機械工学セミナー　Introduction to Mechanical Engineering
[Instructor] Each teacher
[Credits] 2
[Semester] 1st year-Spring-Mon 2
[Course code] T1Q001001
[Room] Bldg. ENG- 15-110, Bldg. ENG- 17-213
[Course enrollment] 80
[Candidate] Only students of Department of Mechanical Engineering.
[Course description] The course provides opportunities for new students of the mechanical engineering department to think about plans for the future through learning necessary aspects and researches undertaken at each laboratory, and how does it inflect after being over the learning content in the mechanical engineering department in the society. By forming a group in small numbers, students will tour multiple laboratories and participate in experiments, seminars, and discussions at each laboratory. Students will also study ethics of an engineer in lectures and participate in discussions about their learning. The course is designed to be a place of amity among faculties and students.
[Course objectives] Entry into the mechanical engineering department serves as an opportunity for students to discover the direction of their future from the point of a new fresh start. Through such opportunity, students will be able to take advantage of discovering answers to questions such as the nature of the university, mechanical engineering, or research, via theme based experiments, seminars, or discussions. Students will also be able to obtain the first step in engineering ethics through lectures of engineering ethics, case studies of accidents, discussions, and report preparation.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Ability to produce a simple writing to highlight the contents learned from lectures, seminars, and experiments in combination to one's opinion. Ability to add further facts and information not acquired in lectures. Ability to explain in writing about opinions for the roles of mechanical engineering in society, and missions of an engineer.	1, 2, 3,4, 5, 6,7	Report writing （Two times）	75%
2	Ability to reflect the image of a career plan after the graduation, an association to learn between mechanical engineering and knowledge necessary in the future from now on.	8,9,10	Report writing	25%
3	Ability to express opinions about matters studied in lectures of engineering ethics and case studies. Ability to participate in discussions.	11,12,13,14, 15,16,	Report writing and Discussion	

[Plans and Contents]
1. What is University ? What is Department of Mechanical Engineering? What is Introduction to Mechanical Engineering?
2. Lectures, Experiments, Practical Training and Discussion related to Theme 1
3. Lectures, Experiments, Practical Training and Discussion related to Theme 1
4. .Lectures, Experiments, Practical Training and Discussion related to Theme 1
5. Lectures, Experiments, Practical Training and Discussion related to Theme 2
6. Lectures, Experiments, Practical Training and Discussion related to Theme 2
7. Lectures, Experiments, Practical Training and Discussion related to Theme 1
8. Lectures, Experiments, Practical Training and Discussion related to Theme 3
9. Lectures, Experiments, Practical Training and Discussion related to Theme 3
10. Lectures, Experiments, Practical Training and Discussion related to Theme 3
11. Introduction to Engineering Ethics
12. Engineering Ethics (Understanding risk)
13. Engineering Ethics (Introduction to Ethics)
14. Engineering Ethics (Understanding Product Liability)
15. Engineering Ethics (Understanding Business Ethics)
[Keywords] Introductory education, Communication, Presentation, Discussion, Monotsukuri, Engineering ethic, Methods of Experiment, Career plan
[Textbooks and Reference Books] “Introduction to Engineering Ethics, 3rd Edition” by Norifumi Saitoh and Koji Sakashita (Showado Publishing)
[Evaluation] Students will be evaluated based on two reports on different themes (each worth 25%), and one report about Problem in the lecture by the alumnus (worth 25%), and one report and discussion on Engineering Ethics (worth 25%)
[Related courses] Synthetic Design
[Course requirements] None
[Remarks] This course is compulsory for all students. This course incorporates the following academic targets. (A) Specific target related to the engineering ethics (A-1) and (E) Specific target related to self-expression (E-1) and (E2)

微分方程式演習　Seminaron Differential Equation
[Instructor] Souta Matsusaka
[Credits] 2
[Semester] 2nd year-Spring-Fri 3
[Course code] T1Q002001
[Room] Bldg. ENG-17-213
[Course description] The seminar follows the lecture contents of the subject "differential equation", Seminars will progress as follows. Review of the previous seminar, explanation of solution and formula, seminar, and small test.
[Course objectives] Students will aim to acquire methods of various analytical resolutions to solve differential equation (primarily ordinary differential equation) which is widely used to describe diverse phenomenon in natural science.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Master the various methods of solving ordinary differential equations (B-1)	2, 3, 4, 5, 6,7, 8, 9, 11, 12,13, 14	small test，the end-of-term exam	80%
2	Be able to model and analyze simple physical phenomena (B-1)	1, 10	the end-of-term exam	20%

[Plans and Contents]
1."Introduction to differential equation": This class will explain classification of equation, and relation with partial differential equation, using terminology, format, and resolution required to handle differential equation. The class will also introduce particular questions can be resolved by mastering the seminar contents with various physical phenomenon as examples.
2."Ordinary differential equation of first order (separable)" This class will explain, and offer a seminar on, resolution of separable for differential equation, the most basic differential equation. The class will also allow students to review frequently used integration, and integrations that often cause errors.
3."Ordinary differential equation of first order (equation returnable to separable)" This class will explain, and offer a seminar on, resolution of differential equation that can return to separable (including ones that are called homogeneous form) by simple variable transformation.
4."Ordinary differential equation of first order (exact differential equation and integrating factor)" This class will explain, and offer a seminar on, terminology such as "total differential" and "exact differential", and resolution of equation of exact differential form. The class also explains, and offers a seminar on, equation that becomes exact differential form by integrating factor.
5."Linear differential equation of first order (variation of constants)": This class will explain, and offer a seminar on, terminology such as "linear" and "homogeneous", and resolution of ordinary differential equation of first order using variation of constants.
6."Linear differential equation of first order (method of undetermined coefficients)": When a differential equation has a certain form, method of undetermined coefficients can become a very effective method. With the view of the 8th week contents, the class will explain, and offer a seminar on, resolution of ordinary differential equation of first order using method of undetermined coefficients.
7."Linear differential equation of second order with constant coefficients (homogeneous equation)": This class will explain, and offer a seminar on, resolution of linear differential equation of second order with constant coefficients using characteristic equation. The class will also explain, and offer a seminar on "Wronskian" and "fundamental solution".
8."Linear differential equation of second order with constant coefficients (inhomogeneous equation and method of undetermined coefficients)": Based on the content of the 6th week, this part will explain, and offer a seminar on, resolution of inhomogeneous linear differential equation of second order with constant coefficients using method of undetermined coefficients.
9."Linear differential equation of second order with constant coefficients (inhomogeneous equation and variation of constants)": This class will explain the resolution of inhomogeneous linear differential equation of second order with constant coefficients using variation of constants, which will be followed by a seminar.
10."Review and application to simple physical phenomenon": Modeling of a simple physical phenomenon such as vibration of a spring and RLC circuit will be analyzed using equations acquired so far.
11."Linear differential equation of arbitrary order": This class will explain, and offer a seminar on, resolution of linear differential equation of higher order. The class will also explain, and offer a seminar on differential equation of Bernoull, Riccati, and Euler.
12."Differential operator": This class will explain, and offer a seminar on, resolution of inhomogeneous linear differential equation using differential operator.
13."Simultaneous differential equations": This class will explain, and offer a seminar on, resolution of simultaneous differential equations using elimination. The class will also explain the use of Cramer's rule.
14."Series solution to differential equations": With the aim of familiarizing with a series solution, students will apply a series solution to simple differential equations of 1st and 2nd order, and understand the possibility of different methods to achieve the same solution.
15. Revise and organize solutions studied in previous classes and establish a clear perspective.
16. The end-of-term exam

[Textbooks and Reference Books]No specific texts required, but the following are suggested for reference:
1) Kenichi NAGASAKI and Masaaki NAKAMURA, “Differential Equation”, Baifukan.
2) Ervin Kreyszig (translated by Kazuo KITAHARA), “Ordinary Differential Equation”, Baifukan
[Evaluation] Exam: 70%: Small tests: 30%. Total mark required to pass =60%.
[Related courses] Pre-calculus, Differential Equations
[Course requirements] Students must have taken the course of Pre-calculus.
[Remarks] 1) This subject is related to the academic target of mechanical engineering courses "(B) essential understanding of events and practical application of expertise". 2) Questions and comments column will be available on mini tests papers. Students are advised to make use of the column to resolve any issues at early stages.

機械システム入門 Introduction to mechanical systems
[Instructor]Hirofumi Hidai, Kazuya Okawa
[Credits] 2
[Semester] 1st year-Fall-Tues 4, 5
[Course code] T1Q008001, T1Q008002
[Room] Bldg. ENG-15-110
[Course enrollment] 75
[Candidate] As a general rule, only 1st year students of Department of Mechanical Engineering
[Course description] Through a design and production of a simple machine, students will establish understand of various problems may arise during the process, draft solutions to such problems, and obtain actual confirmations. Students will form a group of around 5 to design and build an original machine per group, using components such as motor, sensor, and motion transfer mechanism. The course will be undertaken on the basis of 2 segments per week x 8 weeks during the first half of the semester 2.
[Course objectives] Machines are useful equipment's for us but areas of application are expansive. In recent years, information technology equipment's are also considered as machines, but in a more traditional sense, the ordinary definition of a machine can be described as "a tool that consists of one or more parts, and uses energy to achieve a particular goal". In this course, students will aim to understand machine in this traditional sense, through design and production of a simple machine. Upon completion of this course, students will develop an ability to explain fundamental principles in improving machine strength, provision of energy, realization of movement, and be able to perform a design and production of a simple machine and use a microcomputer. In addition, students will learn the significance of team activities and increase their motivation towards lectures in specialized subjects offered from the second year onwards

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to propose a useful piece of machinery based upon the material and methods provided	1, 2, 3, 4, 5, 6	Evaluated by how well item meets production goals.	20%
2	Be able to design and fabricate the proposed machine	7, 8, 9, 10, 11,12, 13, 14	Evaluated by level of completion of item.	30%
3	Be able to actively contribute to team proposal, design and fabrication	5, 6, 7, 8, 9, 10, 11, 12, 13,14, 15, 16	Evaluated by measuring extent of contribution to teamwork.	20%
4	Be able to summarize the proposal, design, and fabrication processes.	15, 16	Evaluated through the report.	30%

[Plans and Contents]
1. (Day 1 - 4th Period) Course objectives, summary, groups assigned explanation of evaluation, development case examples, and basic materials. (Each point can be found in the day one handouts downloaded from Moodle which students must bring to class. => Students cannot take part in the seminar without the handouts.)
2. (Day 1 - 5th Period) General explanation of the functions of PICs (microcontrollers)
3. (Day 2 - 4th Period) Detailed explanation of PIC functions, examples of PIC programming (Each point can be found in the day two handouts downloaded from Moodle which students must bring to class. => Students cannot take part in the PIC Practical training without the handouts.)
4. (Day 2 - 5th Period) Running of PIC program examples, PIC programming
5. (Day 3 - 4th Period) each group's goals, material allocation, and work
6. (Day 3 - 5th Period) each group's work
7. (Day 4 - 4th Period) each group's work
8. (Day 1 - 5th Period) each group's work
9. (Day 5 - 4th Period) each group's work
10. (Day 5- 5th Period) Mid-term report by representative from each group.
11. (Day 6 - 4th Period) each group's work
12. (Day 6 - 5th Period) each group's work
13. (Day 7 - 4th Period) each group's work
14. (Day 7 - 5th) each group's work
15. (Day 8- 4th Period) Performance evaluation of produced item
16. (Day 8 - 5th Period) Demo of produced item and final report by representatives
[Keywords] Machine Machine Design, Machine fabrication, Motors, Sensors, Microcomputers
[Textbooks and Reference Books] Textbook will not be used in the class. Students may use the handouts which can be downloaded from Moodle. Students cannot take part in the seminar or Practical training without the handouts.
[Evaluation] Credit will be awarded to students who receive a total grade over 60%.

[Related courses] Data processing, Programming, Dynamics introduction, Machine Kinematics, Machine parts, Mechatronics, Machine Design and Drawing, Mechanical Machining, Experiment of Mechanical Engineering, other. [Course requirements] None in particular
[Remarks] This course is evaluated under mechanical learning objective “F- Flexible thinking and systematic approach.”

プログラミング　Programming
[Instructor] Yasuo Moriyoshi
[Credits] 2
[Semester] 1st year-Fall-Wed 5
[Course code] T1Q009001
[Room] Bldg. ENG- 17-214
[Course enrollment] Enrollment limit 100 (Limit of Seminar PC)
[Candidate] Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course description] To acquire essential programming skills for the machine control, an integral part of machine engineering,
Students will aim to resolve practical questions through seminars. To achieve the goal, students will acquire skills in designing their own computer program, perform programming, program execution, and bug fixes, and apply optimization.
[Course objectives] The study mainly focuses on the universal programming language of C programming language. Linux will be used for the program development environment, and students will understand practical program development methods and basic programming techniques through on-screen exercise. Students will learn and develop fundamental understanding of practical steps in programming, and aim to acquire the basis of numerical calculation, an essential element not only in machine control but engineering researches.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Master the operation of a terminal for the exercise and acquire an ability to edit, execute, and debug a simple program. Seminars	1, 2, 3	The end-of-term exam and report writing	10%
2	Acquire an ability to carry out a practical programming and execution using LOOP.	4, 5, 6	The end-of-term exam and report writing	20%
3	Understanding and be able to apply the programming method with considerations to array, element, and format.	7, 8, 9	The end-of-term exam and report writing	20%
4	Understand and be able to apply the programming method using multiple functions.	10, 11	The end-of-term exam and report writing	20%
5	Understand and be able to apply the programming method using local variable and pointer.	12	The end-of-term exam and report writing	20%
6	The student will be able to establish and conduct programming of specific numeric calculations on solutions and numerical integration of simultaneous equations.	13, 14, 15	The end-of-term exam and report writing	10%

[Plans and Contents]
1 .Acquire an ability to carry out a practical programming and execution via numerical calculation such as solutions of simultaneous equations and numerical integration.
2. General information, understanding of variable and function. Be able to create a simple program.
3. Master the operation of a terminal for the exercise, experience and acquire an ability to edit, execute, and debug a simple program.
4. Understand the operation, model, and program flow, and practical methods. Understand LOOP and its methods
5. Practice programming using multiple loops and master the usage by solving examples.
6. Understand programming elements and formats, and practical methods.
7. Practice the programming method with considerations to element and format, and master its usage by solving examples.
8. Understand array, its practical usage and its methods.
9. Practice programming using array and master the usage by solving examples.
10. Understand local variable, pointer, and function, and their practical usage and methods.
11. Practice the use of local variable, pointer, and function, and master the usage.
12. Understand the method of practical programming for solutions of simultaneous equations.
13. Understand the method of practical programming for solutions of numerical integration.
14. Practice practical programming such as solutions of simultaneous equations and numerical integration and master their usage.
15. Understand the method of practical programming for solutions of differential equations.
16. The end of term exam
[Keywords] Programming, C programming language,Computer, Information processing, Numerical simulation, Linux
[Textbooks and Reference Books] Clanguage and Numerical simulation by Hidezumi Sugie ete.al. Baifukan publisher
[Evaluation] Students will be assessed by reports (submitted at each class slot), end-of-term examination (90%), and seven reports (10%). End-of-term examination will be based on 100 points for full marks, and the difficulty will be set at 60 points

being equivalent to a level of achievement set forth in the subject target. To achieve a credit, a student must take the end-of-term examination and submit reports. A weighted average of the exam and reports must be greater than 60 points, and the score of the end-of-term examination must be greater than 50 points.
[Related courses] Information Processing
[Course requirements] Students must have taken course of Information Processing.

