operate industrial reactors.

【Course Topics】

Theme	Class number of times	Description
Gas-solid-catalyst reaction (1) Fundamentals	1	Commercial catalysts and industrial gas-solid-catalyst reactions are overviewed. Chemical reaction engineering fundamentals of the gas-solid-catalyst reaction is explained.
Gas-solid-catalyst reaction (2) Generalized effectiveness factor and selectivity in complex reactions	1	The generalized effectiveness factor and the selectivity affected by mass transfer are explained.
Gas-solid-catalyst reaction (3) Deactivation and regeneration of catalyst	2	Deactivation mechanisms of solid catalysts are overviewed. The deactivation and consequent change in selectivity are explained in terms of the decay function and specific activity.
Gas-solid-catalyst reaction (4) Design and operation of industrial catalytic reactors	1	Industrial catalytic reactors including fixed-bed and fluidized-bed reactors are overviewed. Design and operation of these reactors including thermal stability are explained.
Liquid-solid-catalyst reaction -- Simulated moving bed reactor	1	Concept and applications of simulated moving bed reactor are explained. Model-based analysis of simulated moving bed reactor is explained.
CVD reaction	2	Fundamentals of CVD reactions are explained from chemical reaction engineering view point. Kinetic analysis of CVD is described. Reaction models including elementary reaction model and overall reaction model are derived and applied to some examples.
Gas-solid reaction (1) Kinetic analysis	2	Kinetic measurement and analysis of complicated gas-solid reactions, particularly coal pyrolysis, are explained with the first-order reaction model to the distributed activation energy model (DAEM).
Gas-solid reaction (2) Kinetic analysis of gas-solid reaction	1	Concepts and derivation of the reaction models including the grain model and the random-pore model are explained. Application of the models to coal gasification is overviewed.

【Textbook】 Prints are hand out at the class.

【Textbook(supplemental)】

【Prerequisite(s)】 Needs knowledge of chemical reaction engineering including heterogeneous reactions.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Process Systems Engineering

プロセスシステム論

【Code】 10H011 【Course Year】 Master and Doctor Course 【Term】 2016/ Fall term

【Class day & Period】 Tue 2nd 【Location】 A2-305 【Credits】 1.5 【Restriction】 No Restriction

【Lecture Form(s)】 Lecture 【Language】 Japanese 【Instructor】 Dept. of Chem. Eng., Professor, Shinji Hasebe

【Course Description】 In the design and operation of chemical processes, various types of optimization problems arise. In this course, the formulation procedure of these problems and their solution methods are explained.

【Grading】 The degree of understandings is evaluated by the homework (30 %) and final examination (70 %).

【Course Goals】 The course goals are to obtain the ability of constructing the mathematical models, solving the optimization problems, and explaining the results of optimization.

【Course Topics】

Theme	Class number of times	Description
Formulations as the optimization problems	1	For optimization problems which arise in the design and operational problems, formulations as the optimization problems are introduced.
Unconstraint optimization	2	For unconstrained single and multivariable optimization problems, analytical and numerical optimization methods are explained. For the design problem of chemical plants, optimization procedure using numerical differentiation is also explained.
Linear programming	1	The applications of linear programming in the chemical engineering are explained.
Lagrangian multipliers	1	For the problems containing equality constraints, it is explained that the necessary conditions for an extremum can be obtained by Lagrangian multipliers.
Nonlinear programming with constraints	2	The concepts of quadratic programming and successive linear programming are explained, and their applications to chemical engineering problems are introduced.
Dynamic programming	1	The concept of dynamic programming is explained, and its applications to chemical engineering problems are introduced.
Mixed integer programming	2	For process synthesis and scheduling problems, the mathematical formulations as mixed integer (non) linear programming problems are explained, and their solution procedures are illustrated.
Meta-heuristics	1	The concepts of meta-heuristic methods such as simulated annealing and genetic algorithm are explained using the examples which appear in the chemical engineering problems.

【Textbook】 The supplemental prints are distributed in the class.

【Textbook(supplemental)】 Optimization of Chemical Processes (McGraw-Hill)

最適化 (岩波講座情報科学 19, 岩波書店)

これならわかる最適化数学 (共立出版)

【Prerequisite(s)】 The basic knowledge of unit operations, calculus and linear algebra is requested.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This course is not opened in the 2015 academic year.

Process Data Analysis

プロセスデータ解析学

【Code】 10H053 【Course Year】 Master and Doctor Course 【Term】 2017/ Fall term 【Class day & Period】

【Location】 【Credits】 1.5 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Dept. of Chem. Eng., Professor, Shinji Hasebe

【Course Description】 Process data analysis methods for product quality prediction, fault detection and diagnosis, and product yield improvement is explained together with their industrial applications. The basics and methods covered in this lecture are: basics of probability and statistics, correlation analysis, regression analysis, multivariate analysis such as principal component analysis, discriminant analysis, and partial least squares. In addition, soft-sensor design and multivariate statistical process control are explained.

【Grading】 The degree of understandings is evaluated by the homework (30 %) and final examination (70 %).

【Course Goals】 To understand the basics of probability and statistics.

To understand multivariate analysis.

To be able to apply process data analysis to practical problems.

【Course Topics】

Theme	Class number of times	Description
what is process data analysis	1	
preparation for data analysis	1	
point estimation and interval estimation	1	
regression analysis	2	
	1	
multivariate analysis	1	
soft-sensor design	1	
multivariate statistical process control	1	
current topics	2	

【Textbook】 Prints are distributed.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Fine Particle Technology, Adv.

微粒子工学特論

【Code】10H017 【Course Year】Master and Doctor Course 【Term】Autumn 【Class day & Period】Fri 2nd

【Location】A2-306 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Dept. of Chem. Eng., Professor, Shuji Matsusaka

【Course Description】Analyses of particle behavior in gases, Particle handling operations, and measurement methods are lectured. Also, particle charging that affect particle behavior in gases are theoretically explained. Furthermore, the control of the particle charging and its applications are lectured.

