(3) School of Science and Engineering Bachelor's Program in Interdisciplinary Engineering

Foundation Subjects for Major(Required)

Course Number	Course Name	Instructional Type	Credits	standard registration year	Term	Meeting Days,Period etc.	Classroom	Instructor	Course Overview	Remarks
FJ20004	Linear Algebra I	4	3.0	1	FallABC	Wed4,5	3A213	Tong Xiao-Min	This course introduces the basic ideas of vector, matrix and their operations and how to solve linear equations using matrices and vectors. The primary goal of this course is to understand the systems of linear equations, classifications of matrices and their applications. Although most of the problems can be solved without Mathematica, you are encouraged to solve the homework using the software once you know how to solve the problems. The course is a prerequisite for "Linear Algebra II"	Lecture is conducted in English. Hybrid or Others Online(Synchronous), and the recorded materials are available to the students who cannot attend the class synchronously.
FJ20014	Linear Algebra II	4	3.0	1	SprABC	Wed4,5	3A214	Sharmin Sonia	Following "Linear Algebra I"', "Linear Algebra II" will also concentrate on the basics of linear algebra. Emphasis will be given to topics that will be useful in other disciplines, such as determinants, eigenvalues, positive definite matrices, Fourier series and the Fast Fourier Transform. Some homework problems may require you to use a program such as MATLAB or Mathematica, an important tool for numerical linear algebra. No previous programming experience is required.	Lecture is conducted in English. Hybrid or Others (i.e. Face-to-Face+Online (Asynchronous))
FJ20104	Calculus I	4	4.0	1	FallA FallAB FallC	Thu5,6 Tue1,2	3A311	Sano Nobuyuki	This course along with the subsequent course "Calculus II" introduces the basic tools of calculus and develops their technical competence. The primary goal of this course is to understand the concept and to build up a working ability of various mathematical manipulations such as derivatives, integrals, differential equations, parametric representations, polar coordinates, etc. This is efficiently achieved by visualization, numerical and graphical experimentations and, thus, students are required to be acquainted with Mathematica (or similar ones) during the course as working exercises and homework problems. This course as well as "Calculus II" provides a core and practical knowledge required for many scientific courses you shall take hereafter in the IDE program.	Lecture is conducted in English. Hybrid or Others face-to-face, Synchronous and Asynchronous, Take-home exam
FJ20114	Calculus II	4	4.0	1	SprA SprAB SprC	Tue5,6 Thu4,5	3A311	Sano Nobuyuki	Following the "Calculus I", this course also introduces the basic tools of calculus and develops their technical competence, namely, differential equation, infinite series, vector calculus, spherical coordinate system, and partial derivatives etc. This is achieved again by visualization, numerical and graphical experimentations and, thus, students are required to be acquainted with Mathematica (or similar ones) during the course as working exercises and homework problems. This course as well as "Calculus I" provides a core and practical knowledge required for many scientific courses you shall take hereafter in the IDE program.	Lecture is conducted in English. Hybrid or Others face-to-face, Synchronous and Asynchronous, Take-home exam
FJ20124	Introduction to Single-Variable Calculus I	4	2.0	1	SprA FallA	Tue2 Thu5,6 Tue1		Sano Nobuyuki	This course along with the subsequent courses "Introduction to Single-Variable Calculus II" and "Advanced Calculus" introduces the basic tools of calculus and develops their technical competence. The primary goal of this course is to understand the concepts and to build up a working ability of various mathematical manipulations such as derivatives and integrals. This is efficiently achieved by visualization, numerical and graphical experimentations and, thus, students are required to be acquainted with Mathematica (or similar ones) during the course for working exercises and homework problems. The present course provides a basic core and practical knowledge required for many courses in both natural and social sciences.	Lecture is conducted in English. Hybrid or Others face-to-face, Synchronous and Asynchronous, Take-home exam