工業数学 Ⅰ　Applied Mathematics for Engineering I
[Instructor] Masahiro Takei，Hirofumi Hidai
[Credits] 2
[Semester] 2nd year-Spring-Mon4
[Course code] T1Q011001
[Room] Bldg. ENG-17-112
[Course enrollment] Enrollment limit 50
[Candidate] Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course description] The course is aimed at students of mechanical engineering and provides lectures on infinitesimal calculus of multivariable function (vector analysis) and Fourier analysis. Explanation will be given on how treating differential calculus as linearization of a function can reveal multivariable function and mapping of differential calculus to appear identical in form as level-one-variable. Explanation will also be given on primary concept of vector analysis such as divergence and rotation, orientation of curve and surface, and Stokes' theorem and Gauss's theorem will be interpreted. During the second half, explanation will be given on Fourier series and basics of Fourier transformation which are closely related to the resolution of partial differential equation (relational expression of time derivative and space derivative) that essentially describes physical phenomenon. Similarities between Fourier series and linear algebra will also be interpreted. Through a series of lectures, students will establish a strong awareness of connection with linear algebra.
[Course objectives] Following the study of linear algebra and multivariable function during the first year, students will learn the essential mathematics for the specialist subjects of mechanical engineering. During the first 8 lectures, students will learn multivariable calculus (vector analysis) of scalar-valued function and vector‐valued function, and understand linear algebra that handles linear function of multidimensional quantity, as well as connection between level-one-variable and multivariable function. During the last 7 lectures, students will learn basics of Fourier series and Fourier transformation which are essential for application to partial differential equation (covered in Mechanical Science II) and understand how a function can be treated as vector.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand scalar product of vectors, properties of exterior product, their algebraically and geometrical meanings, and be able to apply multivariable calculus of multivariable function or Fourier analysis in place.	5,8,10,12,13,14	The end-of-term exam	20%
2	Understand the meaning of multivariable function, mapping of differential calculus (first approximation), and chain rule, and be able to perform differential calculation of scalar field and vector field.	9,10,11,12	The end-of-term exam	20%
3	Understand the meaning of orientation of curve and surface, and integral theorem, and be able to perform calculation of scalar-valued function, and curvilinear integral and surface integral of vector field.	13,14,15	The end-of-term exam	20%
4	Understand Fourier series and be able to perform calculation of Fourier series expansion of simple periodic function.	1,2,3,4,5	The end-of-term exam small test	20%
5	Understand Fourier transformation and be able to perform calculation of simple Fourier transformation using real variable function calculus of complex value.	5,6,7	The end-of-term exam small test	20%

[Plans and Contents]
1. Fourier series
2. Fourier cosine series，sine series
3. Complex form of Fourier series expansion
4. Introduction to Parseval’s identity and function spaces
5. Fourier integral formula and Fourier transformations
6. Properties of Fourier transformations
7. Superfunctions
8. Vector dot and cross products
9. Total differential and linear approximation
10. Directional derivatives, gradients, chain rule
11. Deriving vector value functions
12. Gradients, divergence, rotation, the Laplace operator
13. Integrating over a curve
14. Integrating over a curved surface
15. Stokes theorem, Gauss’s theorem

16. The end-of-term exam
[Keywords] Outer product of the vector, Differential calculus, Directional derivative, Chain rule, Vector field, Jacobian matrix, Gradient, Divergence, Rotation, Laplace operator, Line integral, Surface integral, Stokes' theorem, Divergence theorem, Fourier series, Euler's formula, orthogonal function, Fourier transform, Delta function
[Textbooks and Reference Books] (1) MEYBERG/VACHENAUER,Masayuki OIKAWA:Koukakei no suugaku [Multivariate calculus],SAIENSU-SHA Co.,Ltd. ISBN 978-4-7819-0781-9 (2) Takashi, KUROKAWA, Hidefumi OBATA:Fourier analysis,KYOURITU Shuppan, ISBN: 978-4320017764
[Evaluation] Students will be assessed by understanding of the concept and theory. End-of-term examination will be based on 100 points for full marks, and the difficulty will be set at 60 points being equivalent to a level of achievement set forth in the subject target. To achieve a credit, a student must take the end-of-term examination and the score of the end-of-term examination must be greater than 60 points.
[Related courses] Linear Algebra B1 (p. Mech.G17123102), Linear AlgebraB2 (p. Mech. G17123202), Calculus B1 (p. Mech. G17121111), Calculus B2 (p. Mech. G17121211), Diff erential Equations (p. Mech. G17153002), Applied Mathematics for Engineering II (1Q026001)
[Course requirements] Have received credit in Linear Algebra B1 (p. Mech. G17123102), Linear AlgebraB2 (p. Mech. G17123202), Calculus B1 (p. Mech. G17121111), Calculus B2 (p. Mech. G17121211)
[Remarks] This subject is the target subject of the achievement evaluation for the specific achievement (B-1) related to "(B) essential understanding of events and practical application of expertise" (the academic target of mechanical engineering courses).

材料力学 Ⅰ　　Mechanics and Strength of Materials I
[Instructor] Ken-ichi Kobayashi
[Credits] 2
[Semester] 2nd year-Spring-Tues 2
[Course code] T1Q012001
[Room] Bldg. ENG-15-110
[Course enrollment] 100
[Candidate] Students in sophomore class in the Department of Mechanical Engineering, and those in the Frontier Science programs and other faculty permitted to take lectures
[Course description] Students will understand the principle of stress and strain, and master the principle in tensile/compressive deformation, torsional deformation, bending moment, bending stress and deflection of beam, effect of shearing force on beam deflection, and the principle of rigidity such as flexural rigidity.
[Course objectives] Mechanics and strength of materials is important for understanding theory of elasticity, theory of plasticity, fractology, and fracture mechanics. In this subject, students will understand the principle of stress, strain, and rigidity which are essential for mechanical engineering, civil engineering or architecture, in the scope of basic deforming behaviors of tension, torsion, and bending.

Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
Gain an understanding of the concepts behind stress and strain. (B-3)	Mainly 1,2	The end-of-term exam	10%
Be able to calculate stress and deformation in components that undergo uniaxial tensile & compression, torsional deformations. (B-3)	3-6	The end-of-term exam	35%
Be able to calculate stress and deformation in components that undergo bending deformation. (B-3)	7-15	The end-of-term exam	55%

[Plans and Contents]
1. Introduction to mechanics and strength of materials: Students will understand inevitability of material deformation when subjected to external force, and learn that mechanics and strength of materials aims to achieve elastic deformation under equilibrium. Linear relation (Hooke's law) between stress and strain will be explained. Learn about tensile test that seeks stress-strain curve. Essential preparation: Using Internet, students must research the mechanical engineering field where mechanics and strength of materials is being applied.
2. Stress and strain: Nominal stress and shearing stress, nominal strain and shearing strain, Young's modulus, Poisson's ratio, elastic modulus will be explained. Learn about material tests other than the tensile test. Essential preparation: Revise the contents of the lecture part 1 and research the relationship between stress and material failure.
3. Tensile deformation and compressive deformation: Students will understand the deformation of a straight bar under tensile/compressive forces, stress, strain, and tensile rigidity. Shearing stress and shearing strain will be explained. Essential preparation: Revise contents of lectures part 1 and part 2.
4, Method to solve statically determinate structure. Thermal stress, the definition and characteristics of statically indeterminate structure will be explained. Students will also learn the resolving method. Essential preparation: Revise contents of lectures part 2 and part 3, and revisit conditions of equilibrium of forces.
5. Torsional deformation (1): Shearing stress of a round bar under torsional moment, shearing strain, and polar moment of inertia will be explained, and students will learn the principle of torsional rigidity. Essential preparation: Using Internet, research about cylindrical shaft deformation and the background in engineering application such as transmission shaft.
6. Bending deformation (2): Students will understand problems of cylindrical shaft deformation, shearing stress on cross section other than circular section, and torsional rigidity. Learn the relationship between load and deformation of a close-coiled helical spring. Essential preparation: Revise contents of the lecture part 5, especially the deformation of a round bar under torsional moment and characteristics of shearing stress.
7. Torsional moment and shearing force (1): Students will understand the bending moment and shearing force working on a section of a straight bar (beam) under lateral load or couple of forces. Essential preparation: Using textbook and Internet, research the characteristics of bending stress and shearing stress on the issue of bending of a beam,
8. Bending moment and shearing force (2): Bending moment and shearing force will be calculated for varieties of support and loading conditions, and students will understand the relationship between the two, bending moment diagram (BMD), and shearing force diagram (SFD). Essential preparation: Revise the bending moment and shearing force on beam from the lecture part 7.
9. Stress in straight beam (1): Students will understand calculation method of longitudinal stress working on a straight beam under bending moment, and bending rigidity. Essential preparation: Revise contents of lectures part 7 and part 8.
10. Stress in straight beam (2): Cross-sectional secondary moment will be explained, and students will understand those of rectangular section, circular section and hollow section. Essential preparation: Revise contents of the lecture part 7 to part 9.
11. Stress in straight beam (3): Students will learn calculation methods to obtain stress on rectangular section, circular section and T-section. Essential preparation: Revise contents of lectures part 7 to part 10.
12. Deformation of straight beam (1): Derive fundamental equation for a deflection of a straight beam under bending moment, and students will understand calculation method to obtain angle of deflection and deflection at arbitrary point of the

beam. Essential preparation: Revise the contents of lectures part 7 to part 10 and research the relationship between bending deformation and bending moment.
13. Deformation of straight beam (2): Students will learn the method of calculating deflection of statically determinate beam, either cantilevered beam or simply supported beam under distributed load or couple of forces. Essential preparation: Revise contents of the lecture part 12.
14. Deformation of straight beam (3): Students will learn the method of calculating deflection of statically determinate beam, either cantilevered beam or simply supported beam under concentrated load. Essential preparation: Revise contents of lectures part 12 and part 13.
15. Deformation of straight beam (4): Students will understand method of calculating deflection using method of moment of area and principle of superposition, and the characteristics of beam deflection caused by shearing force. Essential preparation: Revise contents of the lecture part 12 to part 14.
16. End-of-term test: Test will be carried out for the contents of the entire course that require acquisition, and students will be assessed for their achievement. Essential preparation: Revise contents of the entire course.
[Keywords] stress, train, tension, compression, bending, beam, torsional moment, bending moment, rigidity
[Textbooks and Reference Books] Textbook: Essential mechanics and strength of material (Ed. Nishimura, H., Maruzen), Reference book: Mechanics and strength of materials (Kato, M., Asakura), Handouts will be provided on a timely basis.
[Evaluation] The score of the end-of-term examination must be greater than 60 points.
[Related courses] Analytical Dynamics
[Course requirements] Students must have a clear understand of the basic analytical mechanics.
[Remarks] Students may also take an exercise of Mechanics and Strength of Materials.

熱力学 Ⅰ　　Thermodynamics I
[Instructor] Gaku Tanaka
[Credits] 2
[Semester] 2nd year-Spring-Tues4
[Course code] T1Q013001
[Room] Bldg. ENG- 17-214
[Course enrollment] Enrollment limit 100
[Candidate] Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course description] Fundamentals of thermodynamics required for analysis and understanding of thermodynamic cycle such as heat engine and heat pump or thermodynamic performance will be explained (thermodynamic function, change of state, heat and work, first law of thermodynamics, second law of thermodynamics, relation between thermodynamic functions, and thermodynamic cycle).
[Course objectives] Students will acquire ability to explain principles for fundamentals of thermodynamics (thermodynamic function, change of state, first law of thermodynamics, second law of thermodynamics, general relation of thermodynamics, relation between thermodynamic functions, and thermodynamic cycle) and be able to calculate thermodynamic function and heat and work using change of state.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Ability to understand and explain the fundamental issues and concept of thermodynamics.	1, 2	Interim exam, The end-of-term exam	20%
2	Ability to understand the first law of thermodynamics and be able to calculate the relation between thermodynamic function and change of thermodynamic function caused by state change of closed system, heat, and work.	3, 9, 11	Interim exam, The end-of-term exam	30%
3	Ability to understand and explain the fundamental issues and concept of the second law of thermodynamics. Ability to solve basic problems of the second law of thermodynamics.	4, 5, 6, 7	Interim exam	20%
4	Ability to understand fundamentals of steady flow system and be able to calculate the relation between heat, work, and thermodynamic function caused by the state change of a steady flow system.	10, 11	The end-of-term exam	10%
5	Understanding fundamentals of general thermodynamic equation and be able to derivate basic relational expression.	12, 13	The end-of-term exam	10%
6	Understanding of basic relation of internal energy, entropy, enthalpy, and state equation, and be able to obtain internal energy, entropy and enthalpy from temperature, mass, and volume.	13, 14	The end-of-term exam	10%

[Plans and Contents] The course will consist of lectures on "role of thermodynamics", "thermodynamic function", "state change", "first law of thermodynamics", "second law of thermodynamics", "general thermodynamic equation", and "relation between thermodynamic functions", as well as "interim exam" and "end-of-term exam". Explanation will be given on the fundamental principle of thermodynamics, meanings of key terminology, and method of obtaining basic equation and physical meaning. The calculation method of heat and work, and calculation method of thermodynamic function will also be explained. Students will assess for their achievement by the "interim exam" and "end-of-term exam".
1. Explanation will be given on physical phenomenon thermodynamics deals with, and students will understand the fundamentals of thermodynamics (system, boundary, periphery, thermodynamic equilibrium, thermodynamic function, physical action caused by system and periphery).
2. Students will understand fundamentals of thermodynamics (state equation, state change in reality and ideal state change)
3. Students will understand the physical meaning of the first law of thermodynamics and internal energy (thermodynamic function). In addition students will understand the principle of specific heat at constant volume, specific heat at constant pressure, heat engine cycle, heat pump cycle, Carnot cycle, and reverse Carnot cycle,
4. Students will understand the principle of reversible change, irreversible change, and impossible change. In addition, students will understand the physical meaning of the second law of thermodynamics (Clausius's principle and Thomson's principle).
5. From the second law of thermodynamics, students will understand the theoretical reasoning for the introduction of absolute temperature and entropy (thermodynamic function), and theoretical reasoning for the second law of thermodynamics formulation.

6. From the second law of thermodynamics, students will understand the theoretical reasoning for the introduction of absolute temperature and entropy (thermodynamic function), and theoretical reasoning for the second law of thermodynamics formulation.
7. Students will understand the law of entropy increase, thermodynamic potential under isochor/isothermal, and isobaric/isothermal conditions (Helmholtz free energy and Gibbs free energy) principle of least action.
8. Interim exam
9. Students will understand the method to obtain heat and work caused by the quasi-static change of closed system.
10. Students will understand the law of energy conservation in the steady flow system and enthalpy (thermodynamic function) and method to obtain heat and work in the closed system.
11. Students will understand the method to obtain change of thermodynamic function, heat, and work in a basic heat engine cycle, and the fundamentals of form of energy and conversion.
12. Explanation will be given on the derivation method of general thermodynamic equation formed between thermodynamic functions,
13. Using a general thermodynamic equation, students will understand the derivation method of a general equation formed between the internal energy, entropy or enthalpy, and the state equation (mass, volume, pressure, and temperature relationship).
14. Students will understand the derivation method for an equation of ideal gas, Van der Waals gas, and internal energy of real gas, entropy, and enthalpy, and mass, volume, pressure, temperature.
15. Students will understand the derivation method for an equation of fluid, internal energy of solid form, entropy, enthalpy, and mass, volume, pressure, temperature.
16. The end-of-term exam
[Keywords] first law of thermodynamics, second law of thermodynamics, thermodynamic function, state equation, heat engine cycle, heat pump cycle.
[Textbooks and Reference Books] Handouts provided in class.
[Evaluation] Students will be assessed by interim exam (50%) and end-of-term exam (50%). Both interim exam and end-of-term exam will have a full score of 100 points. To achieve a credit, a student must take both interim exam and end-of-term exam, and achieve a minimum of 60 points for a weighted average of two exams. [Related courses] Thermodynamics Seminar.

鉄鋼材料 Steel Materials
[Instructor] Yun Lu
[Credits] 2
[Semester] 2nd year-Spring-Wed 2
[Course code] T1Q014001
[Room] Bldg. ENG-17-213
[Course enrollment] 100
[Candidate] Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course description] Students will understand the fundamental Fe-C phase diagram, isothermal transformation diagram, and continuous cooling transformation curve for steel materials, the principle materials for machinery. In addition, students will learn the effects of phase transformation, microstructure and alloying element in heat treatment, and understand their relationships with the mechanical properties. Students will understand steel strengthening methods including the working heat treatment and alloying.
[Course objectives] Steel materials are frequently used for machine components and when selecting the right material for the right place in design and production, it is necessary to have a good understanding of the basic Fe-C phase diagram and isothermal transformation diagram. In addition, since the mechanical properties are largely affected by the phase transformation and microstructure change in the heat treatment, it is important to obtain knowledge to be able to autonomously control their mechanical properties. The relationship between phase transformation and microstructure change is also an important basic knowledge for other materials.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Properties of pure iron, Fe-C phase diagram	1, 2, 4	Exam	15%
2	Transformations of super-cooled austenite and microstructures	3, 4, 5, 6, 7, 8	Exam	20%
3	Hardenability and its effect factors	3, 4, 5, 7	Exam	20%
4	Heat treatments	8, 10	Exam	20%
5	Steel strengthening & toughening methods, working heat treatment	12, 14	Exam	10%
6	Special steel	13	Exam	10%
7	Surface hardening methods	14	Exam	5%
8	Material testing methods	9-15	Exam	5%

[Plans and Contents] Students will understand the fundamental phase diagram and isothermal transformation diagram, for the principle materials for machinery: steel, learn the relationship between heat treated microstructures and the mechanical properties, and deepen their understanding the steel strengthening methods. During the course, lectures will highlight the testing methods for related materials, and if time allows, cast iron usages will also be explained. The class contents will be separated into the first half: fundamentals of steel material (part 1 to part 8), and the second half: the detail of steel materials (part 9 to part 15).
1. Manufacturing process and properties of pure iron
2. Fe-C phase diagram and normal microstructures
3. Transformation and microstructure of super-cooled austenite 1
4. Transformation and microstructure of super-cooled austenite 2
5. Mechanical properties and microstructure of carbon steel
6. Hardenability of steel
7. Exercises in Fe-C phase diagram, transformation and microstructure of super-cooled austenite
8. Quenching and tempering of steel
9. Variety of heat treatments and microstructures
10. Working heat treatment
11. Mechanical structural steel
12. Steel strengthening & toughening
13. Special steel 1 (Tool steel, spring steel, bearing steel, etc.)
14. Surface hardening methods for steel materials
15. Special steel 2 (Stainless steel, steel for high and low temperature)
16. Final examination
[Keywords] Iron, Fe-C phase diagram, Isothermal transformation diagram, Heat treatment, Quenching, Critical diameter, Working heat treatment, Steels for special use, Surface hardening methods
[Textbooks and Reference Books] Textbook: Steel Materials (The Japan Institute of Metals and Materials, Suto Hajime), Reference Book: Engineering Materials (The Japan Society of Mechanical Engineers)
[Evaluation] Students will be assessed by final exam (90%) and mini tests (10%).