【Grading】Examination

【Course Goals】Understand the analysis and modeling of dynamic behavior of particles. Furthermore develop the ability to apply the knowledge for particle handling and processing.

【Course Topics】

Theme	Class number of times	Description
Particle properties and measurements	3	Mathematical description of particle diameter distribution, properties of fine particles, and their measurement methods are explained.
Particle adhesion and dynamical analysis	3	Measurement methods for adhesion forces of particles and dynamical analysis method for particle collision and elastic deformation are lectured. Furthermore, distinct element method is explained.
Behavior of particles in airflow	3	Temporal and spatial distribution of deposition and reentrainment of fine particles in gas-solid flow are explained using physical models and probability theory. In addition, complicated reentrainment phenomena during particle collision are discussed.
Particle charging and control	2	Concept of particle charging and quantitative analysis methods of charging process are explained; also, charge distribution of particles is analyzed. Furthermore, new methods to control particle charge are introduced.

【Textbook】Lecture notes

【Textbook(supplemental)】K. Okuyama, H. Masuda and S. Morooka: Biryuushi Kougaku ? Fine particle technology, Ohmsha, Tokyo (1992)

【Prerequisite(s)】Basic knowledge on powder technology in bachelor course

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Surface Control Engineering

界面制御工学

【Code】 10H020 【Course Year】 Master and Doctor Course 【Term】 【Class day & Period】 Wed 2nd

【Location】 A2-305 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 【Language】 Japanese

【Instructor】 M.Miyahara,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	3	
	2	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Engineering for Chemical Materials Processing

化学材料プロセス工学

【Code】 10H021 【Course Year】 Master and Doctor Course 【Term】 Spring 【Class day & Period】 Wed 4th 【Location】 A2-302

【Credits】 1.5 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Dept. of Chemical Engineering, Prof. M.Ohshima

,Dept of Chemical Engineering, Associate Prof. S.Nagamine,

【Course Description】 Focusing on transport phenomena (flow & rheology, mass flux, heat flux) in polymer processing process, the key relationships among polymer properties, processing schemes, and processing machine are taught.

【Grading】 40% midterm quiz, 60% exam at end

【Course Goals】 The objective of this course is to know how the polymers are different in terms of thermal, rheological and mechanical properties. The attendees learn what T_g , T_c , T_m , G' and G'' are, how those properties can be measured and how these obtained measurement data can be appreciated. Visual Observation movies relates those properties with the transport phenomena that occur in several polymer processing processes.

【Course Topics】

Theme	Class number of times	Description
Orientation & Introduction of Polymer Processing	1	The characteristics of polymers are reviewed by exercising the characterization of general polymers, like PE, PP, PLA, PC, PS, PVC in terms of appearance, thermal and mechanical properties.
State of Thermoplastic Polymer	1	The relationship among pressure-volume-temperature of thermoplastic polymer is described. The way of identifying the T_g , T_c is taught. Several equations of state are introduced.
Thermal Properties of Thermoplastic Polymers	2	Several important thermal properties of thermoplastic polymers, such as glass transition temp, T_g , crystallization temp, T_c , and melting temp, T_m are explained together with the measurement methods of those thermal properties. The latest measurement device, Flash DSC, is introduced with some of the interesting data of crystallization process.
Rheological Properties of Thermoplastic Polymers	2	The basic of polymer rheology, viscosity and elasticity, is given. Several phenomena of non-Newtonian fluid are introduced. The fundamental constitutive equations, Maxwell and Voigt models, describing the viscoelasticity of the polymers are explained. Exercising on identification of polymer structures, such as the degree of entanglement, molecular weight, presence of long-chain branch from the rheological data, relationship between polymer rheology and polymer structure is explained.
Basic Flows in Polymer Processing	1	The basics of Polymer Processing are the series of Melt, Flow and Shape. Here the class focus on the Flow. The two types flow, i.e., drag and pressure flows are explained together with master equation. Without solving the mathematical equations, the skill of estimating the velocity profile is cultivated.
Visual Observation of Flow Phenomena in Processing Machine	1	Entertaining several visual observation movies showing the flow phenomena in real polymer processing machine like injection molding machine and extruder, The effects of thermal and rheological properties of polymer on those flow phenomena are clarified.
Phase separation and Morphology Formation	2	The basic of phase separation of polymer-polymer, polymer-solvent are taught.
Phase Separation Phenomena in Polymer Processing	1	Several polymer processing schemes exploiting a phase separation phenomenon are introduced. Synergistic design of the polymer properties, processing scheme and processing machine is stressed.
Check what we learn	1	During the class, plenty of quiz are given to check the understanding.

【Textbook】 Handout

【Textbook(supplemental)】 Agassant, J.F., Polymer Processing: Principles and Modeling

【Prerequisite(s)】 Basic of Transport Phenomena

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Environmental System Engineering

環境システム工学

【Code】 10H023 【Course Year】 Master and Doctor Course 【Term】 【Class day & Period】 Tue 2nd

【Location】 A2-305 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Chemical Engineering, Professor, Kazuhiro Mae

Chemical Engineering, Associate professor, Taisuke Maki

【Course Description】 First, we overview the concept of environmentally benign chemical processing based on the causal relation between energy and environmental issues. Then, we discuss various new technologies for energy production and environmentally harmonized processes from the viewpoint of chemical engineering.

【Grading】 Coursework will be graded based on the reports.

【Course Goals】 To learn methodology for system-up of environmentally benign process based on energy and exergy. To consider perspective of biomass and hydrogen utilization. To understand several environmental evaluation methods.