Course Number	Course Name	Instructional Type	Credits	standard registration year	Term	Meeting Days,Period etc.	Classroom	Instructor	Course Overview	Remarks
FJ20134	Introduction to Single-Variable Calculus II	4	2.0	1	FallBC	Tue1,2		Sano Nobuyuki	This course along with "Introduction to Single- Variable Calculus I" and "Advanced Calculus" introduces the basic tools of calculus and develops their technical competence. The primary goal of this course is to understand the concepts and to build up a working ability of various mathematical manipulations such as parametric equations, polar coordinates, infinite sequences and series. This is efficiently achieved by visualization, numerical and graphical experimentations and students are required to be acquainted with Mathematica (or similar ones) during the course for working exercises and homework problems. The present course provides a basic core and practical knowledge required for many courses in both natural and social sciences.	Lecture is conducted in English. Hybrid or Others face-to-face, Synchronous and Asynchronous, Take-home exam
FJ20144	Advanced Calculus	4	4.0	1	SprA SprABC	Tue5,6 Thu4,5		Sano Nobuyuki	Following "Introduction to Single-Variable Calculus I & II," this course introduces the basic tools of calculus and develops their technical competence, namely, differential equations, infinite series, vector calculus, curvilinear coordinate systems, and partial derivatives, etc. This is achieved by visualization, numerical and graphical experimentations and, thus, students are required to be acquainted with Mathematica (or similar ones) during the course as working exercises and homework problems. This course as well as "Introduction to Single-Variable Calculus I & II" provides a core and practical knowledge required for many courses in both natural and social sciences.	Lecture is conducted in English. Hybrid or Others face-to-face, Synchronous and Asynchronous, Take-home exam
FJ20201	Probability and Statistics	1	2.0	1	FallAB FallC	Thu2 Thu1,2		Islam Monirul Muhammad	This course introduces basics of probability theory and statistics. This course will be mainly oriented to interpret physical problems in engineering and natural sciences through application of probability theory and statistics. Evaluation will be done through class quiz, homework on regular basis, and final examinations.	Lecture is conducted in English. Hybrid or Others face-to-face, Online(Asynchronous) and Online(Synchronous)
FJ22004	Electromagnetism I	4	3.0	2	FallABC	Wed2,3	3A408	AFALLA JESSICA PAULINE CASTILLO	This course introduces the classical theory of electromagnetism at an undergraduate level. It begins with the fundamental laws and relations governing electrostatic force, electric field and electric potential. These quantities are calculated based on a given system of charges or a given charge distribution. The course also continues with work and energy in electrostatics, electric fields in matter (the concepts of polarization and linear dielectrics), as well as electric fields due to polarized objects.	Lecture is conducted in English. Hybrid or Others face to face and some meetings online. recording the face-to-face classes, in case there are any students who are unable to be physically present.
FJ22014	Electromagnetism II	4	3.0	2	SprABC	Tue2,3		You Borwen	This lecture starts from magnetostatics and compares with those properties of electrostatics. The electromagnetic induction is then revealed from the time-dependent variation of electric or magnetic field. All the principles of electric and magnetic fields are summarized in Maxwell's equations. Electromagnetic (EM) waves are finally presented to discuss the EM properties of dielectrics and metals.	Lecture is conducted in English. Only for IDE students Hybrid or Others
FJ25101	Electrical Circuit	1	2.0	2	FallAB	Tue5,6	3A305	Osawa Hirotaka,Akimoto Yutaro	A lecture is given on basic knowledge and analysis methods of electrical and electronic circuits, including linear passive elements, sinusoidal alternating current and complex number, impedance and admittance, resonant circuits, mutual induction circuits, bridge circuits, filters, general circuit theorems, and AC power.	Lecture is conducted in English. Hybrid or Others face-to-face and Online(Asynchronous)
FJ26004	Mechanics I	4	2.0	1	FallAB	Mon5,6	3A213	Matsuda Akihiro	Primary goals of Mechanics I is to develop students' ability to (i) analyze problems in a simple and logical manner and (ii) apply basic principles to find their solutions. This course reviews such fundamental concepts as coordinate, time, mass, force and energy for a particle. The students are required to solve exercises and work on homework assignments.	Lecture is conducted in English. Online(Asynchronous)
FJ26014	Mechanics II	4	2.0	1	SprAB	Mon5,6	3A213	Kawai Masamichi,Shoji Gaku	Following "Mechanics I", "Mechanics II" will just concentrate on the basics of mechanics. Emphasis will be given to topics that will be useful in other disciplines, such as systems of particles, kinematics and plane motion of rigid bodies and principles about analytical vector mechanics.	Lecture is conducted in English. Hybrid or Others face-to-face and Online(Asynchronous)