[Related courses] Material Science (1st year-Full), Nonferrous materials (2nd year-Full), Functional Materials (3rd year-Spring), Strength and Fracture of Materials.
[Course requirements] Student is required to take credits of Material Science (1st year-Fall).
[Remarks] Class notes and seminar problem sets are available for download at http://apei.tu.chiba-u.jp/Luyun-HP.html (Under Lecture)

機械運動学 Machine Kinematics
[Instructor] Takeshi Nakamoto
[Credits] 2
[Semester] 2nd year-Spring-Wed4
[Course code] T1Q015001
[Room] Bldg. ENG- 17-212
[Course enrollment] 80. Students will be given a problem almost every time and to be returned as marked. Thus 80 students is the limit number in the class.
[Candidate] Only for students of Department of Mechanical Engineering
[Course description] In order to provide understanding of the basic machine motion, the faculty will explain methods to analyze displacement, velocity, and acceleration of the machine component parts. Based on the analysis, the faculty will explain the overall movement of a linkage mechanism, a cam mechanism and their concept.
[Course objectives] Through a breakdown of complex machine movements into a series of simple individual movements, students will understand the geometrical and mechanical conditions enabling the movement. Through a learning of such conditions, the course aims for students to understand the underlying principle of machine motion.
[Target] is described in "targets of the subject" below.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	.Students can explain the underlying mechanism of mechanical engineering. To achieve this, students will acquire ability to explain the basic mechanical components such as joints, kinematic pair, and kinematic chain. In addition, students will understand the notion of degree of freedom and obtain skills to calculate the degree of freedom in a kinematic chain. (Machine B-3)	1,2	The end-of-term exam, assignment of report	10%
2	Students understand instantaneous center, a useful notion when analyzing the motion of a planar linkage, and be able to obtain the instantaneous center. (Machine B-3, Machine D-1)	3,4,10,11,12, 13	The end-of-term exam, assignment of report	20%
3	Students can obtain the essential analytic elements for a planar linkage such as displacement mechanism, velocity, and acceleration using graphical solution such as velocity and acceleration polygons. Through the exercise, students will be able to explain the motion of typical key mechanisms essential for the mechanical design such as a linkage mechanism, a cam mechanism and a driving mechanism using rolling contact. (Machine B-3, Machine D-1)	5,6,7,8,9,10,11 ,12,13	The end-of-term exam, assignment of report	70%

[Plans and Contents]
Aims of the kinematics of machinery, joints, kinematic pair, and kinematic chains: Highlight the position of the lectures in relation to the related subjects such as Mechanics, Machine Element, and Basic Mechanical Drawing, the lecture target, and the areas covered by the lecture. Explanation will then be given on the important points (report submission at each slot being essential to qualify to seat in the end-of-the term exam, etc.). Once the above points are explained, students will learn the basic mechanical components such as joints, kinematic pair, and kinematic chain. 2. Degree of freedom in kinematic pair and kinematic chain: Degree of freedom will be first explained, and then students will study a degree of freedom in kinematic pair and kinematic chain. Students will recognize the importance of understanding a degree of freedom.
3. Motion of planar linkage and instantaneous center: Explanation will be given on a planar linkage, a mechanism where all joints are designed to move on the same plane. With planar linkage, students will learn the motion of a certain moment using instantaneous center.
4. Method to obtain instantaneous center: Explanation will be given on actual methods to obtain the instantaneous center. Students will study the instantaneous center of a mechanism consisting of only a lower pair, theorem of the instantaneous center of the rotation of the third element, the instantaneous center of a mechanism with a higher pair, and the centrode.
5 .Displacement of mechanism: Resolution of the motion of a mechanism demands the motion of the driver and the resultant motion of each joint. For this purpose, students will study both graphical solutions and numerical solutions.
6. Fundamental equation for velocity and acceleration of mechanism: In order to resolve the problems of velocity and acceleration of a mechanism, students will derivate a fundamental equation to obtain velocity and acceleration. In addition, the physical meaning of the equation will be explained.
7 .Velocity polygon: Students will study the velocity polygon, an effective method to obtain the velocity using a graphical solution.
8. Acceleration polygon: Students will study the acceleration polygon, an effective method to obtain the acceleration using a graphical solution.
9. Velocity of planar linkage: Students will calculate the velocity of a planar linkage based on the fundamental equation. It must be noted that the velocity of the actual mechanism will not necessarily reflect every value of the fundamental equation. Resolution must take into account the motion of each joint which follows the constraint of the mechanism. This point will be explained.

10. Acceleration of planar linkage: Students will calculate the acceleration of a planar linkage based on the fundamental equation. It must be noted that the acceleration of actual mechanism will not necessarily reflect every value of the fundamental equation. Resolution must take into account the motion of each joint which follows the constraint of the mechanism. This point will be explained.
11. Basics of linkage mechanism: Mechanism consisting of a relatively long rigid body linked with lower pairs is called a linkage. Basics of the linkage mechanism will be explained.
12. Particular example of linkage mechanism: Students will learn and understand particular examples of linkage.
13. Cam mechanism: A definition of a cam mechanism will be described, and types of cam mechanisms will be explained. The most basic cam analysis will be explained.
14. Cam mechanism: Design of a cam mechanism will be summarized and its basic method will be explained. Rolling contact: Driving mechanism using rolling contact: Conditions of a rolling contact will be explained.
15. Rolling contact: Driving mechanism using rolling contact: Conditions of a rolling contact will be explained. Summary: The lecture contents of kinematics of machinery and its usage.
16. Level of understanding of the lecture contents will be tested through this exam.
[Keywords] Mechanism, Joint, Kinematic pair, Degree of freedom, Kinematic chain, Instantaneous center, Displacement, Velocity, Acceleration, Llinkage mechanism, Cam mechanism, Rolling contact
[Textbooks and Reference Books] Study of Mechanisms, CORONA PUBLISHING CO. LTD, Kimihiko Yasuda. No specific reference books designated.
[Evaluation] Evaluation methods are as described in [Targets]. The end-of-term exam will be valued at 70% and the reports will be valued at 30%. To achieve a credit, student must achieve a minimum combined point of 60 points from the report assignment and the end-of-term exam. To qualify to take the end-of-term exam, a student must have no greater than 3 unauthorized absences, and must have submitted report for every lecture slot. Any late submission of reports will subtracts 100% of points allocated to the report assignment on a daily basis. Therefore, a late submission of report can cause the overall report assignment points to become negative. But submission of all report is essential for a qualification to seat at the end-of-term exam. Hence, in order to aim to acquire a credit, it is essential for all students to submit every report in time and avoid any negative scoring. The end-of-term exam will be carried to determine the score for a level of student's understanding and achievements. Areas of insufficient understanding will be highlighted through report assignments.
[Related courses] Physics BI Intro to Dynamics 1, Physics BI Dynamics Seminars 1, Physics BII Intro to Dynamics 2, Seminars 2 Physics BII Dynamics Seminars 2, Fundamentals of Machine Design, Fundamentals of Mechanical Drawing, Machine Design and Drawing
[Course requirements] Students are recommended to have taken Physics BI Intro to Dynamics 1, Physics BI Dynamics Seminars 1, Physics BII Intro to Dynamics 2, and Physics BII Dynamics Seminars 2
[Remarks] This subject is the target subject of the achievement evaluation for the specific achievement (B-1) related to "(B) essential understanding of events and practical application of expertise" and "(D) system design abilities" (the academic target of mechanical engineering courses). References for self-studies are not suggested. Students are advised to engage with report writing assignments. Feedbacks will be provided for the submitted reports. Students are recommended to create study log consisting of notes of the blackboard writing, reports, and report feedbacks for revising. The mechanical engineering course also asks students to create a study portfolio. It is essential for students to review the position of the course and its learning in the perspective all other subjects.

材料力学演習　Exercise of Mechanics of Materials
[Instructor] Kenichi Kobayashi
[Credits] 2
[Semester] 2nd year-Spring-Tues 3 alternate week 1,3 / 2nd year-Fall-Fri 1 alternate week 1,3
[Course code] T1Q017001
[Room] Bldg. ENG- 5-105, Bldg. ENG- 17-214
※The first half of the course will be hosted on the 3rd period of every 1st and 3rd Tuesday of the month at the room number 5-105. The second half will be hosted on the 2nd period of every 1st and 3rd Friday of the month at the room number 17-214. The course registration is only possible during the registration period at the first half. Registration must be selected from the "concentration" column.
[Course enrollment] 100
[Candidate] Sophomore students in Department of Mechanical Engineering, Students in Frontier Science Program and other Department's students who permitted to attend this seminar.
[Course description]　During the first half, seminars will be provided on basic tensile/compressive deformation, torsional deformation, bending moment, bending stress and deflection of beam. At the second half, seminars will be provided on more complex items of deformation such as resolution using a strain energy, continuous beam, Mohr's stress circle, and combined stresses.
[Course objectives] In this subject, students will understand the principle of stress, strain, and rigidity on components with elastic deformation, which are essential for mechanical engineering, electrical parts, civil engineering or architecture. Through seminars, students will also acquire abilities to apply practical calculations for basic problems of tension, torsion, bending, strain energy, continuous beam, and deformation under combined stresses.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to solve problems related to determining tensile & compressive deformation, torsional deformation and dynamic transmission. (Mech. C-1)	1～3	Report、The end-of-term exam	25%
2	Be able to solve problems related to determining bending moments, shearing forces, and deflection in a cross-section of a straight beam under external forces and couples. (Mech. C-1)	5～7	Report、The end-of-term exam	25%
3	Be able to solve problems related to strain energy in statically indeterminate beams and problems related to continuous and curving beams. (Mech. C-1)	8～13	Report、The end-of-term exam	25%
4	Be able to solve problems and derive principle stresses under combined stresses. (Mech. C-1)	14,15	Report、The end-of-term exam	25%

[Plans and Contents]
1. Tensile and compressive deformation (I): Seminar on relationship between external and internal forces, relationship between deformation and strain, and between stress and strain. Hooke's law　Necessary preparatory study: Have learned Mechanics and Strength of Material I.
2. Tensile and compressive deformation (II): Seminar on stress and strain (deformation) in straight beams of both statically determinate and indeterminate structures under tensile and compressive loads.　Necessary preparatory study: Have learned Mechanics and Strength of Material I.
3. Torsional deformation: Seminar on power-transmitting axles & springs, stress and warp angle on members under torsion. Necessary preparatory study: Have learned t Mechanics and Strength of Material I.
4.Stress on straight beams: Seminar on bending moment and shearing force on cross-section of straight beams under external forces and couples　Necessary preparatory study: Have learned Mechanics and Strength of Material I.
5. Bending moment and shearing force: Seminar on how to draw bending moment diagrams (BMD) and shearing force diagrams (SFD) on straight beams under external forces and couples. Necessary preparatory study: Have learned Mechanics and Strength of Material I.
6. Deflection of straight beam (I): Seminar on deflection in statically determinate beams under concentrated load. Necessary preparatory study: Have learned Mechanics and Strength of Material I.
7. Deflection of straight beam (II): Seminar on deflection in statically determinate beams acted upon by distributed loads and couples. Necessary preparatory study: Have learned Mechanics and Strength of Material I.
8. Strain energy (I): Seminar on statically indeterminate problems on beams using Castigliano's method and the reciprocity theorem. Necessary preparatory study: Have learned Mechanics and Strength of Material II.
9. Strain energy (II): Seminar on statically indeterminate problems on beams under virtual applied loads. Necessary preparatory study: Have learned Mechanics and Strength of Material II.
10. Continuous beams (I): Seminar on solutions for continuous beams under distributed load.　Necessary preparatory study: Have learned t Mechanics and Strength of Material II.
11. Continuous beams (II): Seminar on solutions for continuous beams under concentrated load in various support conditions. Necessary preparatory study: Have learned Mechanics and Strength of Material II.

12. Curving beams (I): Seminar on solutions for curved beams under axial forces and curved beams not under axial forces Necessary preparatory study: Have learned Mechanics and Strength of Material II.
13. Curved beams (II): Seminar on statically determinate and statically indeterminate curved beam problems using Castigliano's method. Necessary preparatory study: Have learned Mechanics and Strength of Material II.
14. Combined stress (I): Seminar on using formulas to find nominal and shearing stresses in a cross section, calculating principal stress and principal plane of stress, and calculating maximum and minimum shear stresses. Necessary preparatory study: Have learned Mechanics and Strength of Material II.
15. Combined stress (II): Seminar on calculating principal stresses using Mohr's stress circle and calculating principal strains under combined stress using Hooke's law. Necessary preparatory study: Have learned Mechanics and Strength of Material II.
16. Final exam: Examination on required course content to evaluate overall level of attainment.
Necessary preparatory study. Essential preparation: Revise contents of the entire course.
[Keywords] Stress, Strain Tension, compression Torsion, Beam, Strain Energy Method, Combines Stress, Stress Circle
[Textbooks and Reference Books] Essential mechanics and strength of material (*Ed*. Nishimura, H., Maruzen) , Handouts will be provided on a timely basis.
[Evaluation] Students will be assessed by report (40points for full marks) and end-of-term exam (60 points for full marks). To achieve a credit, a student must take over 60 points in total.
[Related courses] Mechanics and Strength of Materials1 and 1I
[Course requirements] Students may take Mechanics and Strength of Materials I and II.

熱力学演習　Exercise in Thermodynamics
[Instructor] Masanori Ota and Yasuo Moriyoshi
[Credits] 2
[Semester] 2nd year-Spring-Tues5 alternate week 1/3/　2nd year-Fall-Wed3 alternate weeks 1, 3
[Course code] T1Q018001
[Room] Bldg. ENG-17-213, 17-214
※Class will be held in Lecture Room17-214 on Tues 5periods in Spring term, and in 17-213 on Wed 3rd periods ,in Fall term. The course registration is only possible during the registration period at the first half. Registration must be selected from the "concentration" column.
[Course enrollment] Enrollment limit 100
[Candidate] Students of Faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course description] To support the lecture contents of the "Thermodynamics I and II" and help students to deepen their understanding, overlapping items will be highlighted.
[Course objectives] [First half] Students will establish an ability to explain the "fundamental issues and concept of thermodynamics", the most important item for understanding thermodynamics, and also be able to resolve the basic calculations of the "the first law of thermodynamics", "the second law of thermodynamics", "change of thermodynamic function caused by state change", and "general thermodynamic equation". [Second half] Students will establish an understanding of methods to resolve basic calculations of "gas cycle", "stream function and state change", "steam cycle" and "gas flow".

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand and be able to explain the fundamental meaning of thermodynamics.	1	Seminars, The end-of-term exam	5 %
2	Be able to solve fundamental problems related to the first and second laws of thermodynamics.	2, 3	Seminars, The end-of-term exam	20 %
3	Be able to calculate basic state quantity transformation related to quasi-static state variation, and the relationships between work/heat and state quantity transformation.	4, 5,6	Seminars, The end-of-term exam	20%
4	Be able to derive the fundamental relational expressions of thermodynamics. Also, be able to derive the relational expressions between the state quantities.	7	Seminars, The end-of-term exam	5%
5	Be able to solve fundamental problems related to the gas cycle.	9, 10	Seminars, The end-of-term exam	15%
6	Be able to solve fundamental problems related to steam and state variation.	11, 12	Seminars, The end-of-term exam	15%
7	Be able to solve fundamental problems related to the steam cycle.	13, 14	Seminars, The end-of-term exam	15%
8	Be able to solve fundamental problems related to gas flow.	15	Seminars, The end-of-term exam	5%

[Plans and Contents]
[1st Semester: Classes 1-8] [2nd Semester: Classes 9-16]
1. Solve problems by understanding the fundamental points of thermodynamics (e.g. thermodynamic equilibrium conditions, state quantity, change in state, physical behavior of systems and environments, state equations.)
2. Solve problems using the first law of thermodynamics
3. Solve problems using the second law of thermodynamics
4. Solve problems related to changes in state quantity associated with quasi-static state changes.
5. Solve problems related to heat and work associated with quasi-static state changes in closed systems.
6. Solve problems related to heat and work associated with state changes in steady flow systems.
7. Solve problems related to deriving the relation equations between state quantities and the general relational expressions of thermodynamics.
8. First semester exam
9. Solve a variety of basic gas cycle problems.

10. Solve a variety of basic gas cycle problems.
11. Solve problems related to steam and change in state.
12. Solve problems related to steam and change in state.
13. Solve problems related to steam and change in state.
14. Solve problems related to steam and change in state.
15. Solve problems related to gas flow.
16. Fall term final exam

[Keywords] [1st Semester]Quantity of state,State change,Equation of state,Thermodynamics The first law of thermodynamics, The second law of thermodynamics, Gas cycle, Real gas, Rankine cycle, Gas motion

[Textbooks and Reference Books] 1st Semester] Handouts [2nd Semester] Text book from Thermodynamics 2, blackboard work, etc.