【Course Topics】

Theme	Class number of times	Description
Concept of environmentally benign system based on exergy	4	Basic of exergy and calculation of exergy for various conversion process
Biomass conversion	3	Introduction of various conversion processes for biomass and wastes from the view point of kinetics
Environmental evaluation method (1)	2	Introduction of various environmental evaluation methods Calculation of LCA analysis
Environmental evaluation method (2)	2	Calculation of E-factor and environmental efficiency for several chemical processes
Confirmation of study achievement	1	Feedback of evaluation results for reports and exercises.

【Textbook】 The textbook is not required. Materials will be supplied by instructors.

【Textbook(supplemental)】 Physical chemistry, Thermodynamics

【Prerequisite(s)】 Basic knowledge for chemical engineering thermodynamics is required.

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Process Design

プロセス設計

【Code】 10E038 【Course Year】 Master Course 【Term】 1st term 【Class day & Period】 Fri 3rd

【Location】 A2-304 【Credits】 2 【Restriction】 Yes. See the additional information at the bottom of this page.

【Lecture Form(s)】 Lecture and exercise 【Language】 Japanese

【Instructor】 Dept. of Chem. Eng., Professor, hinji Hasebe

Part-time lecturer, Kazuyoshi Baba

All the faculty members of Dept. of Chem. Eng.

【Course Description】 The fundamental skills of designing chemical processes which consist of various unit operations are learned. Then, a conceptual design exercise of a chemical process is executed using the knowledge of chemical engineering and process simulation system.

【Grading】 The results are evaluated by the contents of the final report and the oral presentation.

【Course Goals】 It is requested to understand the way of conceptual design, and to have the skill of designing chemical processes by applying the knowledge of chemical engineering and related field.

【Course Topics】

Theme	<small>Class number of times</small>	Description
Concept of process design	1	The assembly of the optimally designed unit operations does not result in the total optimum system. The concepts of the system boundary and the total optimal design are explained.
Computer-aided process design	1	In an actual process design, use of a process simulator is indispensable. The design technique using the sequential modular approach, which is mainly used in the process simulator, is explained.
How to use process simulators	2	How to use the process simulator which is widely used in the real process design is explained.
Reality of process design	6	Process design consists of successive steps such as the acquisition of market research and data, process synthesis, and an equipment design. For these steps, the problems which should be taken into consideration are made clear, and the techniques which can be used at each step are explained.
Practice of a chemical process design	1	The design exercise is executed by 2 to 3 students' group.
Oral presentation	4	The design result at each group is presented at the oral session where all the faculty members attend.

【Textbook】 Lecture materials are distributed in the class.

【Textbook(supplemental)】

【Prerequisite(s)】 The basic knowledge of chemical engineering such as the unit operation and reaction engineering are requested.

【Independent Study Outside of Class】 The design exercise is executed by 2 to 3 students' group.

【Web Sites】 <http://www.cheme.kyoto-u.ac.jp/processdesign/>

【Additional Information】 Each group of students is supervised by the professors of the affiliation laboratory. The credit obtained in this course cannot be counted as the credit for graduation if the students have taken the same subject at the undergraduate course of chemical process engineering.

Special Topics in Chemical Engineering I

化学工学特論第一

【Code】 10H030 【Course Year】 Master Course 【Term】 Spring 【Class day & Period】 【Location】

【Credits】 1.5 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Katsuaki Tanabe (Associate Professor, Department of Chemical Engineering)

【Course Description】 Advanced Statistical Mechanics and Thermodynamics

【Grading】 Evaluated based on attendance, quizzes, and exams

【Course Goals】 Deepen your understanding for statistical mechanics and thermodynamics

【Course Topics】

Theme	Class number of times	Description
Introduction	1	
Revisits	1	
Thermal cycles	1	
Non-equilibrium thermal cycles	1	
Distribution functions 1	1	
Midterm exam	1	
Feedback	1	
Distribution functions 2	1	
Distribution functions 3	1	
Partition functions	1	
Information thermodynamics	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】 Fundamental thermodynamics and math

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Special Topics in Chemical Engineering II

化学工学特論第二

【Code】10H032 【Course Year】Master Course 【Term】2nd term 【Class day & Period】Fri 3rd

【Location】A2-305 【Credits】1.5 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】ER Center, Ryuichi Ashida

【Course Description】Approach to conversion processes of heavy carbonaceous resources including low-rank coal and biomass from the view point of chemical reaction engineering is explained.

【Grading】class participation, report

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Trend of energy utilization in Japan and in the world	3	Trend of energy utilization in Japan and in the world is introduced.
Technologies for utilizing heavy carbonaceous resource	3	Current situation and challenges concerning technologies for utilizing heavy carbonaceous resource are explained.
Kinetics of chemical reactions of solid having complex physical and/or chemical properties	5	Application of chemical engineering to reactions of complex heavy carbonaceous resources is presented and kinetic modeling of reactions of solids and heavy liquids for predicting the rate and quality of the products is explained.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Special Topics in Chemical Engineering III

化学工学特論第三

【Code】 10H033 【Course Year】 Master Course 【Term】 【Class day & Period】 【Location】 【Credits】

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Department of Chemical Engineering, Junior Associate Professor, Satoshi Watanabe

【Course Description】 In this course, students will learn fundamental phenomena observed in colloidal dispersions and related characterization techniques.

【Grading】 Attendance, reports, and exams.

【Course Goals】 To understand the basic phenomena in colloidal dispersions, including particle charging, interactions, and phase behaviors.