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FJ26104	Thermodynamics I	4	2.0	2	FallAB	Tue3,4	3A311	Kaneko Akiko	Thermodynamics is one of the essential physics to discuss energy conservation for engineer in various fields. The aim of this lecture is to master the basics of the first and second laws of thermodynamics. The specific goal is to be able to appropriately express the first law of thermodynamics for the system, to be able to discuss changes in entropy based on the second law of thermodynamics, and to combine these basic matters. The heat efficiency of the heat engine can be derived.	Lecture is conducted in English. Hybrid or Others face-to-face and Online(Asynchronous)
FJ26114	Thermodynamics II	4	1.0	2	SprAB	Fri4		Kaneko Akiko,Kanagawa Tetsuya	Thermodynamics is one of the essential physics to discuss energy conservation for engineers in various fields. Based on the first and second laws of thermodynamics learned in "Thermodynamics I", we learn free energy and chemical potential as new state quantities, and advanced matters of thermodynamics such as Maxwell relations and phase changes. The aim is to be able to understand these matters based on the major principles of the first law and the second law, and to cultivate the ability to reconstruct the learned matters from a new perspective by using them as tools.	Lecture is conducted in English. Hybrid or Others (face-to-face and Online(Asynchronous))
FJ27004	Programming I	4	2.0	1	SprAB	Fri1,2	3L201, 3L206, 3L207, 3L504	Utsuro Takehito	This course, introduction to programming, is focused on the first steps in C language. Topics that will be covered include fundamentals of programming languages applicable to general engineering systems. They include C-Language (fundamental operations, standard input-output functions), control statements (branching and jumps, if-statement, looping, while- and for-statements), fundamental data types, basics of making and using functions, storage classes and functions, arrays, character strings, and multidimensional array.	Lecture is conducted in English. Only for IDE students Online(Asynchronous)
FJ27014	Programming II	4	1.0	1	SprC	Fri1,2	3L504, 3L201	Kitahara Itaru	[Objective] Develop the ability to process information well using computers. [Overview] Learn the basics of programming in C-language. [Topics] Memory space (scoping), Memory address (pointer variable), Function, File I/O, Structure, Linked list, Sorting.	Lecture is conducted in English. Only for IDE students Online(Asynchronous)
FJ27024	Programming III	4	2.0	2	FallAB	Fri1,2	3A305	Maruyama Tsutomu	Introduction to algorithm, data structure and computational complexity; Writing C program; Programming techniques	Lecture is conducted in English. Only for IDE students Hybrid or Others face-to-face and Online(Asynchronous)
FJ27034	Programming IV	4	1.0	2	FallC	Fri1,2	3A305	Kameda Yoshinari	After Programming I - III, Learn C programming skill by coding basic computer graphics programs.	Lecture is conducted in English. Only for IDE students Hybrid or Others face-to-face and Online(Asynchronous)
FJ28003	Fundamental Labs I	3	2.0	2	FallABC	Mon3-5	3L103, 3L203, 3L204, 3L205	Nakauchi Yasushi,Matsuda Akihiro,Yamaguchi Tomoyuki,Yasojima Akira	Fundamental labs for the basics of Engineering Systems. The labs consist of 6 themes. Each theme will be concluded in 2 weeks (2 weeks x 6 thems = 12 weeks). The 6 thems are as follows: 1. System control engineering basic students' labs, 2. Basics of linear systems using operational amplifiers, 3. Diodes and transistors, 4. Basics of logic circuits and computers, 5. DC motor manufacturing and control, and 6. Mechanisms and mechanical elements.	Only for IDE students Labs (instructions) are conducted in English. We'll condut the labs by face-to-face if the COVID situation allows. If not, we'll conduct as online (asynchronous) with the video suppliments, virtual data, etc.