[Evaluation] [1st and 2nd Semesters] Evaluated based upon seminar problem sets (35% of total mark) and end-of-term exams (65% of total mark.) To earn credit, students must submit all problem sets, attend both term exams, and obtain a weighted average above 60%.

[Related courses] Thermodynamics II

解析力学　Analytical Dynamics
[Instructor] Ken-ichi Tsubota,
[Credits] 2
[Semester] 2nd year-Fall-Tues2
[Course code] T1Q019001
[Room] Bldg. ENG-17-112
[Candidate] Department of Mechanical Engineering Students.
[Course description] Lectures will be provided on analytical dynamics as the basis to analyze the motion of various mechanical systems. Variational problem related to functional maximum and minimum, principle of virtual work, d'Alembert's principle, Hamilton's principle, and principle of least action will be explained, and the application of Lagrange equation of motion to a practical mechanical problem will be described. In addition, practical examples of point mass system vibration and normal vibration will be given and explained.
[Course objectives] Students will come to understand variational problems related to functional maximums and minimums in engineering optimization problems, and use sample problems to learn d'Alembert's principle and the virtual work principle (which makes dynamics easier to understand.) In addition, they will gain an understanding of Hamilton's principle and the principle of least action, and at the same time, learn how to apply the Lagranigan equations of motion to specific dynamics problems, and learn about oscillations and oscillation modes in point mass systems.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to understand the Lagrangian equations of motion and use them to solve problems.	1, 2, 3	The end-of-term exam	20%
2	Be able to understand the derivation of the Lagrangian equations of motion and be able to derive them alone.	13, 14	The end-of-term exam	20%
3	Be able to understand calculus of variations and apply it to solve problems.	11, 12	The end-of-term exam	20%
4	Be able to understand vibration analysis of point mass systems and use it to solve problems.	6, 7	The end-of-term exam	20%
5	Be able to use vibration analysis to solve for various types of complex systems.	4, 5, 9, 10	The end-of-term exam	%

[Plans and Contents] This course will show students how to understand the principle of virtual work, variational problems related to maxima and minima, d'Alembert's principle, Hamilton's principle, and the principle of least action, and will show them to apply the Lagrangian equations of motion to specific dynamics problems. In addition, lectures will provide examples of oscillation and normal modes in point systems.
1. Coordinate transformations
2. Lagrange Equations 1
3. Lagrange Equations2
4. Motion based on binding conditions 1
5. Motion based on binding conditions 2
6. Vibrations 1
7. Vibrations 2
8. Seminar 1
9. Motion of rigid bodies 1
10. Motion of rigid bodies2
11. Calculus of variations 1
12. Calculus of variations2
13. Deriving the Lagrange Equations 1
14. Deriving the Lagrange Equations2
15. Seminars2
16. Final exam
[Keywords] Virtual work,Virtual displacement, Variational problem, d'Alembert's principle, Lagrange equation of motion
[Textbooks and Reference Books] K. Ito, Analytical Dynamics, Kodansha, 2009.
[Evaluation] Students will be assessed by the end-of-term exam.
[Related courses] Physics BI Intro to Dynamics, Physics BII Intro to Dynamics II, System Dynamics, Robotic Engineering

熱力学 ＩＩ　　Thermodynamics II
[Instructor] Yasuo Moriyoshi
[Credits] 2
[Semester] 2nd year-Fall-Wed2
[Course code] T1Q020001
[Room] Bldg. ENG-17-213
[Course enrollment] Enrollment limit 120(It is due to the capacity of Lecture Room)
[Candidate] Students of Faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course description] Basics and applications of one of the important industrial machine design skills of thermodynamics will be explained in continuation to the Thermodynamics I. Students will understand thermodynamic function, the relation between heat, work, and thermodynamic function changes, thermodynamic cycle of heat engine/refrigerator, phase equilibrium and thermodynamics, reaction and thermodynamics, and flow of steam and real gas.
[Course objectives] Students will understand basic principles of machines that use heat energy such as heat-engine, gas turbine, refrigerator, heat pump, and air conditioner, and learn the fundamentals required for appropriate use of such equipment's. In addition, students will increase their awareness of how such equipment's are being used in societies, and understand practical applications of thermodynamics, the essential requirements for the design and development of much industrial equipment.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Learn the fundamental knowledge of thermodynamics necessary to the functional design and development of thermal components (Mech A-2)	5,6,7,11,12,14	The end-of-term exam	25%
2	Be able to solve specific enthalpy, internal energy, entropy, and carnot cycle problems using the second law of thermodynamics. (Mech. B-3)	2,3,4	The end-of-term exam report	25%
3	Understand various gas cycle principles and be able to solve specific applied problems. (Mech. B-3)	5,6,7	The end-of-term exam report	25%
4	Understand steam properties and change in state and be able to solve specific applied problems. (Mech. B-3)	8,9,10,11,12, 13	The end-of-term exam report	25%

[Plans and Contents]
1. Introduction to applied thermodynamics and its importance.
2. Learn the basic thermodynamic principles of enthalpy, internal energy and entropy, and understand the value of specific applications.
3. Learn about Carnot cycles and the second law of thermodynamics, and understand the value of specific applications.4.
4. Discussion on the Otto and Diesel cycles, and understanding specific principles and applications.
5. Discussion on the Sabathe and Brayton cycles, and understanding specific principles and applications.
6. Discussion on the Ericsson and Stirling cycles, and understanding specific principles and applications.
7. Discussion on applied problems regarding various gas cycles, and understanding the reduction of environmental burden and the importance of safety in mechanical design.
8. Discussion on compressed liquid, saturated liquid, superheated steam, and gas-liquid-solid phase-changes, and understanding their application to design.
9. Gain an understanding of steam tables and diagrams, increase/decrease in heat due to steam state change, and moist air.
10. Gain an understanding of design applications using steam tables and diagrams, increase/decrease in heat due to steam state change, and moist air.
11. Discussion of the Rankine cycle, and understanding specific principles and applications.
12. Gain an understanding of the regenerative Rankine cycle, the Rankine cycle with reheat, and the regenerative Rankine cycle with reheat.
13. Discussion of freezing, refrigeration, and heat pumps, and understanding specific principles and applications.
14. Discussion of actual gas flow and its relationship to the speed of sound and internal nozzle flow, and their application to design.
15. Understand how material, temperature, and pressure changes due to chemical reactions during combustion, and learn how to predict post-combustion physical quantities.
16. The end-of-term exam
[Keywords] Heat management design, Environmental load and safety, Heat engine, Turbine, Refrigerator, Heat pump,
[Textbooks and Reference Books] Netsu-rikigaku by Toshio Saitoh and Hiroshi Ichimiya, Shokabo publisher
[Evaluation] Students will be assessed by the end-of-term examination (90%), and report writing (10%). The end-of-term examination will be based on 100 points for full marks, and the difficulty will be set at 60 points being equivalent to a level of achievement set forth in the subject target. To achieve a credit, a student must take the end-of-term examination and submit reports. A weighted average of the exam and reports must be greater than 60 points, and the score of the end-of-term examination must be greater than 50 points.

[Related courses] Thermodynamics I, Exercise in Thermodynamics, Engineering Heat Transfer
[Course requirements] Students are required to take Thermodynamics in principle.

材料力学 ＩＩ　　Mechanics and Strength of Materials II
[Instructor] Kenichi Kobayashi
[Credits] 2
[Semester] 2nd year-Fall-Thurs 2
[Course code]T1Q021001
[Room] Bldg. ENG- 17-113
[Course enrollment] 100
[Candidate] Students in sophomore class in the Department of Mechanical Engineering.
[Course description] Following the Mechanics of Materials I, students will learn the stress and deformation of beam and shaft under loading. Students will participate in advanced and more complex problems than the Mechanics and Strength of Materials I. In particular, students will study the resolution of problems of statically indeterminate beam, resolution of general problems using strain energy, Mohr's stress circle for increasing the principle stress, deformation under combined stress, compression of column and buckling of long column, as well as thin cylinder and thick cylinder stresses.
[Course objectives] Students will master the method to resolve problems of statically indeterminate beam using moment of area and differentiation, method to resolve problems of statically indeterminate beam using strain energy, and methods to handle continuous beam and curved beam. Students will also understand the relationship between the principle of buckling, buckling load, and the end condition, master the method to obtain the principle stress using Mohr's stress circle, and establish a comprehensive understanding of mechanics and strength of materials.
Students will understand Hooke's law under combined stress, and biaxial and triaxial stress states such as plane stress and plane strain conditions.
[Plans and Contents]
1. Explain solutions to statically indeterminate beam problems using differentiation and the superposition principle,

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Deepen understanding of content from Mechanics and Strength of Materials I; be able to solve statically indeterminate beam problems using differentiation and the superposition principle (B-3)	1	The end-of-term exam	10%
2	While gaining an understanding of strain energy, be able to solve statically indeterminate beam problems using the reciprocity theorem and Castigliano’s theorem. (B-3)	2,3,4	The end-of-term exam	20%
3	Understand the three moment equation for continuous beams, add the equations pertaining to restraint conditions for support points at either end, and be able to find the bending moment and reaction force at the support points and the deflection and other values of the continuous beam. (B-3)	5,6	The end-of-term exam	10%
4	Learn how to find the stress and deflection in a curving beam both considering and ignoring the axial force, and using Castigliano’s Theorem, be able to determine deflection and support reaction in statically indeterminate problems. (B-3)	7,8,9	The end-of-term exam	15%
5	Understand Hooke’s Law through stress components in thin-walled cylinders under internal pressure and the combined stresses on thick walls; understand the concepts of volumetric strain, plane stress, and plane strain. Moreover, understand Mohr’s stress circle and be able to use it to find nominal and shearing stress on a surface, and the principal stress and the principal shear stress. (B-3)	10,11	The end-of-term exam	15%
6	Be able to understand the stress components in thin-walled cylinders under internal pressure and stress distribution in thick-walled cylinders. (B-3)	12	The end-of-term exam	15%
7	Understand buckling and potential energy in long columns, bifurcation points, and slenderness ratios, and understand elastic buckling load differences due to end conditions, plastic buckling and buckling formulas. (B-3)	13,14,15	The end-of-term exam	15%

particularly with finding support reactions using the superposition principle. Necessary preparation: Have learned the material regarding beam bending from Mechanics and Strength of Materials I.
2. Strain Energy (I): Explain the concept of strain energy; give students an understanding of the formulas used to strain energy in tensile load, beam bending and axial torsion problems. Necessary preparation: Have read up on the basic principles of work and strain energy due to external forces using the internet and texts.
3.Strain Energy (II): Explain the reciprocity and Castigliano's theorems, particularly in regards to how to apply Castigliano's theorem to determine support reaction on statically indeterminate beams. Necessary preparation : Review material from part 2.
4.Strain Energy (III): Use virtual load to teach students how to determine deflection between points under a distributed load or points with no load. Give an understanding on Castigliano's theorem not only for statically indeterminate beams, but also its application to structures. Necessary preparation Review material from parts 1-3.
5.Continuous beams (I): Find three equation on moment for a continuous beam under a distributed load, grasp the shortfalls in the equations and derive the additional equations needed to account for the differences between support points, and then explain how to use all these equations to find bending moments and support reaction at the support points. Necessary preparation : Review material from parts 1-3.
6.Continuous beams (II): Find three equations on moment for a continuous beam under a concentrated load and under partly distributed loads, Grasp the shortfalls in the equations and derive the additional equations needed to account for the differences between support points, and then explain how to use all these equations to find bending moments and support reaction at the support points. Students will also study how to find support reactions, and learn about simultaneous superposition of both distributed and concentrated loads. Necessary preparation : Review material from part 5.
7. Curving Beams (I): How to think about finding section modulus and stress in curving beams considering axials forces, and for curving beams where axial forces do not need to be considered, learn how to find stress using a simplified equation. Necessary preparation Prepare by learning about curving beams from the text.
8.Curving Beams (II) : Gain an understanding of how to use integration to find deflection and bending moments for curving beams under axial forces and curving beams where axial forces can be ignored. Necessary preparation : Review material from class 7.
9.Curving Beams (III): Find strain energy in curving beams, understand how to apply Castigiliano's theorem to determine deflection and support reactions statically indeterminate problems. Necessary preparation : Review material from parts 1-4 and 7-8.
10. Combined Stress (I): Understand Hooke's law based on combined stresses (stress in two and three axes), and learn the concepts of volumetric strain, plane stress, and plane strain. Necessary preparation : Use the internet and textbooks to preview the differences between uniaxial and combined stress conditions.
11.Combined Stress (II) : Understand Mohr's stress circle and how to use it to determine principal and maximum/minimum principal sheer stresses. Furthermore, learn how to determine the nominal and sheering stress on a surface. Necessary preparation : Review material from class 10, and preview the relationship between combined stress conditions and principal stresses.
12. Thin- and Thick-walled Cylinders: Learn how to find stress components for thin-walled cylinders under internal pressure, and for thick-walled cylinders understand how to find stress components using equations of equilibrium and Hooke's Law. Necessary preparation : Review material from part11.
13. Buckling in Long Columns (I): Explain a concept of core for short columns, and provide an understanding of the relationship between potential energy and buckling, and teach how to find buckling load for column with two hinged ends. Necessary preparation: Use the Internet and textbooks to investigate the relationship between structural strength design and problems dealing with buckling.
14.Buckling in Long Columns (II): Understanding bifurcation points, slenderness ratio; learn how to determine buckling loads using four types of end conditions. Understand the concept of buckling length. Necessary preparation : Review material from part 13.
15.Buckling in Long Columns (III): Explain the relationship between buckling load and transformation of a long column under an eccentric load; learn thinking by Shanley and von Karman regarding plastic buckling, and a variety of empirical formulas for long column buckling and what they mean. Necessary preparation : Review material from parts 13and 14.
16. Final Exam: Examination on all required course content to evaluate overall level of attainment. Necessary preparation: Review material from entire course.
[Keywords] Strain energy, Continuous beam, Curving beam, Combined Stress, Mohr's stress circle, Buckling, Cylinder
[Textbooks and Reference Books] Textbook: Essential mechanics and strength of material (Ed. Nishimura, H., Maruzen), Reference book: Mechanics and strength of materials (Kato, M., Asakura), Handouts will be provided on a timely basis.
[Evaluation] Students get credits over 60 points (100 points for full marks). Students are able to refer to textbooks, note, and handed papers.
[Related courses] Mechanics and Strength of Materials1, Exercise of Mechanics of Materials
[Course requirements] Students are required to understand Mechanics and Strength of Materials I and may tale its exercise.

流体力学 Ⅰ　　Fluid Mechanics I
[Instructor] Fumihiko Mikami
[Credits] 2
[Semester] 2nd year-Fall-Mon3
[Course code] T1Q022001
[Room] Bldg. ENG- 17-214
[Course enrollment] Enrollment limit 100
[Candidate] Students of Faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course description] This course is aimed at the students of mechanical engineering and provides lectures on fluid mechanics.
Fluid mechanics deals with the mechanical behavior of liquids and gases. [First half] (1) The continuum viewpoint and the properties of fluid will be explained. (2) The pressure distribution in a gravitational field of static fluids will be explained using a vertical equilibrium of a fluid element, and application to pressure measurement will be described. (3) Explanation will be given on the basic terminologies of the basic principle and methodology of the fluid mechanics for describing the moving fluid. The involvement of deformation and rotation in the fluid motion will also be highlighted. [Second half] (1) Explanation will be given on the one-dimensional method of flow analysis, particularly highlighting the relationship with the mass conservation law, the momentum conservation law, and the law of energy conservation. (2) The Bernoulli equation, the momentum principle and their application on various problems of fluid mechanics will be highlighted. In addition to this course, more advanced topics will be provided in "Fluid Mechanics II", and "Thermo-Fluid Mechanics".
[Course objectives] Students aims to understand the basic concept of the fluid mechanics, and learn fluid properties, hydrostatics, the mass conservation law of one-dimensional flow, the momentum conservation law, Euler's equation of motion, and Bernoulli equation.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand the concept of continuum bodies, and be able to describe the mechanical properties of a fluid.	1, 2	The end-of-term exam	5%
2	Be able to find pressure distributions in a gravitational field of static liquids and gases using the equilibrium equations, and be able to calculate the force acting on a wall surface in a static fluid.	3, 4	The end-of-term exam	10%
3	Measure pressure from the height of a column of liquid, and understand how to measure static and total pressure.	3, 11	The end-of-term exam	10%
4	Be able to explain basic methods and basic terminology needed to describe flow and the classification of flows.	5	The end-of-term exam	5%
5	Understand the relationship that arise in velocity vector fields and rotations in fluid particles, and be able to explain eddies.	6, 7	The end-of-term exam	5%
6	Understand how to apply conservation laws in open systems, and be able to explain mass and momentum conservation in a one-dimensional flow.	8, 9	The end-of-term exam	5%
7	Understand the process behind deriving Bernoulli equation and which flows they are applicable to, and be able to explain the interpretation of each term of the Bernoulli equation.	10	The end-of-term exam	5%
8	Using Bernoulli equation and the momentum and angular momentum principles, be able to solve a variety of different fluid dynamics problems.	11,12,13,14,15	The end-of-term exam	55%