【Course Topics】

Theme	Class number of times	Description
Colloidal Dispersions	1	The definition of colloidal dispersions and their wide applications will be described.
Particle Charges and Interparticle potentials in Liquids	5	In this theme, following topics will be explained: the formation of electric double layer, the derivation of electric potential by solving the Poisson-Boltzmann equation, and the interaction between two charged surfaces.
Characterization of Colloidal Dispersions	2	In this theme, characterization techniques of colloidal particles will be introduced, including dynamic light scattering, the measurements of electrophoretic mobility and surface forces.
Equilibrium Phase Behavior	3	Colloidal suspensions show an order-disorder transition, which is analogous to the solid-liquid transition of molecular systems. This theme will deal with colloidal crystals formed through the order-disorder phase transition, and the formation process and their optical properties will be discussed.

【Textbook】 Reference materials will be distributed during the lectures if needed.

【Textbook(supplemental)】 1) Colloidal Dispersions, W.B. Russel, D.A. Saville, and W.R. Schowalter, Cambridge University Press

2) Theory of The Stability of Lyophobic Colloids, E.J. W. Verwey and J.Th.G. Overbeek, Dover Publications

【Prerequisite(s)】 Maths, Thermodynamics

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Research Internship in Chemical Engineering

研究インターンシップ(化工)

【Code】 10H040 【Course Year】 Master and Doctor Course 【Term】 1st+2nd term 【Class day & Period】

【Location】 【Credits】 2 【Restriction】 【Lecture Form(s)】 Exercise 【Language】 English 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	27	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Chemical Engineering Seminar

化学工学セミナー 1

【Code】10P043 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Intensive Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Chemical Engineering Seminar

化学工学セミナー 2

【Code】10P044 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Intensive Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Chemical Engineering Seminar

化学工学セミナー 3

【Code】10P045 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Intensive Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Chemical Engineering Seminar

化学工学セミナー 4

【Code】10P046 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Intensive Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Research in Chemical Engineering

化学工学特別実験及演習

【Code】10E045 【Course Year】Master 1st 【Term】1st term 【Class day & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar and Exercise 【Language】Japanese 【Instructor】，

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	5	
	5	
	10	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Research in Chemical Engineering

化学工学特別実験及演習

【Code】10E047 【Course Year】Master 1st 【Term】2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar and Exercise 【Language】Japanese 【Instructor】，

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
	6	
	10	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Research in Chemical Engineering

化学工学特別実験及演習

【Code】 10E049 【Course Year】 Master 2nd 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 【Lecture Form(s)】 Seminar and Exercise 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	6	
	12	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Research in Chemical Engineering

化学工学特別実験及演習

【Code】10E051 【Course Year】Master 2nd 【Term】2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】 【Lecture Form(s)】Seminar and Exercise 【Language】Japanese 【Instructor】,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	4	
	12	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Advanced Material Science and Technology (11 times course)

(English lecture)

先端マテリアルサイエンス通論 (11 回コース) (英語科目)

【Code】 10i053 【Course Year】 Master and Doctor Course 【Term】 Spring term 【Class day & Period】 Fri 5th 【Location】 A2-306 【Credits】 1.5

【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 ER Center, J. Assoc. Prof., Ryuichi Ashida

Related professors

【Course Description】 The various technologies used in the field of material science serve as bases for so-called high technologies, and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】 The average score of the best four reports is employed.

Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Tumor Imaging and Therapy through Photoirradiation	1	The overview of current modalities through photoirradiation as well as the preparation of tumor imaging probes is given. Tumor therapy through photoirradiation is also shown in the lecture. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Carbon Nanorings	1	The preparation of carbon nanorings is outlined in the lecture. The supramolecular interaction as well as the photophysical properties of carbon nanorings is summarized. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Crystal Structure Analysis by Powder X-ray Diffraction Measurement	1	Chemical and physical properties of a material is strongly related with the structure of the material. So, structure analysis is one of the most important part in material researches. Powder X-ray diffraction analysis is powerful way to analyze the crystal structure of solid materials. We study how to use powder X-ray diffraction analysis for material researches. (T. Yamamoto: Dept. of Energy and Hydrocarbon Chemistry)
Principles and Applications of Fluorescence Spectroscopy	1	Fluorescence spectroscopy is applied to various disciplines of science and engineering, and provides unique information of a system upon photo-illumination. This course aims to introduce the background of fluorescence spectroscopy and practical knowledge in fluorescence experiments. (J. Park: Dept. of Molecular Engineering)
Synthesis of Novel π -Conjugated Molecules with Main Group Elements	1	The lecture will show synthesis and properties of novel π -conjugated molecules with main group elements, and their application as functional materials. (T. Higashino: Dept. of Molecular Engineering)
Chemistry of Asymmetric Catalysis Stereoselective Synthesis of Optically Active Pharmaceutical Compounds	1	This class will outline the progress on enantioselective catalysis for the asymmetric synthesis of optically active pharmaceutical compounds such as Herbesser, which is a blockbuster drug developed in a Japanese pharmaceutical company. (K. Asano: Dept. of Material Chemistry)
Electrical Conductivity of Conjugated Polymers and Application to Organic Electronics	1	In this class, structure and property of conjugated polymers are introduced and discussed. The discussion topics include the brief history of the discovery of electrical conductivity of conjugated polymers, mechanism of electrical conductivity in polymer chains, representative evaluation methods of conductivity for conjugated polymers, relationship between molecular and self-assembled structures of conjugated polymers, and recent examples of device applications using conjugated polymers. (I. Sakurai: Dept. of Molecular Engineering)
An Introduction to Smart Shape Changing Materials	1	This course will briefly introduce smart materials as a whole and will then focus specifically on the recent and very active field of smart shape changing materials. We will explore how the design and stimuli-sensitivity of various materials can allow for materials to have planned and useful motion. (K. Landenberger: Dept. of Polymer Chemistry)
Properties of Cementitious Materials and the Future	2	CEMENT may not necessarily be an advanced material, but must surely be a forefront material for human life and society, in the past, present and future. Then, what are your demands to cement? (A. Hattori: Dept. of Urban Management)
Application of Electrical Discharge to Material and Environmental Technology	1	(N. Sano: Dept. of Chemical Engineering)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Introduction to Advanced Material Science and Technology (15 times course)

(English lecture)

先端マテリアルサイエンス通論 (15 回コース) (英語科目)

【Code】10i054 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】Fri 5th 【Location】A2-306 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture

【Language】English

【Instructor】ER Center, J. Assoc. Prof., Ryuichi Ashida
Related professors

【Course Description】The various technologies used in the field of material science serve as bases for so-called high technologies, and, in turn, the high technologies develop material science. These relate to each other very closely and contribute to the development of modern industries. In this class, recent progresses in material science are briefly introduced, along with selected current topics on new biomaterials, nuclear engineering materials, new metal materials and natural raw materials. The methods of material analysis and future developments in material science are also discussed.

