Course Number	Course Name	Credits	standard registration year	Term	Meeting Days,Period etc.	Classroom	Instructor	Course Overview	Remarks
0AH0203	Renewable Energy Engineering	2.0	1, 2	FallAB	Wed1,2	3B303	Aki Hirohisa	This course provides discussions on renewable energy from various viewpoints: fundamental principle, technology development and challenges, and expected roles in energy system, social impact including state holders.	Students from various departments are welcome. Identical to 01CM440. Online(Asynchronous) Hybrid or Others Basically Online Asynchronous, Hybrid of Asynchronous and Synchronous in some cases
0AH0210	Basis and practical training of machining	1.0	1, 2	Sum Vac	Intensive		Enami Kazuhiro,Monji Hideaki	This course describes the basis of machining and cutting in order to enrich the knowledge and experience of machining, which is the base of manufacturing. Students learn the basic operation of machines by practical training of turning and milling at the workshop. Successful candidates get permission to use the open workshop of engineering workshop division.	講義は対面形式とオンデマンド形式で行う。どちらかを選択して受講すること。実習は対面形式のみで行う。なお、実習の制限より本科目の受講定員を8名とし、8名を超える受講希望者が出た場合は、抽選によって受講者を決定する。
0AL0600	Energy System Engineering	2.0	1, 2	SprAB	Tue1,2	3B303	Okajima Keiichi,Ishida Masayoshi	This course focuses on a systematic overview of energy supply, power infrastructure, and gas infrastructure for energy problems and technologies that have a wide range of aspects. It also explains how the supply and demand adjustment of the power system, frequency control, voltage control, and supply reliability are ensured.	Core subject Identical to 01CM401.
0AL0601	Advanced Solid Mechanics	2.0	1, 2	SprAB	Tue3,4	3B302	Kameda Toshihiro,Matsuda Akihiro	This course describes the solid mechanics for elastic and plastic materials with fundamental framework of tensor analysis. Application to engineering issues are provided as some exercises.	Core subject Identical to 01CM201.
0AL0602	Advanced Structural Mechanics	2.0	1, 2	SprAB	Wed1,2	3B302	Isobe Daigoro,Yamamoto Kyosuke	This course focuses on behaviors of beams and plates with geometrical and material nonlinearities, which are popularly used as structural components in civil, architectural and mechanical fields.	Core subject Identical to 01CF408 and 01CM101. Lectures are conducted in English if requested
0AL0603	Advanced Vibration Analysis	2.0	1, 2	SprAB	Fri1,2	3B406	Shoji Gaku,Morita Naoki	The course provides the foundations and advanced topics on dynamics in structures and mechanical systems, focusing onto the study of vibration theory associated with modal analysis, numerical method, and random vibration.	Core subject On-demand and realtime online. Identical to 01CM102. Lectures are conducted in English if requested
0AL0604	Engineering of Electromagnetic Energy	2.0	1, 2	FallAB	Fri1,2	3B302	Fujino Takayasu,Takahashi Toru	This course focuses on the reviews of Maxwell's equations written in integral and differential forms, generation, conversion, and transmission of electric energy. Power storage and electric equipment/system are also described.	Core subject Identical to 01CM403. Online(Asynchronous)
0AL0605	Disaster Information	2.0	1, 2	FallAB	Fri1,2	3B304	Shoji Gaku,Kawamura Youhei	This course provides students with a practical understanding of the application of disaster control informatics based on fundamental theories from the perspective of risk assessment, information gathering (handling) and various core technologies such as Geographic Information System (GIS).	Class days from the 6th week to the 8th week will be treated as an intensive lecture in mid-November. Identical to 01CM129 and 02RB238. Hybrid or Others On-demand and realtime online
0AL0606	Advanced Fluid Mechanics 1	2.0	1, 2	SprAB	Thu1,2	3B303	Takewaka Satoshi,Shirakawa Naoki	We will explore Potential Theory, derivation of Navier-Stokes equation and its solutions. Keywords: Velocity potential, Bernoulli theorem, complex velocity potential, wing theory, effect of viscosity, Navier-Stokes equation	Core subject Identical to 01CM301.