[Plans and Contents]
1. Fluid Properties 1: Defining a fluid, units, dimensions, density/specific gravity/specific volume, real substances and continuum hypothesis, viscosity
2. Fluid Properties 2: Shear rate, Newtonian fluids and non-Newtonian fluids, surface tension, compressibility, ideal gases
3. Pressure variation in static fluid and pressure measurements: Pressure and shear stress, pressure characteristics, vertical pressure distribution in a gravitational field of static fluids, measurement of static fluid pressure
4. Hydrostatic forces on walls: Pressure in a gas, hydrostatic forces acting on a plane wall, buoyancy, relative equilibrium state
5. Kinematics of fluid flow and flow classification: description of flow, stream lines/streak lines/path lines, temporal and spatial classification of flow, laminar and turbulent flow, Reynolds number, compressible and incompressible fluid
6. Deformation and rotation of fluid particles: How do deformation and rotation come from? Velocity gradient tensors, extension, simple shear
7. Rotation of fluid particles, vortices, and circulation: Rigid body rotation, vorticity and angular velocity, rotational and irrotational flows, examples of vortex motion, circulation
8. Continuity equations for one-dimensional flow: Laws of conservation, control volume, basic equations in a flow tube, law of conservation of mass and the continuity equation
9. Equations of motion for one-dimensional inviscid flow: law of conservation of momentum, types of forces that act on a control volume, Euler's equations of motion, accelerated motion of fluid
10. Bernoulli equation: Deriving Bernoulli equation, physical meaning of pressure energy, various forms of Bernoulli equation, dynamic and static pressure
11. Applications of Bernoulli Equation: Flow in pipes with area change, Venturi gauge, Pitot tubes, the exit jet from a circular orifice in a reservoir
12. Momentum principle and their application 1: Momentum integral in steady flows, fluid forces on curved pipes, pressure losses in an abrupt expansion pipe, hydraulic jumps
13. Momentum principle and their application 2: A jet incident on to a plane, jet propulsion and power efficiency, drag on a body in a uniform fluid
14. Momentum principle and their application 3: One-dimensional analysis of flow past a propellor (actuator disk model), propeller thrust, power, and efficiency
15. Angular momentum principle and its application: Angular momentum integral in a steady flow, torque acting on a curved pipe, impeller power (centrifugal pump), sprinkler revolution speed
16. Final exam
[Keywords] Viscosity, Compressibility, Surface tension, Pressure, Vortex, One-dimensional flow, Continuity equation, Euler's equation of motion, Bernoulli equation, Law of momentum, Law of angular momentum
[Textbooks and Reference Books] Textbook: Kenichi Ohba, Kiyoshi Bando: Fluid Mechanics –Phenomenon and Its Modeling-, (Corona Publishing Co., Ltd.), ISBN978-4-339-04581-9 Reference Books: Kazuyasu Matsuo: Introduction to fluid mechanics for mechanical engineers, (Rikogakusha Publishing Co., Ltd.), ISBN978-4-8445-2157-0, Hideo Ohashi, Fluid Mechanics (1), (Corona Publishing Co., Ltd.), ISBN978-4-339-04010-4, JSME Textbook Series Fluid Mechanics, (MARUZEN Co., Ltd.), ISBN978-4-88898-119-4
[Evaluation] Students will be assessed by end-of-term exam which is a full score of 100points.
The score must be greater than 60 points.
[Related courses] Physics BI Intro to Dynamics 1 (G17322102), Physics B II Intro to Dynamics 2 (G17322202), Industrial Mathematics I (T1Q011001), Seminars I, Fluid Dynamics Seminars I(T1Q027001), Fluid Dynamics II (T1Q032001), Thermo-Fluid Engineering (T1Q043001)
[Course requirements] Students must also take Fluid Mechanics I (T1Q027001).
[Remarks] This course will be evaluated upon the mechanical engineering course study & educational goals as laid out in "(B) Essential understanding of events and application of specialized knowledge" (B-3) and "(D) System design ability" (D-1).

基礎制御理論Ⅰ　Introduction to Control Theory, Part I
[Instructor] Akio Namiki
[Credits] 2
[Semester] 2nd year-Fall-Fri2
[Course code]T1Q023001
[Room] Bldg. ENG-17-113
[Candidate] Students of Faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course description] Lecture will also cover the basics of control theory. In particular, the lecture will concentrate on the basic classical control theory using Laplace transform, and the basics of modern control theory using state equations.
[Course objectives] By going through familiar examples of a control system, students will acquire the basic concept of the feedback control. In addition, students will understand the basics of theoretical techniques to find the model to express the control system, which will then be used to discover the method to analyze the characteristics of the control system.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand Laplace transformations and transfer functions, be able to use block diagrams.	2,3,5,6,7,8	The end-of-term exam	30%
2	Be able to use the state space model.	4,5,6	The end-of-term exam	20%
3	Understand and be able to use system time response.	9,10,1,112, 13	The end-of-term exam	30%
4	Understand and be able to use system frequency response.	14	The end-of-term exam	20%

[Plans and Contents]
1. A history of control theory and feedback control
2. Laplace transformation and inverse Laplace transformation
3. Transfer functions
4. State-space model
5. Transformation from transfer functions to state space models
6. Transformation from state space models to transfer functions
7. Basics of block diagrams
8. Conversion between block diagrams.
9. Poles and zeros
10. Primary response
11. Secondary response
12. Solutions of state equations
13. Characteristics of feedback control
14. Frequency response
15. Feedback control
16. Final exam

[Keywords] Laplace transform, transfer functions, state-space equations, block diagrams, poles and zeros, feedback control, frequency response.
[Textbooks and Reference Books] K. Nonami, Basics of Control Theory, Tokyo Denki University Press.
[Evaluation] Students will be assessed by the score of the end-of-term exam.

設計基礎論 Fundamentals of Machine Design
[Instructor] Takeshi Nakamoto
[Credits] 2
[Semester] 2nd year-Fall-Tues3
[Course code] T1Q024001 T1Q024001
[Room] Bldg. ENG-17-214
[Course enrollment] 80. Students will be given a problem several times, and to be returned as marked. Thus 80 students is the limit number in the class.
[Candidate] Only for students of Department of Mechanical Engineering
[Course description] The faculty will explain the relation of the mechanical systems and the machine elements for the mechanical design. This course will focus primarily on the machine elements of the mechanical design. The faculty will explain the roles of various elements in the machinery and their working principles. Particularly important elements such as screws, shafts, gears, and bearings, their mechanical, material mechanic, and kinematic meanings will be described, and simple methods to design these elements and ways to select from standardized items will be explained. The course leads to the "Basic Mechanical Drawing" offered in the following period.
[Course objectives] [General aim] To design machinery, students will understand roles of the machine component elements which structure the mechanical system. In addition, students will also understand how to select or design such elements.
[Target] is described in "targets of the subject" below.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to explain the meaning of standards and benchmarks, typical fastening machine element functions. (Mech B-3, Mech D1)	1,2,3	the end-of-term exam、assignment of report	10%
2	Be able to do the simple calculations that are necessary in mechanical design for tightening torque, bolt strength, etc. in high-use bolt/nut assemblies. (Mech B-3, Mech D1)	1,2,4,5,6	The end-of-term exam、assignment of report	30%
3	Be able to design power transmission shaft under simple load conditions. (Mech B-3, Mech D1)	1,2,7,8	The end-of-term exam、assignment of report	10%
4	Be able to do the simple calculations regarding transmission power, strength, dimensions, etc. of gears.(Mech B-3, Mech D1)	1,2,9,10,11	The end-of-term exam、assignment of report	20%
5	Understand guide elements, particularly the function of bearings, and be able to explain their function. Be able to calculate longevity in rolling bearings based on usage conditions, and be able to choose the appropriate bearing. Understand the principles behind sliding bearings. (Mech B-3, Mech D1)	1,2,11,12,13	The end-of-term exam、assignment of report	20%
6	Be able to explain the function of machine elements for motion control. (Mech B-3, Mech D1)	1,2,14	The end-of-term exam	10%

[Plans and Contents]
1. Think about what a machine is, and explain the modern definition of machinery. From machines with a few components to machines with millions of components, show that the method of building machines is the same.
2. Define the machine elements students will learn about during this course. Discuss basic standards in machine elements such as dimensional tolerance.
3. Explain tolerance. Give general overview of general fastening machine elements.
4. Discuss welding and adhesion coupling methods. Explain tightening torque for square slot screws.
5. Explain in equations how triangular slot screws are comparatively difficult to tighten and loosen in comparison to square slot screws. Discuss the necessary axial forces applied to screws to calculate torque.
6. Learn how to calculate the necessary tightening torque for two-piece bolt-nut assemblies. By introducing the internal force coefficient, understand changes in force within the bolt-nut assembly when external force is added.
7. Outline axles as one way to transmit motion and power.
8. Learn the basic calculation method needed to ensure an axle such as a general transmission or machine tool axle doesn’t break when torque is applied.
9. Outline the purposes for different types of gears that transmit motion and power.
10. Learn gear theory, and understand power transmission using involute gears. Explain the standardization of elements for involute gears.
11. Find the relationship between gear transmission power and gear strength, gain a general understanding of gear strength design methods.
12. Outline the basics of guide elements and corresponding elements. Outline the characteristics, use, and differences in operating principles between sliding and rolling bearings.
13. Explain the operating life of rolling bearings.

14. Understand how to calculate operating life of rolling bearings in order how to learn how to choose bearings based upon that information. Explain bearing modulus, Sommerfeld number, etc. for dynamic pressure bearings, and explain their characteristics.
15. Explain how to derive the Reynolds equation and reasons why bearing load can be maintained for dynamic pressure bearings. Comparison between sliding and rolling bearings. Outline the roles and operating principles of clutches and brakes as machine elements for motion control.
16. Final exam
[Keywords] Machine elements, Bolt, Shaft, Gear, Bearing, Tolerance, Fit
[Textbooks and Reference Books] Kikai Sekkei Kougaku 1 (Kaiteiban), Jyuuhachi Oda and Yoshisada Murotsu, Baifuukan
[Evaluation] Evaluation will be completed as laid out in [Course objectives]. The final exam will be worth 70% of the final mark and reports will be worth 30%. Students need to achieve a combined mark over 60% in the exam and reports to pass the course. To take the final exam, students must have three of fewer absences and must have submitted all reports. A 100% deduction will be applied every day for late reports, so the student's total mark will drop when reports are submitted late. However, in order to take the final exam all reports must still be submitted. It is necessary to strictly follow submission deadlines to avoid receiving a negative report mark, and in order to receive credit for the course. The final exam is designed to measure the student's level of mastery regarding the material. The reports will be used to increase understanding in areas where mastery is incomplete.
[Related courses] Mechanics of Materials I, Mechanics of Materials II, Fundamentals of Mechanical Drawing, Mechanical Drafting and Design, Kinematics of Machinery
[Course requirements] Students are recommended to have taken Mechanics of Materials I.
[Remarks] This subject is the target subject of the achievement evaluation for the specific achievement (B-1) related to "(B) essential understanding of events and practical application of expertise" and "(D) system design abilities" (the academic target of mechanical engineering courses). References for self-studies are not suggested. Students are advised to engage with report writing assignments. Answers will be provided upon return of submitted reports. Students are recommended to create study log consisting of notes of the blackboard writing, reports, and report feedbacks for revising. The mechanical engineering course also asks students to create a study portfolio. It is essential for students to review the position of the course and its learning in the perspective all other subjects.

計測基礎論　Fundamentals of Instrumentation
[Instructor] Akio Namiki
[Credits] 2
[Semester] 2nd year-Fall-Wed1
[Course code] T1Q025001
[Room] Bldg. ENG-17-112
[Candidate] Students of Faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course description] This course will provide lectures on basics of crucial instrument for the realization of a mechanical system, namely: knowledge of various measuring instruments and sensors, methods of handling measurement data and statistical processing, measurement standard, concept of precision assessment and improvement, and understanding of instrumentation system which extract the target information with sensitivity and accuracy. Lectures will highlight the general outline of such issues with occasional discussion on details of their mathematical principles.
[Course objectives] The aim of the course is for students to learn the fundamentals of measurements and signal processing, and acquire an ability to construct their own instrumentation system. Lectures will introduce varieties of instrumentation systems as examples, and students are advised to learn their common underlying principles and concepts.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Acquire the basic knowledge and learn how to use measuring systems.	1, 2	The end-of-term exam	20%
2	Acquire the basic knowledge and learn how to use data processing related to measurement.	3, 4, 5	The end-of-term exam	30%
3	Understand the mechanisms and use of measuring systems.	6-11	The end-of-term exam	30%
4	Learn about the operating principles and uses of various sensors, and be able to use them.	12-14	The end-of-term exam	20%

[Plans and Contents]
1. Measurement Basics I, Units and standards (SI units, calculations of physical quantities)
2. Measurement Basics II, Basic measurement methods (deflection method and null method)
3. Measurement and Data Processing I, Measurement errors (Origin of errors, statistically error management, measurement accuracy)
4. Measurement and Data Processing II, Statistical treatment of measurement errors (Significant digits, arithmetic average, error propagation)
5. Measurement and Data Processing III, Statistical treatment of measurement errors (Least-square method)
6. Measurement Systems I, Basic configuration of measurement systems
7. Measurement Systems II, Analog signal processing (operating amplifiers, analog processing circuits, analog filters)
8. Measurement Systems III, Digital signal processing (Sampling theorem, AD conversion)
9. Measurement Systems IV, Digital signal processing (Signal processing for random noise)
10. Measurement Systems V, Digital signal processing (Fast Fourier transforms)
11. Measurement Systems VI, Measurement system characteristics and system analysis
12. Sensors I (Mechanical sensors)
13. Sensors II (Electrical/electronic sensors)
14. Sensors III (Fluid sensors)
15. Sensors IV (Optical sensors)
16. End-of-term exam
[Keywords] Instrumentation engineering, Signal processing, Sensor engineering
[Textbooks and Reference Books] Minami, Kimura, Araki: Beginners' instrumentation engineering, Kodansha Ltd.
[Evaluation] Students will be assessed by the score of end-of-term exam.

工業数学 ＩＩ Applied Mathematics for Engineering II
[Instructor] Tomonori Watanabe
[Credits] 2
[Semester] 2nd year-Fall-Mon2
[Course code] T1Q026001
[Room] Bldg. ENG-17-113
[Course description] In this course, lectures will mainly explain the handling of functions of complex variable and partial differential equations, which are necessary mathematical tools for describing and understanding the physical phenomena.
[Course objectives] One of the advantages of mastering the complex function theory is the ability to easily calculate various definite integrals frequently used when learning specialist subjects. Meanwhile, when analyzing partial differential equation, it is necessary to master various mathematical tools and have a skillful command of such tools. To address this, this course not only offers a learning of functions of complex variable and partial differential equations, which are necessary mathematical tools for describing and understanding the physical phenomena, but also provides opportunities for studying several mathematical tools and methods along the way, which will be also effective for engineering applications. The aims and targets of the course are as follows.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand the characteristics of complex functions, and be able to use them in actual calculations.(B-1)	1, 2, 3, 4, 5, 6, 14, 15	The end-of-term exam	35%
2	Learn the solutions of second-order partial differential equations, and be able to solve them. (B-1)	7, 8, 9, 10, 11, 12, 13, 14, 15	The end-of-term exam	35%
3	（B-1）Master mathematics as an engineering analysis tool (B-1)	1, 2, 3, 4, 5, 6, 7, 8,9,10,11,12, 13, 14, 15	The end-of-term exam	30%
4				%

[Plans and Contents]
1.Complex numbers & functions and Regular Functions I (Basic arithmetic operations, Cauchy-Riemann equations) Necessary preparation: Go over the keywords.
2. Complex numbers & functions and Regular Functions I (Basic arithmetic operations, Cauchy-Riemann equations) Necessary preparation: Review and understand the previous lecture material.
3. Integration and Expansion of Complex functions I (Cauchy integral theorem, complex series, Laurent expansions, residue theorem) Necessary preparation: Review and understand the previous lecture material.
4. Integration and Expansion of Complex functions Ⅱ (Cauchy integral theorem, complex series, Laurent expansions, residue theorem) Necessary preparation: Review and understand the previous lecture material.
5. Integration and Expansion of Complex functions**III**(Cauchy integral theorem, complex series, Laurent expansions, residue theorem) Necessary preparation: Review and understand the previous lecture material.
6. Integration and Expansion of Complex functions IV(Cauchy integral theorem, complex series, Laurent expansions, residue theorem) Necessary preparation: Review and understand the previous lecture material.
7. Introduction to partial differential equations and characteristics of second-order partial differential equations I Necessary preparation: Go over the keywords.
8. Introduction to partial differential equations and characteristics of second-order partial differential equations II Necessary preparation: Go over the keywords.
9. Mathematical Apparatuses I (Ordinary differential equations, Fourier series, Fourier transformations, Laplace transformations, Delta function) Necessary preparation: Have taken industrial Mathematics I.
10. Mathematical Tools II (Ordinary differential equations, Fourier series, Fourier transformations, Laplace transformations, Delta function) Have taken industrial Mathematics I.
11. Solving Second-Order Partial Differential Equations I (wave equations, diffusion equations, Laplace's equation, Poisson's equation, Green's function) Necessary preparation: Understand solution methods.
12. Solving Second-Order Partial Differential Equations II (wave equations, diffusion equations, Laplace's equation, Poisson's equation, Green's function) Necessary preparation: Understand solution methods.
13. Solving Second-Order Partial Differential Equations III (wave equations, diffusion equations, Laplace's equation, Poisson's equation, Green's function) Necessary preparation: Understand solution methods.
14. Review I Necessary preparation: Review of lectures, particularly on complex function theory
15. Review II and non-linear partial differential equations (solutions to Burgers equation) Necessary preparation: Review of lectures, particularly regarding partial differentiation theory.
16. Final Exam:Lectures Necessary preparation: Review material from all lectures.