【Grading】The average score of the best five reports is employed.
Please go to KULASIS Web site for more information.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Tumor Imaging and Therapy through Photoirradiation	1	The overview of current modalities through photoirradiation as well as the preparation of tumor imaging probes is given. Tumor therapy through photoirradiation is also shown in the lecture. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Carbon Nanorings	1	The preparation of carbon nanorings is outlined in the lecture. The supramolecular interaction as well as the photophysical properties of carbon nanorings is summarized. (K. Miki: Dept. of Energy and Hydrocarbon Chemistry)
Crystal Structure Analysis by Powder X-ray Diffraction Measurement	1	Chemical and physical properties of a material is strongly related with the structure of the material. So, structure analysis is one of the most important part in material researches. Powder X-ray diffraction analysis is powerful way to analyze the crystal structure of solid materials. We study how to use powder X-ray diffraction analysis for material researches. (T. Yamamoto: Dept. of Energy and Hydrocarbon Chemistry)
Principles and Applications of Fluorescence Spectroscopy	1	Fluorescence spectroscopy is applied to various disciplines of science and engineering, and provides unique information of a system upon photo-illumination. This course aims to introduce the background of fluorescence spectroscopy and practical knowledge in fluorescence experiments. (J. Park: Dept. of Molecular Engineering)
Synthesis of Novel π -Conjugated Molecules with Main Group Elements	1	The lecture will show synthesis and properties of novel π -conjugated molecules with main group elements, and their application as functional materials. (T. Higashino: Dept. of Molecular Engineering)
Chemistry of Asymmetric Catalysis Stereoselective Synthesis of Optically Active Pharmaceutical Compounds	1	This class will outline the progress on enantioselective catalysis for the asymmetric synthesis of optically active pharmaceutical compounds such as Herbesser, which is a blockbuster drug developed in a Japanese pharmaceutical company. (K. Asano: Dept. of Material Chemistry)
Electrical Conductivity of Conjugated Polymers and Application to Organic Electronics	1	In this class, structure and property of conjugated polymers are introduced and discussed. The discussion topics include the brief history of the discovery of electrical conductivity of conjugated polymers, mechanism of electrical conductivity in polymer chains, representative evaluation methods of conductivity for conjugated polymers, relationship between molecular and self-assembled structures of conjugated polymers, and recent examples of device applications using conjugated polymers. (I. Sakurai: Dept. of Molecular Engineering)
An Introduction to Smart Shape Changing Materials	1	This course will briefly introduce smart materials as a whole and will then focus specifically on the recent and very active field of smart shape changing materials. We will explore how the design and stimuli-sensitivity of various materials can allow for materials to have planned and useful motion. (K. Landenberger: Dept. of Polymer Chemistry)
Properties of Cementitious Materials and the Future	2	CEMENT may not necessarily be an advanced material, but must surely be a forefront material for human life and society, in the past, present and future. Then, what are your demands to cement? (A. Hattori: Dept. of Urban Management)
Application of Electrical Discharge to Material and Environmental Technology	1	(N. Sano: Dept. of Chemical Engineering)
Theory of Precision Cutting, Grinding, Polishing and Related Properties of Materials	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Metrology and Control Theory for Precision Manufacturing, and Applications	1	Fine finishing of surfaces is of critical importance to a wide range of science and technology, from lens and mirror based optical and communication systems, to sliding and rolling contact surfaces required in orthopedic, automotive, aeronautics, and high-precision equipment. Across two lectures, the machinability of materials and methods to obtain precise and smooth surfaces will be explored, as well as the metrology (measuring equipment) that enables quality control and process feedback. (A. Beucamp: Dept. of Micro Engineering)
Fabrication of Inorganic Nanofiber by Electrospinning	1	When a high voltage is applied to a polymer solution, the solution is sprayed as thread-like droplets, and turns to polymer nanofibers. This fiber forming technique is called electrospinning. This lecture will give a brief introduction on the fabrication of nanofibers of inorganic materials including metal oxide and carbon by electrospinning. (S. Nagamine: Dept. of Chemical Engineering)
Solid Surface Analysis, Including a Potential Method: Tip-Enhanced Raman Spectroscopy	1	Surface analytical techniques each have their own analytical volume. The students learn about the volume, and look at an issue for tip-enhanced Raman spectroscopy, a nanoscale Raman spectroscopy, as a potential surface analytical technique. (M. Nishi: Dept. of Material Chemistry)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Advanced Modern Science and Technology (4 times course) (English lecture)

現代科学技術特論 (4回コース) (英語科目)

【Code】 10i055 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】 Thu 5th

【Location】 A2-306 【Credits】 0.5 【Restriction】 No Restriction 【Lecture Form(s)】 Relay Lecture 【Language】 English

【Instructor】 ER Center, J. Assoc. Prof., Ashida
ER Center, J. Assoc. Prof., Matsumoto
ER Center, J. Assoc. Prof., Maeda
ER Center, J. Assoc. Prof., Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】 None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '4 times course' should select one of the topics and attend the lectures. (Students who take '8 times course' should attend the lectures of the both topics.) Attend a course orientation held before the first lecture (Nov. 1) even if you take only the second topic.