0AL0607	Advanced Fluid Mechanics 2	2.0	1, 2	FallAB	Thu3,4	3B302	Shirakawa Naoki,Kyotoh Harumichi	The laminar boundary layer solution and the momentum integral equation is derived from the Navier-Stokes equation. For turbulent flows, the Reynolds equation and the logarithmic law are explained, and the average flow velocity and resistance law of the pipe and turbulent boundary layer are derived. A method of predicting the occurrence of turbulence in the boundary layer and the structure of anisotropic turbulence are introduced. In a fully-developed turbulence, the Kolmogorov theory is explained.	Core subject Identical to 01CM302. Online(Asynchronous)
0AL0609	Advanced Space Exploration Engineering Workshop 2021	2.0	1, 2	SprAB, FallAB	Fri7		Kameda Toshihiro	It is a workshop style project based class, handling space exploration engineering mission proposal and realization. During the class, students are expected to propose their own space mission and provide some prototype equipment for the mission, including space environment test. Collaboration with foreign space engineering teams such as cubesat development project is strongly encouraged.	Students can register this course even if they took previous Advanced Space Exploration Engineering courses, however, up to two credit hours can be provided in total for graduation requirement. Identical to 01CM437. Lecture is conducted in English. Online(Synchronous)
0AL0620	インフラ開発工学特別演習	2.0	1, 2	SprAB, FallAB	Wed7	3B406	Yamamoto Kyosuke	This is a PBL-style course, in which students participate group workshops on the theme of new civil engineering systems that contribute to solving global issues.	Identical to 01CM130. Lectures are conducted in English if requested
0AL0621	Advanced Exercises for Planning and Designing	1.0	1, 2	Sum Vac	Intensive		Kanakubo Toshiyuki, Yasojima Akira	The exercises of planning, designing, and drafting for the definite topics in designing of buildings and housing are conducted. The field works are also conducted for actual structures and introducing presentations for them are assigned.	Identical to 01CM131.
0AL5600	Micromechanics	2.0	1, 2	SprAB	Thu5,6	3A409	Kawai Masamichi,Matsuda Tetsuya	The course aims to give the theoretical knowledge of the mechanics of a class of heterogeneous solids with an emphasis on the micro-macro transition in mechancial properties. This includes the crystal plasticity for metals and the analytical and numerical homogenizations for composite materials of different kinds. A generalized continuum mechanics for higher-order materials is also explained.	Identical to 01CM223.

Code	Course Title	Credits	Year	Term	Time	Room	Instructor	Description	Notes
OAL5601	Advanced Dynamics of Compressible Flow	2.0	1, 2	FallAB	Wed5, 6	3B303	Yokota Shigeru	We cover several unique concepts and applications of compressible flow, including: speed of sound and Mach number, isentropic 1-D flow in variable area ducts, converging nozzles, choking, converging-diverging nozzles, moving shocks, shock tubes, normal and oblique shock waves, expansion fans, and small perturbation theory.	Sub-core subject Identical to 01CM311. Online(Asynchronous)
OAL5602	Advanced Space-Development Technology	1.0	1, 2	FallC	Intensive		Matsumoto Satoshi, Sugita Hiroyuki, Mizutani Tadahito	This course provides lectures on spacecraft thermal control technology, structure and material technology, space environment utilization technology, and lunar and planetary exploration technology.	Coordinator: Prof. Kohei Shimamura Identical to 01CM428. Online(Asynchronous)
OAL5603	Environmental Fluid Engineering	2.0	1, 2	SprAB	Fri5, 6	3B302	Shirakawa Naoki, Denda Masatoshi, Kyotoh Harumichi, Takewaka Satoshi, Dairaku Koji	Presents the basic concepts of hydraulics for open channel flow and hydrology. Some recent topics on river and coastal engineering are also introduced.	On-line (on-demand), but face-to-face or on-line exercises may be given during the lecture time. Identical to 01CM323. Lectures are conducted in English if requested
OAL5604	Advanced Computational Mechanics	2.0	1, 2	FallAB	Mon1, 2	3B303	Matsushima Takashi, Shintaku Yuichi	This course provides the theoretical basis, formulation, and implementation of Finite Element Method (FEM). Theoretical basis includes variational method, weighted-residual method and virtual work principle. Also, the FE formulation and implementation of 2-dimensional Poisson equation and elastic continuum are described in details.	Sub-core subject Identical to 01CM211. Online(Asynchronous)
OAL5605	Structure Design of Nuclear Plant	2.0	1, 2	SprAB	Tue5, 6	3B402	Matsuda Akihiro	This course describes the high temperature structural design for nuclear power plants and thermal power plants. Assessment methods for high temperature materials in some design topics of the power plants are provided.	Identical to 01CM221.