[Keywords] Cauchy–Riemann equations,holomorphic function, Cauchy integral theorem, Laurent series,Residue theorem,wave equations, diffusion equations, Laplace's equation, Poisson's equation, Burgers equation, Delta function, Fourier series, Fourier transformations, Laplace transformations,difference method
[Textbooks and Reference Books] Textbook is not used. Reference books will be introduced with the process of class on appropriate time.
[Evaluation] Conduct the final exams. As a principle, the standard criteria from the results of the final exams shall be a passing grade of at least 60 points. The submission of voluntary reports (optional) may also be considered as for evaluation. Note that, in the results of Industrial Mathematics ll, if the Standard Mathematics General exams of the year (linear algebra, calculus, ordinary differential equation) were to be taken, that performance may also be taken into account.
[Related courses] Linear Algebra B1, Linear Algebra B2, Calculus B1, Calculus B2, Differential Equations, Engineering Mathematics I [Course requirements] In principle, students should have completed Linear Algebra B1, Linear Algebra B2, Calculus B1, Calculus B2, Differential Equations, and Engineering Mathematics I.
[Remarks] This course is in line with mechanical course study & educational goals as laid out in "(B) Essential understanding of events and application of specialized knowledge" (B-3).

流体力学演習Ⅰ　Exercises in Fluid Mechanics I
[Instructor] Fumihiko Mikami
[Credits] 1
[Semester] 2nd year-Fall-Tues 1alternate week 1,3
[Course code] T1Q027001
[Room] Bldg. ENG- 17-113
[Course enrollment] 90
[Candidate] Students of Faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course description] This course is a seminar type targeted by the students of Mechanical Engineering. To be able to intensify the understanding of the contents of the lecture of Fluid Mechanics l, develop application and calculation skills.
[Course objectives] Ensure the understanding of the basic concept of fluid dynamics by solving exercises and acquire the skills of application and calculation.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to solve problems related to fluid characteristics such as viscosity, compressibility, surface tension, etc.	1	The end-of-term exam	10%
2	Be able to solve problems related to pressure distribution in a static fluid under gravitational force and measuring pressure.	2	The end-of-term exam	20%
3	Be able to solve problems related to force acting on a wall surface in a static fluid and buoyancy.	3	The end-of-term exam	10%
4	Be able to solve problems related to the basics of flow, including vortices, Reynolds number, etc.	4	The end-of-term exam	10%
5	Be able to solve problems through application of Bernoulli equation.	5	The end-of-term exam	20%
6	Be able to solve problems through application of the momentum equations.	6	The end-of-term exam	20%
7	Be able to solve problems through application of the angular momentum equations.	7	The end-of-term exam	10%

[Plans and Contents] Seven seminars will be held in line with the lectures of Fluid Dynamics I. Bring textbooks, notebook, and a scientific calculator.
1. Exercises on Fluid Characteristics
2. Exercises on Pressure Characteristics and Pressure Measurement
3. Exercises on Forces Acting on Walls and Buoyancy
4. Exercises on Vortices and Reynolds Number
5. Exercises on Application of Bernoulli Equation
6. Exercises on Application of Momentum Equations
7. Exercises on Application of Equations of Angular Momentum
8. The end-of-term exam
[Keywords] Viscosity, Compressibility, Surface tension, Pressure, Vortex, One-dimensional flow, Continuity equation, Euler's equation of motion, Bernoulli equation, Law of momentum, Law of angular momentum
[Textbooks and Reference Books] Textbook: Kenichi Ohba, Kiyoshi Bando: Fluid Mechanics –Phenomenon and Its Modeling-, (Corona Publishing Co., Ltd.), ISBN978-4-339-04581-9 Reference Books: Kazuyasu Matsuo: Introduction to fluid mechanics for mechanical engineers, (Rikogakusha Publishing Co., Ltd.), ISBN978-4-8445-2157-0, Hideo Ohashi, Fluid Mechanics (1), (Corona Publishing Co., Ltd.), ISBN978-4-339-04010-4, JSME Textbook Series Fluid Mechanics, (MARUZEN Co., Ltd.), ISBN978-4-88898-119-4
[Evaluation] To achieve credit, the score of the end-of-term exam must be greater than 60 points.
[Related courses] Fluid Mechanics I (T1Q022001)
[Course requirements] Students must also take Fluid Mechanics I (T1Q022001) ,or have already taken that course.
[Remarks] This course covers the following mechanical course learning & education objectives: "(B) Essential understanding of events and application of specialized knowledge" (B-3) and "(C) theoretical thinking" (C-1).

機械加工学　Mechanical Machining
[Instructor] Noboru Morita
[Credits] 2
[Semester] 3rd year-Spring-Wed3
[Course code] T1Q029001
[Room] Bldg. ENG- 17-112
[Course enrollment] 90
[Candidate] Non-Degree Student, 3rd and 4th year students of Department of Electronics and Mechanical Engineering, students in advanced science programs and other department, or faculties.
[Course description] The cutting is one of the most basic method / tool in machining. At first the student will study about the principle of the cutting process. Next the student will learn the methodology applied to the manufacturing of precision parts and study of fundamentals of various machining method.
[Course objectives] Learn about Historical changes in the role of cutting, basic mechanical machining, cutting theory, machinability of cutting, various cutting tools and cutting methods, cutting machine and about the application of theory to precision machining. The specified achievement target is according to the following.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Will be able to understand the mechanical Basics of machining, cutting theory of metal and cutting phenomenon.	1.2.3.4	Small test, interim exam	30%
2	Will be able to understand machinability in cutting (in form of chips, cutting force, cutting temperature, tool wear, and surface texture).	5,6,7,8 9	Small test, interim exam	25%
3	Will is able to understand the type of cutting method, various kinds of cutting machines, cutting tools.	9,10,11	Small test, the end-of-term exam	25%
4	The theory application of the precision parts of the machine processing can be learned.	12,13,14,15	Small test, the end-of-term exam	20%

[Plans and Contents]
1. The role and historical changes in machining, types of processing, and position of machining
2. Metal machining theory (1) Machining styles and chip form classification
3. Metal machining theory(2) Cutting dynamics and production mechanisms
4. Metal machining theory (3) Shear theory and shear strain, typical dynamic environment in machining
5. Metal machining theory(4) Cutting resistance and its causes, methods for analyzing and measuring cutting resistance
6. Metal machining theory(5) Cutting temperature and its causes, methods for analyzing and measuring cutting resistance.
7. The reality of machining and machinability (1) Chip types and processability.
8. Mid-term summary
9. The reality of machining and machinability (2) Cutting tool wear mechanisms and operating life, tool life test
10. The reality of machining and machinability (3) Finished surface texture and its causes, methods of evaluating finished surface texture.
11. The reality of machining and machinability (4) Application mechanisms and types of cutting fluid
12. Types of cutting (lathe process, Milling process, drilling process, broaching process) and each type of cutting tool
13. Cutting machinery structures and automatic production systems
14. Applied machine-processed precision part fabrication theory 1
15. Applied machine-processed precision part fabrication theory 2
16. Final exam
[Keywords] Cutting, Cutting tool, Cutting Machine, CIM/FMS/FA, Manufacturing system, Precision machining, Surface texture
[Textbooks and Reference Books] Kakougaku-kiso (1) Kiso-sessaku-kakougaku,Tadaaki Sugita, Kanji Ueda, Toyoshiro Inamura,Kyouritu-syuppan
[Evaluation] Evaluation will be completed as laid out in [Course objectives], with minor tests being worth 20% and mid-term and final tests worth 80% of the final mark. Students must have a combined mark of 60% or higher to pass.
[Related courses] Precision Machining, Plastic Dynamics, Plastic Machining, Mechanical Engineering Practical Training
[Remarks].This course will be evaluated upon the mechanical engineering course study & educational goals as laid out in “(B) Essential understanding of events and application of specialized knowledge” (B-3) and “(D) System design ability” (D-1).

機械工学実験　Experiment of Mechanical Engineering
[Instructor] Each teacher
[Credits] 6
[Semester] 3rd year Spring-Fall-Thurs3,4,5
[Course code] T1Q030001, T1Q030002, T1Q030003
[Room] Bldg. ENG- 15-110, Bldg. ENG- 17-214, Bldg. ENG- 17-215
[Course enrollment] As a general rule, only for students of Department of Mechanical Engineering
[Course description] Divide into teams of about 10 people each, conduct experiments every week or every 2 weeks, regarding the basic fundamentals in Mechanical Engineering, collect the data, organize, discuss and summarize in report. With regards to the report, conduct the lecture and if there are any insufficient points indicate them, make the corrections and submit again.
[Course objectives] Intensify the student's understanding on what the student has learned in the lecture about the specialized subjects by actually seeing with the student's own eyes and trying to touch them with their hands, and from now on, the things that the student will be learning would give them the objective of acquiring prior knowledge. Then, it is also an important goal to learn experimental techniques and how to report and summarize experimental results. By taking this course, in-depth knowledge of fundamentals in mechanical engineering can be obtained, and the student can also learn the method of machine design and research.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Systematic experiments will be undertaken and IT utilized to gather, organize and summarize data, and students will be able to write an experiment report. (B-2,B-4,E-2,F-2)	Every Week	Report	60%
2	Be able to develop a text using correct theory. Be able to clearly express own opinion. Be able to support own opinion using documents and/or concrete examples. Be able to come up with unique ideas.(E-2)	Every Week	Report	40%

[Plans and Contents]
[Fundamental Experiment], [Experiment Assignment 1 - Heat-Treating Metal], [Experiment Assignment 2 - Long column buckling and bending], [Experiment Assignment 3 - Tensile Test], [Experiment Assignment 4 - Fluid Flow],[Experiment Assignment 5 - Engines and Heat Transfer], [Experiment Assignment 6 - Viscosity and Friction],[Experiment Assignment 7 – Vibration],[Experiment Assignment 8 – Interfaces],[Experiment Assignment 9 – Control]
1. Guidance and how to write the report
2. Fundamental Experiment
3. Choose one from Experiment Assignments 1-9
4. Choose one from Experiment Assignments 1-9
5. Choose one from Experiment Assignments 1-9
6. Choose one from Experiment Assignments 1-9
7. Choose one from Experiment Assignments 1-9
8. Choose one from Experiment Assignments 1-9
9. Choose one from Experiment Assignments 1-9
10. Choose one from Experiment Assignments 1-9
11. Choose one from Experiment Assignments 1-9
12. Choose one from Experiment Assignments 1-9
13. Choose one from Experiment Assignments 1-9
14. Choose one from Experiment Assignments 1-9
15. Choose one from Experiment Assignments 1-9
16. Choose one from Experiment Assignments 1-9
17. Choose one from Experiment Assignments 1-9
18. Choose one from Experiment Assignments 1-9
19. Choose one from Experiment Assignments 1-9
20. Choose one from Experiment Assignments 1-9
21. Choose one from Experiment Assignments 1-9
22. Choose one from Experiment Assignments 1-9
23. Choose one from Experiment Assignments 1-9
24. Choose one from Experiment Assignments 1-9
25. Choose one from Experiment Assignments 1-9
26. Choose one from Experiment Assignments 1-9
27. Choose one from Experiment Assignments 1-9
28. Choose one from Experiment Assignments 1-9
29. Choose one from Experiment Assignments 1-9
30. Choose one from Experiment Assignments 1-9
[Textbooks and Reference Books] Handouts in the guidance and Experiment book downloaded in Chiba University moodle

[Evaluation] Evaluation shall be based on the manner of experimenting and experiment report. Perform all the assigned experiments including those basic experiments and a unit can be obtained if there is a passing score of at least 60% in all of the reports. Report can be re-submitted after the lecture. Those with unfinished preparations for study, tardiness and delayed submission of reports will be subjected to reduction of points.
[Related courses] All specialized course
[Remarks] This course is covered by educational goals as laid out in "(B) Essential understanding of events and application of specialized knowledge" (B-2) and (B-4), "(E) Self-Expression" (E-2), and "(F) Flexible thinking and Systematic Approach" (F-2).

機械製図基礎　Fundamentals of Mechanical Drawing
[Instructor] Takeshi Nakamoto
[Credits] 2 Credits
[Semester] 3rd year-Spring-Fri4,5
[Course code]T1Q031001, T1Q031002
[Room] Bldg. ENG- 17-112
[Course enrollment] 45
[Candidate] Only 3rd years and 4th year of Department of Mechanical Engineering.
[Course description] There will be explanations on the relevant standards and rule of mechanical drawing and Basis of projection. Full explanations on the Fundamentals of the 3rd Angle Projection, students learn part drawing of the law drafting assembly drawing through training. Explanation on the caution of designing the equipment, students will learn the basic operation of drafting instruments and drawing a simple line using the CAD and drafting machine.
[Course objectives] To learn about the basics of projection and JIS standards related to mechanical drawing. Then the student will also learn the concept in the design of mechanical products, by using CAD drawing and drafting machine assembly drawing figures and their parts, and learn the basic operation of the machine and CAD drafting.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to understand solid objects and drawings projected onto 2D paper through Assignment 1: Drawings from Objects, Assignment 2: Objects from Drawings and Assignment 3: Flange Drawings. (MechC-1, MechD-1)	1,2,3,4,5,6	Drawing	20%
2	Be able to do basic dimensioning while learning technical drawing standards and be able to draw the most basic of mechanical elements, the screw, through Assignment 4: Bolt Drawing. (MechC-1, MechD-1)	1,2,3,4,5,6, 7,8	Drawing	20%
3	Be able to draw an assembly drawing through Assignment 5: Clutch Drawing. (MechC-1,Mech D-1)	1,2,3,4,5,9, 10, 11	Drawing	20%
4	Be able to introduce simple design changes through Assignment 6: Bearing Drawing. (MechC-1, Mech D-1)	1,2,3,4,5,12,13, 14,15	Drawing	20%
5	Understand the concept of CAD through CAD: Gear Drawing, and CAD: Emblem, and be able to make basic drawings using CAD. (MechC-1, Mech D-1)	6,7,8,9, 10, 11,12,13,14,15	Drawing	20%

[Plans and Contents]
1. The purpose of mechanical drawings, explanation of design drawings: how to draw projections and fabrication drawings. Discuss what the course will cover in regards to other related courses, and the purpose and scope of the course. Explanation of points students attending this class must know (i.e. all assignments must be submitted and even if all assignments are submitted credit may not be earned.) After discussing these points, discuss purpose of drafting and design in the work flow from industrial product planning and preparation to fabrication. Teach students the importance of reducing environmental burden and being conscious of safety in mechanical design.
2. Explain mechanical drawing (line thickness, projection, and third-angle projection). Practical Drawing “Assignment 1: Drawings from Objects”: Learn projection in order to show 3D objects on 2D surfaces. Explain the Japanese Industrial Standard third angle projection method used in mechanical drawing, and then draw a 2D three-view drawing from a 3D solid figure diagram in Assignment 1: Drawings from Objects.
3. Explain mechanical drawing (Basic sectioning methods, isometric projection). Practical Drawing “Assignment 2: Objects from Drawings”: Continuing from last class, explanation of third angle projection, useful sectioning methods, and the basics of sectioning. Next, explain isometric projection in order to draw a solid figure diagram, and then draw a 3D solid figure from a three-view drawing in “Assignment “: Objects from Drawings.”
4. Explain mechanical drawing (Sectioning method applications, abbreviations, methods of checking). Checking drawings from Assignments 1 & 2: Continuing on from last class, explain the application of sectioning methods. Next, explain methods for checking drawings made by students, then students work together to check drawings from Assignments 1 and 2.
5. Explain mechanical drawing (Dimensioning methods). Practical Drawing “Assignment 3: Flange Drawings”: Explain methods of dimensioning for component dimensions within a drawing. After this explanation, do “Assignment 3: Flange Drawings.” Do this assignment using the methods explained thus far; third angle projection, sectioning methods, and dimension methods.
6. Explain bolt drawing, CAD, and drawing instruments (drafters). Practical Drawing “Assignment 4: Bolt Drawing”: after explaining Assignment 4, students will be split into two groups, and one group will be taught how to use drawing instruments before doing “Assignment 4: Bolt Drawing”. The other group will receive an explanation on CAD utilization methods, and will do Practical Drawing using what they learn. Review of course material thus far with the goal of acquiring greater proficiency in the mechanical drawings from the assignments. The bolt drawing will be completed using a drawing tool. In the bolt drawing, by drawing the most basic of mechanical components, the screw, students will learn technical drawing standards and surface roughness, and will be given an explanation of methods of indicating surface texture. Discuss how indicating a surface texture that is smoother than necessary can result in wasteful fabrication.