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FJ28013	Fundamental Labs II	3	2.0	2	SprABC	Mon3-5		Ohno Yuzou, Makimura Tetsuya, Isobe Takanori, Oigawa Haruhiro, Sekiba Daiichiro, Yamagishi Hiroshi	Fundamental labs for the basics of Engineering Sciences Topics will include logic circuits, electronic circuits, electric conduction, radiation measurement, and light.	Lecture is conducted in English. Only for IDE students

Major Subjects(Required)

Course Number	Course Name	Instructional Type	Credits	standard registration year	Term	Meeting Days, Period etc.	Classroom	Instructor	Course Overview	Remarks
FJ10001	Complex Analysis	1	3.0	2	FallABC	Tue1, 2	3A305	Islam Monirul Muhammad	This course introduces theories for functions of a complex variable. Students will acquire skill to use complex derivatives function, to have knowledge about integration in the complex plane, use of Cauchy integral theorem, power series, to evaluate complicated real integrals via residue calculus, etc.	Lecture is conducted in English. Hybrid or Others face-to-face, Online(Asynchronous) and Online(Synchronous)
FJ10101	Applied Mathematics	1	3.0	2	SprABC	Thu1, 2		Islam Monirul Muhammad	Applied mathematics will focus on the applications of mathematics in the field of engineering and physics. Students in this course will acquire problem-solving skills using applied knowledge in mathematics in vector analysis, complex variables, group theory, partial differential equation, Fourier series, Fourie and Laplace transforms.	Lecture is conducted in English. Hybrid or Others face-to-face, Online(Asynchronous) and Online(Synchronous)
FJ11001	Engineering Ethics	1	1.0	4	FallAB	Wed1		Kakeya Hideki		Not open in 2021. Lecture is conducted in English.
FJ11101	Introduction to Interdisciplinary Engineering I	1	1.0	1	FallAB	Tue5	3A311	Maruyama Tsutomu, Yano Hiroaki, Yamamoto Kyosuke, Osawa Hirotaka, Matsuda Akihiro, Date Hisashi, Kameda Toshihiro, Kaneko Akiko, Takewaka Satoshi, Izawa Jun, Aki Hirohisa	This course discusses issues relevant to Engineering Systems and aims to help students grasp general concepts involved in this field of study.	Lecture is conducted in English. Hybrid or Others face-to-face, Online(Asynchronous) and Online(Synchronous)
FJ11111	Introduction to Interdisciplinary Engineering II	1	1.0	1	SprAB	Tue1	3A214	Matsuishi Kiyoto	This course discusses issues relevant to Engineering Sciences and aims to help students grasp general concepts involved in this field of study.	Lecture is conducted in English. Online(Asynchronous)
FJ12001	Modern Physics	1	3.0	2	SprABC	Fri1, 2		Islam Monirul Muhammad	The course will focus about overview of modern physics aiming at Engineering students. Students in this course will have introductory concept about wave-particle properties of electromagnetic radiation, quantum mechanics, properties of atom, molecular structure, statistical physics, and solid state physics.	Lecture is conducted in English. Hybrid or Others face-to-face, Online(Asynchronous) and Online(Synchronous)
FJ15001	System Modeling	1	2.0	2	SprAB	Wed1, 2	3A214	Nguyen Triet Van	This course introduces fundamental concepts and techniques in building linear, time-invariant, state-space models of typical engineering systems, including translational and rotational mechanical systems, electrical and electronic circuits, thermal systems, fluid systems, and transductors. Analogies are drawn among these systems in different energy domains based on such concept as the across and the through variables, as well as their energy storages and dissipaters. Response characteristics of standard first and second-order systems are explained, as a prelude to control system designs.	Lecture is conducted in English. Hybrid or Others The lecture is face-to-face learning, but it may be changed to online (asynchronous) due the status of the Covid.
FJ15101	Electronic Circuits	1	2.0	2	SprAB	Wed3, 4		Maeda Yuka, Hassan Modar	Following “Electrical Circuits”, this course introduces the fundamentals of electronic circuits, their components, and their analysis. Topics covered are: circuit abstraction method, two terminal elements, Kirchhoff laws, circuit analysis methods, digital abstraction, MOSFET switch, MOSFET amplifier, energy storage elements, operational amplifiers circuit and analysis, and diodes and semiconductors.	Lecture is conducted in English. Online(Asynchronous)