OAL5606	Structural Design Methodology	2.0	1, 2	FallAB	Wed4, 5	3B401	Yasojima Akira, Nishio Mayuko	The procedures of the seismic design method for reinforced concrete structures are explained. Furthermore, the exercises on structural design of buildings are conducted based on allowable stress concept and lateral load-carrying capacity calculation.	Identical to 01CM127. face-to-face
OAL5607	Multiphase Flow Engineering	2.0	1, 2	FallAB	Fri5, 6	3A304	Monji Hideaki, Kaneko Akiko, Kanagawa Tetsuya	Focusing on the features and dynamics of multiphase flows as important role in thermo-fluid machinery, environmental field, and so on, basic property and concept, flow behavior, wave propagation, measurement technique, and recent progress and topic are introduced.	Identical to 01CM427. Hybrid or Others
OAL5608	Strength and Fracture of Solids	2.0	1, 2	FallAB	Fri1, 2	3B406	Kawai Masamichi	The course aims to give students the theoretical and practical knowledges of the strength of solids. This includes the phenomena and mechanisms of elasticity, plasticity and fracture for a class of metallic materials, and the mechanics for these behaviors, respectively, emphasizing the interdiscipline of the practical approach to the strength of solid materials.	Identical to 01CM222.
OAL5609	Advanced Reliability Engineering	2.0	1, 2	SprAB	Wed3, 4	3B406	Nishio Mayuko	In this course, the basics of structural reliability theory and reliability design are first explained, including the associated probability theory. In addition, exercises using Matlab programming will be taken to understand numerical methods for analyzing structural reliability and safety.	Sub-core subject Identical to 01CF406 and 01CM111. Online(Asynchronous) Online(Synchronous) Hybrid or Others
OAL5610	Computational Fluid Dynamics	2.0	1, 2	FallAB	Fri3, 4	3B402	Mitsume Naoto	This course focuses on computer simulation of fluid dynamics, and introduces fundamental and applied mathematical models and numerical methods related to the computational fluid dynamics (CFD). Recent research trends on CFD is also introduced in this course.	Sub-core subject Identical to 01CM312. Online(Asynchronous) Online Asynchronous
OAL5611	Advanced Earthquake Engineering	2.0	1, 2	FallAB	Tue1, 2	3B406	Shoji Gaku, Asai Takehiko, Mitsume Naoto	In this course, you will study the fundamental and advanced topics on earthquake engineering. The first part describes the mechanism of fault ruptures, wave propagation process, and strong ground motion occurrence, and the evaluation method of seismic hazards. The latter part describes the relationship between ground motion intensity and structural damage, nonlinear seismic response analysis of structures, and seismic design of structures.	on-demand and realtime online. Identical to 01CF409 and 01CM121.
OAL5612	Advanced Geotechnical Engineering	2.0	1, 2	SprAB	Fri3, 4	3A214	Matsushima Takashi	This course describes complicated mechanical response of geomaterials as a mixture of solid grain, pore water and air, basic framework of the governing equation including typical constitutive models, and various numerical methods for engineering design.	Given in English if requested Identical to 01CM128.
OAL5613	Transport Phenomena	2.0	1, 2	SprAB	Fri1, 2	3B302	Nishioka Makihito	Transport phenomena of mass and heat will be explained theoretically from a macroscopic viewpoint. Examples of actual phenomena related to mass diffusion and/or heat conduction, and their practical applications will also be introduced.	Sub-core subject Identical to 01CM411.
OAL5614	Thermo-Fluids Measurement Techniques	2.0	1, 2	SprAB	Wed5, 6	3B303	Monji Hideaki, Shimamura Kohei	Hot-wire anemometer, laser anemometer, image processing anemometer, holographic anemometer, NMR, laser-induced fluorescence method, etc. can be obtained as the latest measurement methods for the speed, temperature, concentration, pressure, etc. of thermal fluid. Discussed with data processing methods.	Sub-core subject Identical to 01CM412.
OAL5615	Advanced Composite Structural Engineering	2.0	1, 2	SprAB	Mon1, 2	3B401	Kanakubo Toshiyuki	Outline, construction method, and design method of reinforced concrete structures are introduced. Structural behavior of beams, columns, walls, beam-column joints, and so on, of reinforced concrete is explained based on the limit stress design method and ultimate state design method.	Identical to 01CM125.