7. CAD Practical Training Explain CAD “Gear Drawing”. CAD Practical Drawing “Assignment 4: Bolt Drawing”: Explain Gear Drawings. Each group from the previous class will learn the material the other group learned in class 6.
8. Practical Drawing “Assignment 4: Bolt Drawing”, CAD “Gear Drawing”: The class will be split into two parts and all student will do both Assignment 4 and the CAD drawing, one during each part of the class.
9. Practical Drawing “Assignment 5: Clutch Drawing”, CAD “Gear Drawing”: After explaining jaw clutches, the class time will be split into two groups as in the previous class. One group will do “Assignment 5: Clutch Drawing” and the other group will do CAD “Gear Drawing”. For the clutch drawing, students will add assembly drawings to their knowledge of mechanical drawings. Explain tolerance, and discuss how indicating a higher tolerance than necessary can result in wasteful fabrication
10. Explain CAD “Emblem”, Practical Drawing “Assignment 5: Clutch Drawing”, CAD “Gear Drawing”: Create an emblem using CAD, and discuss wire electric discharge machine practical training that will take place during the Mechatronics course in semester 4. The previous groups will now switch and each will learn the material the other group learning in class 9.
11. Practical Drawing “Assignment 5: Clutch Drawing”. CAD “Gear Drawing”: The class will be split into two parts and all student will do both Assignment 5 and the CAD drawing, one during each part of the class.
12. Practical Drawing “Assignment 6: Bearing Drawing”. CAD “Emblem”: “Explain Assignment 6: Bearing Drawing”. Students using drawings tools to complete Assignment 6 will do so in the drafting room. Students drawing Assignment 6 using CAD will do so in the CAD room.
13. Practical Drawing “Assignment 6: Bearing Drawing”. CAD “Emblem” Continuing from the previous class, students will be completing Assignment 6: Bearing Drawing or CAD “Emblem”.
14. Practical Drawing “Assignment 6: Bearing Drawing”. CAD “Emblem” Continuing from the previous class, students will be completing Assignment 6: Bearing Drawing or CAD “Emblem”.
15. Practical Drawing: Assignment Return: Practical drawing assignments from the previous classes will be returned as appropriate. Assignments not yet returned will be returned during this class, responses will be checked, and hints will be given for any points that remain unclear.
[Keywords] Japanese Industrial Standards, Mechanical drawing, Third-angle system, CAD
[Textbooks and Reference Books] JIS Mechanical Drawing (New Edition), Takeo Yoshizawa, Morikita Publishing Co. Ltd.
[Evaluation] The evaluation method is according to what is shown in [Objectives/ Goals]. Absence of 4 times would result in the disqualification of the students. Even if absence is below 3 times, 5 points would be deducted for every absence. In order to obtain a unit, submission of all drafting assignments is required. After the 1st submission of the drafting assignments, teachers shall encode the corrections in draft. The students will re-submit a revised drawing based on the corrections. The final grade shall be based on the re-submitted draft. Incompletion and delayed submission of the drawing will result to 10% equivalent of deduction from each of the assignments. The graded drawing shall be appropriately returned. For the evaluation criteria, at 60% overall would be the passing grade.
[Related courses] Machinery Kinematics, Fundamental Design Theory, Mechanical Design Drawing, Mechanical Engineering Practical Training
[Course requirements] Students have preferably taken Fundamentals of Machine Design.
[Remarks] This course covers the specific mechanical engineering learning educational goals as laid out in “(C) Theoretical Thinking” (C-1) and “(D) System Design Ability” (D-1).

機械設計製図　Machine Design and Drawing
[Instructor] Hirofumi Hidai, Tatsuo Ohmori
[Credits] 2
[Semester] 3rd year-Fall-Fri4, 5
[Course code] T1Q039003, T1Q039004
[Room] Bldg. ENG- 17-215
[Course enrollment] 40
[Candidate] Department of Mechanical Engineering
[Course description] Design a simple machine as a basis for each subject of fundamentals of mechanical drawing, mechanics of materials, fundamentals of machine design, steel materials, such as the machine kinematics that the student has already mastered and then lecture on the completion method of the parts drawing and assembly illustration. Explains the fundamental method of design through comprehensive gear pump and manual winding winch. Because the specification given to each student is different (load and lift hoist), it is important that the design to satisfy the specification should be the student's own design and idea.
[Course objectives] A Technique to realize as a drawing after the analysis and verification from initiative, mechanism, strength, economy, environment, etc., and other aspects required for the design of the machine. In this lecture, the student will learn the rudimentary techniques of mechanical design, the gear pump and hand winding winch being set as an example. In other words, the design considered in the condition that is actually used in mechanical components and apparatus forking of mechanism, gear, shaft, bearings and other sliding hoist can be taken in consideration. In addition, the student will learn the method of basic considerations in the design and mechanical interference between the mechanical parts, operability, and weight.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Grasp design thought through an understanding of the basic concepts behind design problems, and learn how to reflect those ideas in design drawings. Also, understand the most important structures for power transmission, conversion and force in machinery, create actual applications through real design that considers safety and environmental burden. (Mech B-1, Mech C-1, Mech D1)	1, 2, 3, 11	account of specifications, component drawings	20%
2	Learn how to apply problem solution learned in material mechanics to the design of machine elements under actual conditions through axle and bearing design. Also, be able to design axle related elements. (Mech B-1, Mech C-1, Mech D1).	1, 2, 3, 4, 13	account of specifications, component drawings	15%
3	Understand braking mechanism as an essential element for output motion control in machinery, be able to design brakes suitable to output. (Mech B-1, Mech C-1, Mech D1)	1, 2, 3, 4, 5, 6	account of specifications, component drawings	15%
4	Be able to adjust designs based upon whether the systematic structure of the entire machine and the coordination between components meet basic specifications, upon review of inter-component interference, and based upon the results of that review through creation of an overall design. (Mech B-1, Mech C-1, Mech D1)	1, 2, 3, 4, 5, 6,12	overall design drawing	20%
5	Be able to create technical drawings of designed components. (Mech C-1, Mech D1)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,12, 13, 14, 15	Drawing	30%

[Plans and Contents]
1. The purpose of mechanical design, explanation of hand winches: discuss of what this class will cover in regards to other related courses, and the purpose and scope of the course. Discuss how not only efficiency, economic efficiency, and functionality are important in mechanical design, reduction of environmental burden and consideration of safety is also important. Actual issues will be explained. Wire rope selection and winding drum design seminar – "Assignment 1: Wire rope and winding drum design": Through selecting wire rope, learn the workplace safety regulations and understand that mechanical design must conform to societal norms. Regarding winding drums, explain the calculations based on winding load and lifting height and how to determine specifications.
2. Gear design 1, design seminar – "Assignment 2: Gear design and gear configuration drawings": Explain reduction ratio, tooth number proportion and the methods of determining basic spur gear particulars. Also, discuss related strength design methods.

3. Gear design 2, design seminar – “Assignment 2: Gear design and gear configuration drawings”. How to draw gear configuration drawings, and explanation of methods of confirming the existence of interference between gears and winding drums. Also, methods of handling interference.
4. Design seminar “Assignment 3: Axle and bearing design”: Discussion on types of axles needed for basic specifications. Strength calculations considering support methods and load measurement for each axle, and how to determine shaft diameter.
5. Brake mechanism design, design seminar “Assignment 4: Brake mechanism design and Schematics”: How to calculate the brake elements to control axle torque, and explanation on how to design brake-related components. Explanation of mechanical design considering safety using the safety ratio of rivet joints. Outline of assembly drawing, and discussion of how to confirm the existence of other forms of interference.
6. Design seminar “Assignment 5: Creating overall design drawing”: Explanation on how to create an overall design drawing that shows the configuration of all the major components. Discussion on how to confirm the existence of interference between each component, satisfaction of design specifications, operability, etc.
7. Design seminar “Assignment 6: Handle shafts, handle shaft gear drawing”: Creating technical drawings based in results of calculation using CAD (Until class 10)
8. Design seminar “Assignment 7: Intermediate axis, intermediate axle main gear technical drawing”
9. Design seminar “Assignment 8: Winding drum gear technical drawing”
10. Design seminar “Assignment 9: Winding drum technical drawing”, submit edited calculation statement, component drawings, and overall design drawing.
11. Gear pump design 1 – Explain the mechanism of gear pumps, explanation of design policy “Assignment 10: Gear pump design”.
12. Gear pumps design 2. Gear pump design “Assignment 11: Gear pump design drawing” Create a design drawing showing the designed gear pump components, check for interference.
13. Gear pump design 3
Explanation of methods of calculating strength of drive axles. Creating technical drawings using CAD. (Until class 15) “Assignment 13: Gear and drive axle technical drawings.”
14. Technical drawing seminar “Assignment 14: Drive cover technical drawing”
15. Technical drawing seminar “Assignment15. Ear case technical drawing”
[Keywords] Machine Design and Drawing, hand winches, Gear pump, CAD
[Textbooks and Reference Books] “Textbook of Mechanical design drafting Manual Winch”, Takuo Nagamachi, CORONA Publishing CO.LTD, ”New edition JIS Mechanical Drawing”, Takeo Yoshizawa, MORIKITA Publishing CO.LTD
[Evaluation] To be able to take the final evaluation for all the design and draft exercises problems required to be submitted. The person in charge of the class shall check each submitted problem and make call outs on those errors then return the submitted problem. The student shall correct the errors based on the call outs and then re-submit the drafts.
The final grading shall be done in accordance with the table shown in the goals and objects. The passing criteria shall be 60% at least of the overall points.
[Related courses] Mechanics of Materials I , Machine Kinematics,Fundamentals of Machine Design, Steel materials, Fundamentals of Mechanical Drawing.
[Course requirements] Students must have made the grade of Fundamentals of Mechanical Drawing. Also Students have preferably taken Mechanics of Materials I, Machine Kinematics, Fundamentals of Machine Design, Steel materials.
[Remarks] This course covers the following mechanical course learning & education objectives: “(B) Essential understanding of events and application of specialized knowledge” (B-3), “(C) theoretical thinking” (C-1), and “(D) System design ability” (D-1).

流体力学 ＩＩ　Fluid Mechanics II
[Instructors] Hao Liu, Masanori Ota
[Credits] 2
[Semester] 3rd year-Spring-Tues3
[Course code] T1Q032001
[Room] Bldg. ENG-17-214
[Teaching Methods] Lectures
[Course enrollment] 100
[Candidate] Students of Faculty of Engineering, other Faculties, Specially Registered Non-Degree Student, 3rd year Students of Mechanical Engineering and Frontier Science program, and those from other Departments and schools who are permitted specifically.
[Course description] Description and basic equations of fluid phenomena, Stream function and velocity potential of ideal fluid, Characteristics of laminar and turbulent flows, Example of the analytical solutions to the Navier-Stokes equations, Basis of boundary layer theories, and the fundamentals of fluid mechanics shall be systematically taught.
[Purposes and Objective] The students will have a basic understanding of fluid phenomena involving mathematical description of governing equations and analytical theories as well as their applications in engineering. In particular, the lectures provide examples of simple analytical solutions regarding typical basic equations, and the students will be able to explain the fundamentals of fluid dynamics such as hydrodynamic velocity potential and stream function, vortex and circulation, laminar and turbulent flows, boundary layer and drag forces.

	Objectives of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Inviscid ideal fluids: vorticity → rot V =O (Velocity vector V) I.E. zero-vorticity flow = potential flow. Understand the fundamentals of simple flows with basic functions and inviscid flows around a cylinder. (B-3)	1,2,3,4	Interim exam, the end-of-term exam	20,10%
2	Introduce the concept of circulation around a body (circumference integration of velocity); understand that elliptical wings and other lift characteristics can be determined using a circulation-based lift on a plane with the functional relationships between cylindrical planes. (B-3)	5,6,7,8	Interim exam, the end-of-term exam	20,10%
3	Through some typical solutions to the Navier-Stokes equations, understand mathematical descriptions of fluid phenomena, analysis of basic governing equations and physical phenomena. (B-3)	9,10,11	The end-of-term exam	20%
4	Understand the concept of boundary layer and drag forces on a body and the fundamentals of boundary layer theories. (B-3)	12,13, 14,15	The end-of-term exam	20%

[Plans and Contents]
Inviscid ideal fluids – potential flow: flow around a cylinder, flow around a corner, circulation (circumference integration of velocity), determining lift on a surface using the function relationships between planes in a cylinder, lift characteristics of elliptical wings, friction coefficient, drag coefficient. Viscous fluid: Reynolds number, laminar flows and turbulence, low Reynolds number flow. Navier-Stokes equations, flow between parallel plates, Couette flow, flow within a pipe (Poiseuille flow), boundary layer, separation, examples of Karman's vortices.
1. Outline of mathematical descriptions of fluid phenomena and basic analysis of governing equation. Basic concepts of potential flows - vorticity: rot V = 0 (velocity vector V)
2. Complex potential, velocity potential, and complex velocity to understand basic flows such as uniform flows, diagonal uniform flow using simple functions.
3. Basic concepts of Welling, absorption, and vortices.
4. Flows around a cylinder (Superposition of potential solutions) a corner, and rotating cylinders.
5. Introduction to circulation (circumference integration of velocity) and calculation methods of fluid forces for a purpose of engineering applications.
6. Forces on a body surface: Blasius' theorem through complex potential and the Kutta condition.
7. Lift on a rotating cylinder, Biot-Savart Law and lift characteristics on an elliptical wing, and lift & drag coefficients.
8. Mid-term exam
9. Basic concepts of Newtonian fluids, Navier-Stokes equations, and Reynolds number.
10. Introduction to solutions to the Navier-Stokes equations of viscous flows between parallel plates.
11. Relationship between flow velocity and wall shear stress associated with the solutions to the Navier-Stokes equations.
12. Viscous flow in a pipe (Poiseuille flow), Rayleigh flow, and flows induced by an oscillating plane.
13. Introduction to boundary layer phenomena around a body and a basis of boundary layer theories.
14. Fundamental analytical methods on boundary layers around flat plats, cylinders and spheres.

15. Flow separation around a cylinder and Karman vortices, as well as their relationship with lift & drag forces acting on a body; an introduction to turbulent flows.
16. End-of-term exam
[Keywords] Reynolds number, laminar flow, turbulent flow, boundary layer, flow separation, resistance, potential flow, vorticity

[Evaluation] Evaluation will be given by interim exam(40%) and the end-of-term exam (60%) which will be totally 100 points. To achieve a credit, a total score must be over 60 points.
[Related courses] Fluid Mechanics I, Practices in Fluid Mechanics I, II
[Requirements for registration] Students have preferably taken Fluid Mechanics I, and Fluid Mechanics II

塑性力学　Mechanics of plasticity
[Instructor] Hideo Koyama
[Credits] 2
[Semester] 3rd year-Spring-Mon 3
[Course code] T1Q034001
[Room] Bldg. ENG- 17-112
[Course enrollment] 100
[Candidate] Students of Faculty of Engineering, and Specially Registered Non-Degree Student
[Course description] The lecture will focus on the basic idea of yield conditions from a variety of simple deformation regarding the dynamics necessary for plasticity during the forming process of the design and material of the machine. Then, there will also be a lecture on the application of theory on how to design and manufacture a product that is around the student as much as possible.
[Course objectives] During the forming process of materials and mechanical design, in many cases, a large plastic deformation is to be considered, to those involved in the development and research design of the machine, making full use of the understanding of plastic dynamics is important. Therefore, in this lecture, the student will understand the mechanical properties in the range of plastic deformation of the material, learn the basic solution of the problem for a variety of plastic deformation behavior, and aim to acquire the basic academic skills that can deal with advance deployment by learning the theory concerning further plastic deformation.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to theoretically explain mechanical properties in regions with plastic deformation.	1, 2	Interim exam	10%
2	Be able to solve basic statically-indeterminate problems related to tension and compression, which lie at the core of plastic deformation behavior.	3, 4	Interim exam	10%
3	With tension and compression deformation as a basis, be able to theoretically explain bending deformation	5, 6, 7	Interim exam	15%
4	With shear deformation as a basis, be able to theoretically explain torsional deformation.	7, 9, 10	Interim exam	15%
5	Be able to explain initial conditions for which plastic deformation begins.	11, 12, 13	The end-of-term exam	20%
6	Be able to explain the characteristics of various yield criteria.	12, 13, 14, 16	The end-of-term exam	20%
7	Be able to explain the important points to remember when using plastic deformation in actual industrial product fabrication.	1, 2,5, 7, 11, 16	The end-of-term exam	10%

[Plans and Contents]
1. Overview of the definition of plastic and the standpoint of plastic dynamics.
2. Basic of tensile and compressive stress and strain, yield stress, work-hardening, approximation of stress-strain curve, deformation work, residual stress.
3. Simple statically-indeterminate problems (1); Balancing conditions and strain compatibility conditions, elastic loading path and elasto-plastic loading path.
4. Simple statically-indeterminate problems (2); Plastic loading paths and extreme states, unloading process.
5. Fundamental thinking behind bending deformation, uniform bending, bending moment, neutral axes, plastic region development.
6. Simple support beam bending, residual strain, and spring back when a neutral axis moves in a bending beam.
7. Similarities between bending deformation and shear deformation, basis of shear deformation and torsional deformation, torsion in thin-walled pipes.
8. Mid-term exam (Date may change).
9. Mid-term exam evaluation and commentary. Torsion in a solid cylinder.
10. Deformation work from torsion, the Bauschinger effect.
11. Initial conditions of plastic deformation, description of stress and torsion components in plastic deformation.
12. Maximum shearing stress theory (Tresca's criterion).
13. Octahedral shear stress theory (von Mises's criterion).
14. Yield surface and π-planes under tri-axial stress, equivalent stress, strain velocity, total strain theory and incremental strain theory.
15. Final exam.
16. Final exam commentary. Application of theory of plasticity in processing.