Course Number	Course Name	Instructional Type	Credits	standard registration year	Term	Meeting Days,Period etc.	Classroom	Instructor	Course Overview	Remarks
FJ18003	Advanced Labs I	3	2.0	3	FallABC	Tue3-5		Uedono Akira,Sakurai Takeaki,Suemasu Takashi	We conduct basic experiments on important topics in electron and quantum engineering [i) X-ray diffraction, ii) semiconductor conductivity and the Hall effect, and iii) optoelectronics]. Through this course, the techniques necessary for research in electron and quantum engineering will be given.	Lecture is conducted in English. Only for IDE students
FJ18013	Advanced Labs II	3	2.0	3	SprABC	Tue3-5		Yano Hiroaki,Maeda Yuka,Kawai Shin	We will deepen our understanding of Engineering Systems. The labs consist of 3 themes. Each theme will be concluded in 4 weeks (4 weeks x 3 themes = 12 weeks). The 3 themes are as follows: 1. Control System design, 2. Sensors and analog signal processing, and as the other topic, we will provide one of the topics from Engineering Mechanics and Energy.	Not open in 2021. Lecture is conducted in English. Only for IDE students Hybrid or Others
FJ19003	Interdisciplinary Engineering PBL I	3	6.0	3	FallABC	by appointment		Kameda Toshihiro	Project-based learning opportunities are provided. The students must choose two different laboratories from the field of Engineering Science and Engineering Systems, respectively. Under the laboratory academic advisor's supervision, the students are expected to collect the information regarding to their research field.	Only for IDE students Lecture is conducted in English. Only for IDE students Hybrid or Others (PBL style will be advised by each academic advisor)
FJ19013	Interdisciplinary Engineering PBL II	3	6.0	3	SprABC	by appointment1				Not open in 2021. Lecture is conducted in English. Only for IDE students
FJ19023	Interdisciplinary Engineering PBL III	3	6.0	4	FallABC	Mon1				Not open in 2021. Lecture is conducted in English. Only for IDE students
FJ19033	Interdisciplinary Engineering PBL IV	3	6.0	4	Annual	Mon1				Not open in 2021. Lecture is conducted in English. Only for IDE students

Major Subjects(Core Electives)

Course Number	Course Name	Instructional Type	Credits	standard registration year	Term	Meeting Days,Period etc.	Classroom	Instructor	Course Overview	Remarks
FJ12101	Statistical Physics I	1	1.0	3	FallAB	Wed5		Sano Nobuyuki	Statistical Physics as well as Quantum Mechanics provides the most important backbone of modern physics. In the present course, the basic principles of statistical mechanics are explained. After reviewing the basics of probability theory, the fundamental assumption of Statistical Mechanics, "principle of equal a priori probabilities," is introduced to construct statistical ensembles. The microscopic interpretation of entropy is explained so that the connection to thermodynamics becomes constructed.	Lecture is conducted in English. Hybrid or Others
FJ12111	Statistical Physics II	1	1.0	3	FallC	Wed4,5		Sano Nobuyuki	The fundamental concepts introduced in Statistical Physics I are applied to a few simple physical systems such as ideal gases. We derive the classical (Boltzmann) and quantum (Fermi-Dirac and Bose-Einstein) statistics from statistical ensembles. The fundamental principles underlying when extracting the maximum work from heat are clarified. The physical interpretation and connection between chemical reaction and Gibbs free energy are also discussed.	Lecture is conducted in English. Hybrid or Others
FJ12121	Statistical Physics III	1	1.0	3	SprAB	Wed5		Sano Nobuyuki	Following "Statistical Physics I, II", the fundamental principles and various statistical ensembles in Statistical Mechanics are applied to some important phenomena and models encountered in physics, namely phase transition and landau phenomenological theory, binary mixture such as alloys, semiconductor statistics and quasi-Fermi potentials. A brief introduction to nonequilibrium statistical mechanics such as kinetic theory of gas, linear response, and Boltzmann transport theory, is also explained.	Not open in 2021. Lecture is conducted in English.