Code	Course Name	Credits	Year	Term	Type	Time	Room	Instructor	Description	Notes
OAL5616	Topics in Engineering Mechanics and Energy I	1.0	1, 2	SprBC	Intensive			Nagata Shigeru, Fukushima Masaki	This course will be taught by visiting lecturers who are specialized in infrastructure systems, civil construction, disaster prevention and management, energy systems and related fields. In the classes, followings will be discussed: technology development, project management, maintenance of infrastructures, overseas projects etc.	Coordinator: Profs. S. Takewaka and G. Shoji Identical to 01CM901. Online(Synchronous) We are still adjusting (5 and 6 periods on any day of the week from June to July)
OAL5617	Topics in Engineering Mechanics and Energy II	1.0	1, 2	Sum Vac	Intensive		3B402	Sakakita Hajime	In this course, technologies on plasma processing are described. For human being, "Plasma" is very important, since it is related on many natural phenomena (Steller such as sun, ionosphere, aurora, and lightning). Moreover, the plasma is utilized in fluorescent light, semiconductor processing, space propulsion and so on. Academic background and technologies are studied, and many of novel development trends such as a medical application are introduced.	Coordinator: Prof. Toshihiro Kameda Identical to 01CM907.
OAL5618	Topics in Engineering Mechanics and Energy III	1.0	1, 2	FallA	Intensive			Ichikawa Kazuyoshi	Japan relies on fossil-fueled thermal power generation for about 80% of its electricity generation and the reduction of greenhouse gases which is a major factor in climate change is an urgent issue. This lecture will focus on the latest thermal power technologies for low carbon, and will cover the latest energy situation, basics of thermal power generation, innovative power generation technologies, biomass energy utilization technologies, and zero-emission technologies (e.g., CO2 capture, utilization, storage, and hydrogen utilization technologies). In addition, based on the above, we will discuss the future of Japan's energy system.	Coordinator: Prof. Akiko Kaneko Identical to 01CM909.
OAL5619	Topics in Engineering Mechanics and Energy IV	1.0	1, 2	FallC	Intensive			Sato Hiroyuki	In this course, students can learn High Temperature Gas-cooled Reactor (HTGR) technologies, a Generation IV nuclear system with superior safety and capability of high temperature heat supply of 1,000 deg C. Topics also includes the HTGR heat application technologies such as high efficiency helium gas turbine power generation and CO2-free massive hydrogen production. The course also deals with energy situation in Japan and trends of development in nuclear and hydrogen energies.	Coordinator: Prof. Akiko Kaneko Identical to 01CM904. Online(Asynchronous)
OAL5620	Topics in Engineering Mechanics and Energy V	1.0	1, 2	FallC	Intensive			Yoshida Hiroyuki	This course provides, at first, an outline of a light water reactor (boiling water reactor and pressurized water reactor) that is used as electricity generation systems, focusing on the light water reactor design procedures related to thermal-hydraulics phenomena. In the second part of this topic, numerical simulation related to thermal-hydraulics will be introduced. In this part, a multi-phase computational fluid dynamics simulation methodology will be explained briefly. Finally, this course provides issues in the application of CFD to design works of the nuclear reactor.	Coordinator: Prof. Akiko Kaneko Identical to 01CM905. Online(Asynchronous)
OAL5621	Leaning from Disasters: Extreme events and their impact on infrastructure, engineering and society	2.0	1, 2	FallAB	Tue3, 4			Matsushima Takashi, Shoji Gaku	Extreme events such as hurricanes Maria, Irma and Harvey in 2017, Katrina in 2005, or the 2011 Tohoku earthquake and Tsunami in Japan, have resulted in high death tolls, and devastating damage to housing units, urban infrastructure, and lifelines (water, power ...). Emergency response to extreme events is difficult due to their large impacts, and recovery often very slow. In developing countries, where resources tend to be limited, extreme events such as earthquakes and typhoons often result in medical threats from infectious diseases due to the limited availability of clean water and emergency medical services. Since many global warming models predict a sharp increase in the number, as well as severity, of extreme events it is important to learn from past disaster, in order to reduce their potential for destruction. In this course, we will examine several major disasters, including local case histories, and discuss engineering design methods/concepts, as well as, their effects in terms of preparedness, vulnerability, robustness, flexibility, and resilience.	The course is designed as PBL(Project-Based Learning) style online course open both in University of Tsukuba and Ohio State University. Participants are supposed to belong to a small group, work together, and make a presentation as the group. Identical to 01CM132. Lecture is conducted in English. Online(Synchronous)
OAL5622	熱流体計測工学特別演習	2.0	1, 2	FallAB	Thu1, 2			Kaneko Akiko, SHEN Biao	原子力安全を主眼においた熱流動場について，構造物および流動パラメータの設定に対して，種々の先端計測技術を駆使し伝熱特性を解明することをテーマとし，ワークショップ形式でプロジェクトを遂行する。	
OAL5623	Advanced Exercise for Structure and Solid Mechanics	2.0	1, 2	FallAB	Tue5, 6			Matsuda Akihiro, Shoji Gaku, Shintaku Yuichi, Morita Naoki	原子力工学分野の構造力学・固体力学に関連する課題に対して、ワークショップ形式でプロジェクトを実施する。具体的には、原子力発電所および原子力関連施設を対象として、内部機器を選定し、構造力学・固体力学に関連した先端的な数値シミュレーション技術を用いて性能評価・安全性評価を実施する。	Online(Synchronous)
OALF000	Internship	1.0	1, 2	Annual	by request			Matsushima Takashi	The purpose of this course is to provide opportunities for students to work in private companies, public institutions, NGOs, etc. for weeks and help them to develop fundamental business skills and knowledge through practical experience. The students must apply both to the host organization and to the department (graduate program) of EME by themselves in advance, and submit the final report after the internship.	Identical to 01CM911.