Advanced Modern Science and Technology (8 times course) (English lecture)

現代科学技術特論（8回コース）（英語科目）

【Code】10i056 【Course Year】Master and Doctor Course 【Term】2nd term 【Class day & Period】Thu 5th

【Location】A2-306 【Credits】1 【Restriction】No Restriction 【Lecture Form(s)】Relay Lecture 【Language】English

【Instructor】 ER Center, J. Assoc. Prof., Ashida
ER Center, J. Assoc. Prof., Matsumoto
ER Center, J. Assoc. Prof., Maeda
ER Center, J. Assoc. Prof., Yorozu

Related professors

【Course Description】 Engineering/Engineers have been expected to fulfill key roles among social issues and others, such as energy, environment and resource. This class introduces cutting edge science and technologies from their backgrounds, research and development, to problems for the practical applications. In addition to the understanding of each technology, the attendances learn the importance for engineers to have multidisciplinary mind and understand the significance of engineering to realize sustainable development. Group discussions will be done for further understanding of the topics of the course.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Computer-Aided Analyses for Fluid (11 /1)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /8)	1	Lagrangian Meshfree Methods as New Generation Computational Tools (A. Khayyer: Dept. of Civil and Earth Resources Engineering)
Computer-Aided Analyses for Fluid (11 /15)	1	CFD in Process Systems Engineering (O. Tonomura: Dept. of Chemical Engineering)
Computer-Aided Analyses for Fluid (11 /29)	1	CFD in Hydraulic Engineering (K. Yorozu: ER Center)
Utilization of Light Energy (12/6)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/13)	1	Photochemistry of Organic Molecules (T. Umeyama: Dept. of Molecular Engineering)
Utilization of Light Energy (12/20)	1	Solar Energy Conversion Using Semiconductor Photocatalysts (M. Higashi: Dept. of Energy and Hydrocarbon Chemistry)
Utilization of Light Energy (12/27)	1	Efficiency Improvement in Solar Cells by Photonic Nano Structures (Y. Tanaka: Photonics and Electronics Science and Engineering Center)

【Textbook】None

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 There are two topics, each of which consists of four lectures. Students who take '8 times course' should attend the lectures of the both topics. (Students who take '4 times course' should select one of the topics and attend the lectures.)

Instrumental Analysis, Adv.

先端科学機器分析及び実習

【Code】 10D043 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】

【Location】 A2-307 【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Instrumental Analysis, Adv.

先端科学機器分析及び実習

【Code】 10D046 【Course Year】 Master and Doctor Course 【Term】 2nd term 【Class day & Period】

【Location】 A2-307 【Credits】 1 【Restriction】 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	2	
	2	
	2	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (6H course)

現代科学技術の巨人セミナー「知のひらめき」(6Hコース)

【Code】10i051 【Course Year】Doctor Course 【Term】First term, intensive

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】0.5

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 6H course, students have to select two classes and will earn 0.5 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Frontiers in Modern Science and Technology (12H course)

現代科学技術の巨人セミナー「知のひらめき」(12Hコース)

【Code】10i052 【Course Year】Doctor Course 【Term】First term/Spring term

【Class day & Period】Intensive (Saturday, Jun.-Jul) 【Location】B-Cluster 2F Seminar Room 【Credits】1

【Restriction】Student number will be limited. 【Lecture Form(s)】Intensive Lecture 【Language】Japanese

【Instructor】GL center: J.Assoc. Tanaka, Matsumoto, Ashida, Maeda and Related professors

【Course Description】This course provides lectures and panel discussions by lecturers inside and outside the campus who have a remarkable achievement in engineering and are active as international leaders.

【Grading】Separate four classes will be provided. One class has three hours. Each class will assign a report. Evaluation bases on the assignment and class contribution. The classes will be opened on Saturdays. In 12H course, students have to complete all four classes and will earn 1 credits.

【Course Goals】This course cultivates the ability to develop familiar problem consciousness into a big concept through utilizing the materials of advanced fields in each field. This course also shows how leaders have improved their response to problems. Through this course, students learn fundamental culture, and the importance of human growth.

【Course Topics】

Theme	Class number of times	Description
Topic 1	2	Detail will be announced later
Topic 2	2	Detail will be announced later
Topic 3	2	Detail will be announced later
Topic 4	2	Detail will be announced later

【Textbook】Course materials will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Project Management in Engineering

エンジニアリングプロジェクトマネジメント

【Code】 10i049 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Fri 4th 【Location】 A2-308 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Lecture 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu

Assoc.Prof. Lintuluoto, J. Assoc. Prof. Tanaka

【Course Description】 This course provides a basic knowledge required for the project management in various engineering fields such as process design, plant design, construction, and R&D projects. Also, visiting lecturers from industry and public works provide management insights of actual engineering projects.

【Grading】 Evaluated by assignments (project report exercise) and class contribution

【Course Goals】 This course will help students gain a fundamental knowledge of what project management in engineering is. Throughout the course, students will learn various tools applied in project management. Students will also understand the importance of costs and money, risks, leadership, and environmental assessment in managing engineering projects. This course is followed with the course Seminar on Project Management in Engineering. in the second semester.