Course Number	Course Name	Instructional Type	Credits	standard registration year	Term	Meeting Days,Period etc.	Classroom	Instructor	Course Overview	Remarks
FJ12201	Quantum Mechanics I	1	1.0	3	SprA	Tue/Thu 2		Sharmin Sonia	After a brief historical review, we will cover the basics of quantum theory from the perspective of wave mechanics. This includes a discussion of the wavefunction, the probability interpretation, operators, and the Schrödinger equation. We will then consider simple one-dimensional scattering and bound state problems. Next, we will cover the mathematical foundations needed to do quantum mechanics from a more modern perspective. We will review the necessary elements of matrix mechanics and linear algebra, such as finding eigenvalues and eigenvectors, computing the trace of a matrix, and finding out if a matrix is Hermitian or unitary. We will then cover Dirac notation and Hilbert spaces. The postulates of quantum mechanics will then be formalized and illustrated with examples.	Not Open in 2021. Lecture is conducted in English. Hybrid or Others
FJ12211	Quantum Mechanics II	1	1.0	3	SprBC	Thu2		Sharmin Sonia		Not Open in 2021. Lecture is conducted in English.
FJ12221	Quantum Mechanics III	1	1.0	4	FallAB	Thu2		Sharmin Sonia		Not Open in 2021. Lecture is conducted in English.
FJ12301	Advanced Electromagnetism I	1	1.0	3	FallA	Fri1,2		Fujioka Jun	This course introduces the fundamental concept of electromagnetic field and the Maxwell's equations. First, the fundamental laws of electromagnetic field in vacuum is explained and Maxwell's equation is derived. Next, the application of Maxwell's equation to the static electric/magnetic field is described.	Lecture is conducted in English. Hybrid or Others
FJ12311	Advanced Electromagnetism II	1	1.0	3	FallB	Thu4,5		JUNG Mincherl	Time-varying/time-harmonic electromagnetic fields and electrical properties of matter based on Maxwell' s equations will be studied. Topics include: variable forms of Maxwell' s eq., dielectrics/magnetics-polarization/magnetization-permittivity/permeability, etc.	Lecture is conducted in English. face-to-face
FJ12321	Advanced Electromagnetism III	1	1.0	3	FallC	Thu1,2		JUNG Mincherl	Wave equation, propagation, polarization, reflection, transmission, radiation, and scattering will be studied. Topics include: variable formed wave eq., transverse electromagnetic modes (in Lossy media), linear/circular polarization, different incidence issues in Lossy media with multiple interfaces, electromagnetic theorems and principles, etc.	Lecture is conducted in English. face-to-face
FJ12401	Solid State Physics I	1	1.0	3	FallAB	Mon4		Kojima Seiji	We learn fundamental knowledge of solid state physics, i.e. Crystal, structure, diffraction, reciprocal, lattice, Brillouin zone, ionic crystals, elastic constants.	Lecture is conducted in English. face-to-face
FJ12411	Solid State Physics II	1	1.0	3	FallBC	Fri4		Kojima Seiji	We learn fundamental knowledge of solid state physics, i.e. crystal structure, wave diffraction and reciprocal lattice, thermal motion of atoms in crystal, electronic states in crystal. The thermal properties, transport phenomena, phase transitions and so on, in solids, will be discussed for understanding of advanced contents of materials science.	Lecture is conducted in English. face-to-face
FJ12421	Solid State Physics III	1	1.0	3	Fall Semester	Intensive		Kojima Seiji	We learn fundamental knowledge of solid state physics, i.e. band structure, semiconductor crystals, Fermi surfaces, metals.	Lecture is conducted in English. face-to-face
FJ15011	Control Systems I	1	2.0	3	FallAB	Wed3,4		Date Hisashi	This course introduces the control theory for linear systems based on state-space modeling. It covers the notion of stability, controllability, and observability, followed by the design of state feedback and observer. It also briefly covers the notion of frequency-domain techniques.	Lecture is conducted in English. Hybrid or Others
FJ15021	Control Systems II	1	2.0	3	SprAB	Wed3,4		Mochiyama Hiromi		Not open in 2021. Lecture is conducted in English.
FJ16001	Fluid Dynamics I	1	3.0	3	FallABC	Mon1,2		Yokota Shigeru	This course covers the principal concepts and methods of fluid dynamics. Topics include basic laws of fluids, analysis of irrotational flow and vortex, introduction to compressible flows and viscos flows.	Lecture is conducted in English. Online(Asynchronous)