OALF500	Seminar in Engineering Mechanics and Energy I	2.0	1	Annual	by appointment				This course provides an overview of any research field of Engineering Mechanics and Energy for first-year MS students. Presentation of the individual research project is required.	Identical to 01CM011.
OALF501	Seminar in Engineering Mechanics and Energy II	2.0	2	Annual	by appointment				This course provides an overview of any research field of Engineering Mechanics and Energy and evaluates the individual research project for second-year MS students. Presentation of the individual research project is required.	Identical to 01CM012.

OALF502	Research in Engineering Mechanics and Energy I	4.0	1	Annual	by request			This course is for individual research projects in Engineering Mechanics and Energy emphasizing fundamental knowledge for first-year MS students. This course is approved by advisors.	Identical to 01CM021.
OALF503	Research in Engineering Mechanics and Energy II	4.0	2	Annual	by request			This course is for individual research projects in Engineering Mechanics and Energy emphasizing advanced knowledge for second-year MS students. This course is approved by advisors, aiming to complete MS theses.	Identical to 01CM022.
OALF504	Seminar in Engineering Mechanics and Energy Ia	1.0	1	SprABC	by appointment			This course provides an overview of any research field of Engineering Mechanics and Energy for first-year MS students. Presentation of the individual research project is required.	Only students enrolled in the fall and those approved by the program leader can take this course.
OALF505	Seminar in Engineering Mechanics and Energy Ib	1.0	1	FallABC	by appointment			This course provides an overview of any research field of Engineering Mechanics and Energy for first-year MS students. Presentation of the individual research project is required.	Only students enrolled in the fall and those approved by the program leader can take this course.
OALF506	Seminar in Engineering Mechanics and Energy IIa	1.0	2	SprABC	by appointment			This course provides an overview of any research field of Engineering Mechanics and Energy and evaluates the individual research project for second-year MS students. Presentation of the individual research project is required.	Only students enrolled in the fall and those approved by the program leader can take this course.
OALF507	Seminar in Engineering Mechanics and Energy IIb	1.0	2	FallABC	by appointment			This course provides an overview of any research field of Engineering Mechanics and Energy and evaluates the individual research project for second-year MS students. Presentation of the individual research project is required.	Only students enrolled in the fall and those approved by the program leader can take this course.
OALF508	Research in Engineering Mechanics and Energy Ia	2.0	1	SprABC	by request			This course is for individual research projects in Engineering Mechanics and Energy emphasizing fundamental knowledge for first-year MS students. This course is approved by advisors.	Only students enrolled in the fall and those approved by the program leader can take this course.
OALF509	Research in Engineering Mechanics and Energy Ib	2.0	1	FallABC	by request			This course is for individual research projects in Engineering Mechanics and Energy emphasizing fundamental knowledge for first-year MS students. This course is approved by advisors.	Only students enrolled in the fall and those approved by the program leader can take this course.
OALF510	Research in Engineering Mechanics and Energy IIa	2.0	2	SprABC	by request			This course is for individual research projects in Engineering Mechanics and Energy emphasizing advanced knowledge for second-year MS students. This course is approved by advisors, aiming to complete MS theses.	Only students enrolled in the fall and those approved by the program leader can take this course.
OALF511	Research in Engineering Mechanics and Energy IIb	2.0	2	FallABC	by request			This course is for individual research projects in Engineering Mechanics and Energy emphasizing advanced knowledge for second-year MS students. This course is approved by advisors, aiming to complete MS theses.	Only students enrolled in the fall and those approved by the program leader can take this course.