【Course Topics】

Theme	Class number of times	Description
Guidance	1	4/13 (Matsumoto) Course guidance
Special lecture by extramural instructor 1	1	4/20 (Inaoka(JICA))@A2-306 Project management in the case of Japanese ODA
Introduction to project management	1	4/27 (Maeda) Introduction to project management Project phases
Tools for project management I	1	5/11 (Lintuluoto) Tools for project management, cost, and cash flows I
Tools for project management II	1	5/18 (Lintuluoto) Tools for project management, cost, and cash flows II
Tools for project management III	1	5/25 (Lintuluoto) Tools for project management, cost, and cash flows III
Project scheduling I	1	6/1 (Ashida) Project scheduling I
Project scheduling II	1	6/8 (Ashida) Project scheduling II
Leadership I	1	6/15 (Tanaka) Leadership I
Leadership II	1	6/22 (Tanaka) Leadership II
Risk management I	1	6/29 (Matsumoto) Risk management I
Risk management II	1	7/6 (Matsumoto) Risk management II
Environmental Impact Assessment	1	7/13 (Yorozu) Environmental Impact Assessment
Special lecture by extramural instructor 2	1	7/20 (Kumagai(JGC CORPORATION)) To be announced
Feedback	1	7/27 (Matsumoto) Feedback

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 1. Lock, Dennis. Project Management. 10th edition. Gower Publishing Ltd.

2. Cleland, David L., and Lewis R. Ireland. Project Management. 5th edition. McGraw-Hill Professional

3. Roger Miller and Donald R. Lessard. The strategic management of large engineering projects, Shaping Institutions, Risks, and Governance, The MIT Press

【Prerequisite(s)】 No pre-requisite

【Independent Study Outside of Class】

【Web Sites】 The web-site is opened in the home page of the GL education center.

【Additional Information】

Exercise on Project Management in Engineering

エンジニアリングプロジェクトマネジメント演習

【Code】 10i059 【Course Year】 Master and Doctor Course 【Term】 2nd term

【Class day & Period】 Friday 4th period and 5th period 【Location】 B-Cluster 2F Seminar Room 【Credits】 2

【Restriction】 Student number will be limited. 【Lecture Form(s)】 Seminar 【Language】 English

【Instructor】 GL center: J. Assoc. Prof. Matsumoto, Ashida, Maeda, Yorozu
Assoc.Prof. Lintuluoto

【Course Description】 In this course, students will apply the engineering know-how and the skills of management, and group leadership which they learned in the course of Project Management in Engineering to build and carry out a virtual inter-engineering project. This course provides a forum where students' team-plan based on ideas and theories, decision making, and leadership should produce realistic engineering project outcomes. The course consists of intensive group work, presentations, and a few intermediate discussions. A written report will be required.

【Grading】 Report, class activity, presentation

【Course Goals】 This course prepares engineering students to work with other engineers within a large international engineering project. In particular this course will focus on leadership and management of projects along with applied engineering skills where the students learn various compromises, co-operation, responsibility, and ethics.

【Course Topics】

Theme	Class number of times	Description
	10/5	
Guidance	1	Introduction to Exercise on Project Management in Engineering Lecture on tools for the Project management in engineering Practice
Teamwork	7	Each project team may freely schedule the group works within given time frame. The course instructors are available if any need is required.
Mid-term presentation	1	Each project team will have a mid-term presentation.
Lecture & Teamwork	2	Some lectures will be provided, such as Leadership structuring, Risk Management, and Environmental Impact Assessment, depending on projects you propose.
Presentation	1	Each project team will have a presentation based on its proposed project.

【Textbook】 Course materials will be provided.

【Textbook(supplemental)】 Will be informed if necessary.

【Prerequisite(s)】 Fundamental skills about group leading and communication, scientific presentation.

【Independent Study Outside of Class】

【Web Sites】 The web-site will be opened in the home page of the GL education center.

【Additional Information】 The number of students may be restricted. Students are requested to check in advance whether the credit from this course will be accepted as a graduation requirement for their department.

Safety and Health Engineering (4 times course)

安全衛生工学（4回コース）

【Code】 10i057 【Course Year】 Master and Doctor Course 【Term】 1st term 【Class day & Period】 Tue 4th

【Location】 C3-Lecture Room 1 【Credits】 【Restriction】 No Restriction 【Lecture Form(s)】 Lecture

【Language】 Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

JGP 計算実習 (CFD)

【Code】10P470 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

JGP 計算実習 (MO)

【Code】10P471 【Course Year】Master and Doctor Course 【Term】1st term 【Class day & Period】 【Location】

【Credits】 【Restriction】 【Lecture Form(s)】 【Language】Japanese 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Special Seminar of Chemical Engineering 1

化学工学特別セミナー 1

【Code】 10T004 【Course Year】 Doctor 1st 【Term】 1st term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	2	
	2	
	1	
	2	
	1	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Special Seminar in Chemical Engineering 2

化学工学特別セミナー 2

【Code】10T005 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】 【Location】

【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese 【Instructor】Matsusaka

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	<small>Class number of times</small>	Description
Interaction in Granular Material	3	
Fluidization	4	
Granular Material in a State of Flow	3	
Mixig & Segregation	3	
Numerical Simulation	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Special Seminar of Chemical Engineering 3

化学工学特別セミナー 3

【Code】 10T006 【Course Year】 Doctor 1st 【Term】 2nd term 【Class day & Period】 【Location】

【Credits】 2 【Restriction】 No Restriction 【Lecture Form(s)】 【Language】 Japanese 【Instructor】 ,

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	2	
	2	
	2	
	2	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Special Seminar in Chemical Engineering 4

化学工学特別セミナー 4

【Code】10T007 【Course Year】Doctor Course 【Term】2nd term 【Class day & Period】Wed 5th

【Location】A2-305 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】Japanese

【Instructor】Chemical Engineering, Professor, Noriaki Sano

【Course Description】Application of electric field to chemical processes will be lectured from fundamentals to applications. Here, the method to generate high voltage, measurement, safety, and applications to separation and material synthesis will be lectured.

【Grading】Coursework will be graded based on the reports.

【Course Goals】Students will gain knowledge about application of electric field to variety of applications based on fundamentals.

【Course Topics】

Theme	Class number of times	Description
Fundamentals of high-voltage technology	3	High voltage generation, measurement, application, and safety, which are useful to apply high voltage to chemical process, will be lectured.
Fundamentals and application of non-equilibrium plasma to separation operations	3	Based on fundamentals, application of plasma generated in vacuum conditions to separation operations and synthesis of materials will be lectured.
Application of non-uniform electric field	3	Application of extremely non-uniform electric field will be lectured. For example, electrostatic precipitator and dielectrophoresis will be explained.
Application of atmospheric pressure plasma to separation operations and material syntheses	3	Method to generate arc plasma, plasma torch, and dielectric barrier discharge will be explained. Also, application using these features will be lectured.
Electrochemistry	2	Electrochemistry in solutions from general ones with direct low-voltage to unique ones with high-frequency high-voltage will be lectured.
Confirmation of study achievement	1	Feedback of evaluation results for reports and exercises.

【Textbook】The textbook is not required. Materials will be supplied by instructors.

【Textbook(supplemental)】

【Prerequisite(s)】Required master degree knowledge on chemical engineering

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Special Seminar in Chemical Engineering 5

化学工学特別セミナー 5

【Code】 10T008 【Course Year】 Doctor Course 【Term】 1st term

【Class day & Period】 a series of lectures-chemical engineering 【Location】 【Credits】 2 【Restriction】

【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Dept. of Chemical Engineering, Profs. M. Miyahara, M. Ohshima, N. Sano, and K. Mae

【Course Description】 The state of the arts in chemical engineering is given in a series of lectures of professors who are experts in a specific field.

【Grading】 Presence to the lecture and Report submission

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4	
Polymer Processing -How to make a fine cellular foam	4	Introducing the processing schemes of polymeric porous materials, the importance of the literacy of chemical engineering for the polymer processing is discussed.
	4	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】

Special Seminar in Chemical Engineering 6

化学工学特別セミナー 6

【Code】 10T009 【Course Year】 Doctor Course 【Term】 1st term 【Class day & Period】 Intensive lecture

【Location】 【Credits】 2 【Restriction】 【Lecture Form(s)】 Lecture 【Language】 Japanese

【Instructor】 Department of Chemical Engineering, Professors R. Yamamoto, M. Kawase, S. Hasebe and S. Matsusaka

【Course Description】 Through the lectures on the advances and latest problems in the chemical engineering, future directions of technology are discussed.

【Grading】 The contribution to the discussion and the contents of the homework of each subject are used for evaluation.

【Course Goals】 Deep understanding of the fundamental and/or latest contents of a field of chemical engineering.

【Course Topics】

Theme	Class number of times	Description
	4	
Chemical reaction engineering for material synthesis processes	4	Of material synthesis processes, theory of chemical reaction engineering modeling and kinetic analysis of chemical vapor deposition (CVD) processes are explained.
Transport phenomena in complex fluids and soft materials	4	Students will learn basic theories for the dynamics of particulate fluids and techniques for performing numerical simulations.
Process synthesis	3	Using separation processes as examples, the modeling and solution methods of synthesis problem are lectured.

【Textbook】 Printed materials of related contents are offered.

【Textbook(supplemental)】

【Prerequisite(s)】 Required master degree knowledge on chemical engineering

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This class is opened in 2019 and every other year.

Special Seminar in Chemical Engineering 7

化学工学特別セミナー 7

【Code】 10T010 【Course Year】 Doctor Course 【Term】 2nd term

【Class day & Period】 Intensive (10:00--17:00 on Saturdays 20th, 27th Jan., 3rd Feb.) 【Location】 【Credits】 2

【Restriction】 No Restriction 【Lecture Form(s)】 Intensive Lecture 【Language】 Japanese

【Instructor】 Professor Motoaki Kawase and Junior Associate Professor Ryuichi Ashida

【Course Description】 Some topics in the state-of-the-art studies related to chemical engineering are lectured. In the first half, extension of chemical engineering to electrochemical reaction processes is explained with taking a polymer electrolyte fuel cell as an example. In the latter half, application of chemical engineering to reactions of complex heavy carbonaceous resources is presented and kinetic modeling of reactions of solids and heavy liquids for predicting the rate and quality of the products is explained.

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Chemical reaction engineering of fuel cells	5	Extension of chemical engineering to electrochemical reaction processes is explained with taking a polymer electrolyte fuel cell as an example.
Case studies of polymer electrolyte fuel cell	4	Based on the proposed theory, some case studies are discussed in which the effects of convective flow as well as the effects of catalyst layer structure including the catalyst layer thickness, pore structure parameters, and catalyst activity on the cell performance are estimated.
Chemical reaction engineering of conversion of heavy carbonaceous resources	6	Approach to conversion processes of heavy carbonaceous resources including low-rank coal and biomass from the view point of chemical reaction engineering is explained.

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Independent Study Outside of Class】

【Web Sites】

【Additional Information】 This is an biennial course which will be open in 2017, 2019, ...

工学研究科シラバス 2018 年度版
([C] Advanced Engineering Course Program)
Copyright ©2018 京都大学工学研究科
2018 年 4 月 1 日発行 (非売品)

編集者 京都大学工学部教務課
発行所 京都大学工学研究科
〒 615-8530 京都市西京区京都大学桂

デザイン 工学研究科附属情報センター

工学研究科シラバス 2018 年度版

- ・ [A] Common Subjects of Graduate School of Engineering
- ・ [B] Master's Program
- ・ [C] Advanced Engineering Course Program
- ・ [D] Interdisciplinary Engineering Course Program
- ・ オンライン版 <http://www.t.kyoto-u.ac.jp/syllabus-gs/>

本文中の下線はリンクを示しています。リンク先はオンライン版を参照してください。

オンライン版の教科書・参考書欄には 京都大学蔵書検索 (KULINE) へのリンクが含まれています。