[Keywords] Plastic deformation, Elastic deformation, Dynamics, Material working, Yield criterion
[Textbooks and Reference Books] “Kaitei Kogyo Soei Rikigaku”; M. Masuda & T. Murota, Yo-Ken-Do (in Japanese).
[Evaluation] To achieve a credit, total score of interim exam and end-of-term exam must be over 60%.
[Related courses] Mechanics of Materials I (T1Q012001), Mechanics of Materials II(T1Q021001), Plastic working (T1Q042001)
[Course requirements] Students must take Mechanics of Materials I/II.
[Remarks] This course is evaluated under mechanical engineering learning objective “F- Flexible thinking and systematic approach.”

伝熱工学　Engineering Heat Transfer
[Instructor] Masanori Ota
[Credits] 2
[Semester] 3rd year-Spring-Mon4
[Course code] T1Q035001
[Room] Bldg. ENG- 17-213
[Course enrollment] Enrollment limit 80
[Candidate] Students of Faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course description] This lecture is about the analysis and understanding of the thermal performance of heat distribution and heat transfer of the Industrial Machinery and of engineering fundamentals of heat transfer in the thermal design of the machine.
[Course objectives] To be able to explain the physical meaning of fundamental equations, understanding the key terms and basic concepts of Heat conduction, convective heat transfer and radiant heat transfer and thermal radiation that are the Basic Items of Heat Transfer Engineering. In addition, the student will be able to calculate the basic heat conduction problem, convective heat transfer problem, and the radiation heat transfer problem.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand and be able to explain the fundamental concepts of heat-transfer engineering, and the meaning of important terminology.	1,2,3,6,9,10, 13,14	Interim exam，the end-of-term exam	10%
2	Understanding the meaning of the fundamental points of heat transfer, and be able to solve basic questions to calculate temperature distribution, heat flux distribution.	3,4,5	Interim exam	30%
3	Understand the fundamental meaning of heat transfer in heat exchangers, and be able to calculate thermal transmittance and heat exchange amount through basic questions.	6,7	Interim exam	10%
4	Understand the fundamental points regarding convective heat transfer, and be able to calculate heat transfer coefficient, heat transfer amount and heat transfer surface temperature through basic questions.	9,10,11,12	The end-of-term exam	30%
5	Understand the fundamental points of heat emission and radiant heat transfer, and be able to calculate configuration factors and heat transfer amount through basic questions.	13,14	The end-of-term exam	20%

[Plans and Contents] Lectures will be structured around classes dealing with “the role of heat transfer engineering,” “heat transfer”, “heat transfer by convection”, “heat emission and radiant heat transfer,” and the mid-term and final exams. Explanations will be given on the fundamental concepts of heat transfer engineering and the meaning of important terms, and on how to derive the basic equations and their physical meaning. Also, the course will provide explanations on methods of solving basic heat conduction problems, convection heat transfer problems, and radiant heat transfer problems. Evaluation will be based upon the results of the mid-term and final exams.
1. Explain the thermal engineering knowledge necessary for thermal design of industrial equipment using heat-transfer engineering application examples. In addition, students will be given an understanding of the characteristics of and differences between the three types of heat transmission: heat conduction, heat convection, and radiation.
2. Heat conduction-1 -The fundamental parts of heat conduction: thermal fields, heat flux, Fourier’s law and thermal conductivity.
3. Heat conduction-2 -How to derive the basic heat equation and what it physical means. Next, applying the heat equation to the most basic “parallel plate 1-D steady state heat conduction” problem, and understanding how to find temperature distribution and how to use Fourier’s law to find heat flux distribution.
4. Heat conduction-3 -Apply the heat equation to solving 1-D steady state heat conduction problem for a cylindrical column and inside a sphere, and understand how to find temperature distribution in cylindrical columns and spheres. In addition, understand how to use Fourier’s law to find heat flux distribution.
5. Heat conduction-4 -Understand non-steady state heat conduction phenomena and how to mathematically calculate 1-D non-steady state heat conduction between parallel plates.
6. Heat exchange -1 - Understand the important thinking behind overall heat transfer to understand heat transfer in heat exchangers. Also, how to find thermal ratio in a heat exchanger and heat medium temperature distribution within heat exchangers.
7. Heat exchange-2 -Understand the important thinking behind overall heat transfer to understand heat transfer in a heat exchanger. Also, how to find thermal ratio in a heat exchanger and heat medium temperature distribution within heat exchangers.
8. Mid-term exam

9. Convective heat transfer -1 - Understand the fundamental points of convective heat transfer (velocity boundary layers, thermal boundary layers, forced convection, natural convection, average heat transfer rate, local heat transfer rate) and the important dimensionless numbers that govern heat convection (Reynolds number, Prandtl number, Nusselt number).
10. Convective heat transfer-2 -How to derive the fundamental equations for calculating forced convection, the boundary layer equations (mass conservation equation, momentum conservation equation, energy conservation equation) And examples of boundary layer equation analysis.
11. Convective heat transfer-3 -. Understanding the experimental use of the correlation equations to find forced convection heat transfer rate and natural convection heat transfer rate, and finding them experimentally through dimensional analysis.
12. Convective heat transfer-4 -Understanding the experimental use of the correlation equations to find forced convection heat transfer rate and natural convection heat transfer rate, and finding them experimentally through dimensional analysis.
13.Heat emission and radiant heat transfer -1 -Understanding the concept of radiant heat transfer concepts, and the fundamental laws of heat radiation (Planck's law, Wien's law, Stefan-Boltzmann law, Kirchhoff's law), and the fundamental points of heat emission (black-body radiation, gray-body radiation, matter emissivity/absorption/reflectivity).
14. Heat emission and radiant heat transfer-2 -Explanation of Lambert's law, radiative strength, view factor and calculating radiant heat transfer between two simple black bodies.
15. Heat-transfer phenomenon due to phase-change, and use of heat-transfer engineering in industry, space applications, etc.
16. Final exams
[Keywords] thermal design, thermal conduction, convective heat transfer, heat emission and radiant heat transfer, heat exchanger
[Textbooks and Reference Books] J.P. Holman, "Heat Transfer", 7th ed., McGraw-Hill, 1990.
[Evaluation] Evaluation shall be by attendance/exercises, mid-term exams (50%) and final exams (50%). Points for mid-term exams and final exams shall be 100 points each. In order to obtain a unit, it is necessary that the weighted average of the two tests is at least 60 points.
[Remarks] A credit transfer system with Chiba Institute of Technology

数値計算法 Numerical Computation
[Instructor] Masahiro Takei
[Credits] 2
[Semester] 3rd year-Spring-Tues5
[Course code] T1Q036001
[Room] Bldg. ENG- 17-113
[Course enrollment] 90
[Candidate] Students of Faculty of Engineering, and other Faculties
[Course objectives] Describes the numerical method of the formulas that appear in the field of algebra and elementary analysis primarily. If the student attempts to find a specific numerical in these formulas manually calculated as mathematical formulas, calculation would be so enormous making it impossible. An efficient and fast algorithm has been devised from long ago than using the mathematical formula. In addition to the classical algorithm, new algorithm is described as computer-oriented.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Confirmation of basic numerical computation	1	The end-of-term exam	2%
2	Understanding algorithm of non-linear equation	2,3	The end-of-term exam	14%
3	Understanding algorithm of coalition linear equation	4,5,6	The end-of-term exam	14%
4	Understanding algorithm of eigenvalue	7	The end-of-term exam small test	14%
5	Understanding algorithm of function approximation	8,9	The end-of-term exam small test	14%
6	Understanding algorithm of numerical value integral calculus	10,11	The end-of-term exam	14%
7	Understanding algorithm of differential equation	12,13,14	The end-of-term exam	14%
8	Understanding algorithm of partial differential equation	15	The end-of-term exam	14%

[Plans and Contents]
1. Fundaments of numerical computation
2. Non-linear equations 1
3. Non-linear equations 2
4. Systems of first-order equations 1
5. Systems of first-order equations 2
6. Systems of first-order equations 3
7. Eigenvalues
8. Function approximations 1
9. Function approximations 2
10. Numerical integration 1
11. Numerical integration 2
12. Differential equations 1
13. Differential equations 2
14. Differential equations 3
15. Partial differential equations
16. Exams

[Keywords] Numerical computation, Differential calculus, Integral calculus, Differential equation, Linear algebra
[Textbooks and Reference Books] Tetsuya Kawamura [Introduction to Numerical Computation] Saiensu-Sha Co.Ltd. Computer Science Library 17
[Evaluation] Report on assignment problems as indicated during class
[Course requirements] Students have preferably Information Processing.

機械設計製図 Machine Design and Drawing
[Instructor] Noboru Morita, Souta Mstsusaka
[Credits] 2
[Semester] 3rd year-Fall-Wed 4, 5
[Course code] T1Q039001, T1Q039002
[Room] Bldg. ENG-17-215
[Course enrollment] 40
[Candidate] Department of Mechanical Engineering
[Course description] Design a simple machine as a basis for each subject of fundamentals of mechanical drawing, mechanics of materials, fundamentals of machine design, steel materials, such as the machine kinematics that the student has already mastered and then lecture on the completion method of the parts drawing and assembly illustration. Explains the fundamental method of design through comprehensive gear pump and manual winding winch. Because the specification given to each student is different (load and lift hoist), it is important that the design to satisfy the specification should be the student's own design and idea.
[Course objectives] A Technique to realize as a drawing after the analysis and verification from initiative, mechanism, strength, economy, environment, etc., and other aspects required for the design of the machine. In this lecture, the student will learn the rudimentary techniques of mechanical design, the gear pump and hand winding winch being set as an example. In other words, the design considered in the condition that is actually used in mechanical components and apparatus forking of mechanism, gear, shaft, bearings and other sliding hoist can be taken in consideration. In addition, the student will learn the method of basic considerations in the design and mechanical interference between the mechanical parts, operability, and weight.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Grasp design thought through an understanding of the basic concepts behind design problems, and learn how to reflect those ideas in design drawings. Also, understand the most important structures for power transmission, conversion and force in machinery, create actual applications through real design that considers safety and environmental burden. (Mech B-1, Mech C-1, Mech D1)	1, 2, 3, 11	account of specifications, component drawings	20%
2	Learn how to apply problem solution learned in material mechanics to the design of machine elements under actual conditions through axle and bearing design. Also, be able to design axle related elements. (Mech B-1, Mech C-1, Mech D1).	1, 2, 3, 4, 13	account of specifications, component drawings	15%
3	Understand braking mechanism as an essential element for output motion control in machinery, be able to design brakes suitable to output. (Mech B-1, Mech C-1, Mech D1)	1, 2, 3, 4, 5, 6	account of specifications, component drawings	15%
4	Be able to adjust designs based upon whether the systematic structure of the entire machine and the coordination between components meet basic specifications, upon review of inter-component interference, and based upon the results of that review through creation of an overall design. (Mech B-1, Mech C-1, Mech D1)	1, 2, 3, 4, 5, 6, 12	overall design drawing	20%
5	Be able to create technical drawings of designed components. (Mech C-1, Mech D1)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,12, 13, 14, 15	Drawing	30%

[Plans and Contents]
1. The purpose of mechanical design, explanation of hand winches: discuss of what this class will cover in regards to other related courses, and the purpose and scope of the course. Discuss how not only efficiency, economic efficiency, and functionality are important in mechanical design, reduction of environmental burden and consideration of safety is also important. Actual issues will be explained. Wire rope selection and winding drum design seminar – "Assignment 1: Wire rope and winding drum design": Through selecting wire rope, learn the workplace safety regulations and understand that mechanical design must conform to societal norms. Regarding winding drums, explain the calculations based on winding load and lifting height and how to determine specifications.
2. Gear design 1, design seminar – "Assignment 2: Gear design and gear configuration drawings": Explain reduction ratio, tooth number proportion and the methods of determining basic spur gear particulars. Also, discuss related strength design methods.

3. Gear design 2, design seminar – “Assignment 2: Gear design and gear configuration drawings”.How to draw gear configuration drawings, and explanation of methods of confirming the existence of interference between gears and winding drums. Also, methods of handling interference.
4. Design seminar “Assignment 3: Axle and bearing design”: Discussion on types of axles needed for basic specifications. Strength calculations considering support methods and load measurement for each axle, and how to determine shaft diameter.
5. Brake mechanism design, design seminar “Assignment 4: Brake mechanism design and Schematics”: How to calculate the brake elements to control axle torque, and explanation on how to design brake-related components. Explanation of mechanical design considering safety using the safety ratio of rivet joints. Outline of assembly drawing, and discussion of how to confirm the existence of other forms of interference.
6. Design seminar “Assignment 5: Creating overall design drawing”: Explanation on how to create an overall design drawing that shows the configuration of all the major components. Discussion on how to confirm the existence of interference between each component, satisfaction of design specifications, operability, etc.
7. Design seminar “Assignment 6: Handle shafts, handle shaft gear drawing”: Creating technical drawings based in results of calculation using CAD (Until class 10)
8. Design seminar “Assignment 7: Intermediate axis, intermediate axle main gear technical drawing”
9. Design seminar “Assignment 8: Winding drum gear technical drawing”
10. Design seminar “Assignment 9: Winding drum technical drawing”, submit edited calculation statement, component drawings, and overall design drawing.
11. Gear pump design 1 – Explain the mechanism of gear pumps, explanation of design policy “Assignment 10: Gear pump design”.
12. Gear pumps design 2. Gear pump design “Assignment 11: Gear pump design drawing” Create a design drawing showing the designed gear pump components, check for interference.
13. Gear pump design 3
Explanation of methods of calculating strength of drive axles. Creating technical drawings using CAD. (Until class 15) “Assignment 13: Gear and drive axle technical drawings.”
14. Technical drawing seminar “Assignment 14: Drive cover technical drawing”
15. Technical drawing seminar “Assignment15. Ear case technical drawing”
[Keywords] Machine Design and Drawing, hand winches, Gear pump, CAD
[Textbooks and Reference Books] “Textbook of Mechanical design drafting Manual Winch”, Takuo Nagamachi, CORONA Publishing CO.LTD, ”New edition JIS Mechanical Drawing”, Takeo Yoshizawa, MORIKITA Publishing CO.LTD
[Evaluation] To be able to take the final evaluation for all the design and draft exercises problems required to be submitted. The person in charge of the class shall check each submitted problem and make call outs on those errors then return the submitted problem. The student shall correct the errors based on the call outs and then re-submit the drafts.
The final grading shall be done in accordance with the table shown in the goals and objects. The passing criteria shall be 60% at least of the overall points.
[Related courses] Mechanics of Materials I, Machine Kinematics,Fundamentals of Machine Design, Steel materials, Fundamentals of Mechanical Drawing.
[Course requirements] Students must have made the grade of Fundamentals of Mechanical Drawing. Also Students have preferably taken Mechanics of Materials I, Machine Kinematics,Fundamentals of Machine Design, Steel materials.
[Remarks] This course covers the following mechanical course learning & education objectives: “(B) Essential understanding of events and application of specialized knowledge” (B-3), “(C) theoretical thinking” (C-1), and “(D) System design ability” (D-1).

機械設計製図　Machine Design and Drawing
[Instructor] Hirofumi Hidai, Tatsuo Ohmori
[Credits] 2
[Semester] 3rd year-Fall-Fri4, 5
[Course code] T1Q039003, T1Q039004
[Room] Bldg. ENG-17-215
[Course enrollment] 40
[Candidate] Department of Mechanical Engineering
[Course description] Design a simple machine as a basis for each subject of fundamentals of mechanical drawing, mechanics of materials, fundamentals of machine design, steel materials, such as the machine kinematics that the student has already mastered and then lecture on the completion method of the parts drawing and assembly illustration. Explains the fundamental method of design through comprehensive gear pump and manual winding winch. Because the specification given to each student is different (load and lift hoist), it is important that the design to satisfy the specification should be the student's own design and idea.
[Course objectives] A Technique to realize as a drawing after the analysis and verification from initiative, mechanism, strength, economy, environment, etc., and other aspects required for the design of the machine. In this lecture, the student will learn the rudimentary techniques of mechanical design, the gear pump and hand winding winch being set as an example. In other words, the design considered in the condition that is actually used in mechanical components and apparatus forking of mechanism, gear, shaft, bearings and other sliding hoist can be taken in consideration. In addition, the student will learn the method of basic considerations in the design and mechanical interference between the mechanical parts, operability, and weight.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Grasp design thought through an understanding of the basic concepts behind design problems, and learn how to reflect those ideas in design drawings. Also, understand the most important structures for power transmission, conversion and force in machinery, create actual applications through real design that considers safety and environmental burden. (Mech B-1, Mech C-1, Mech D1)	1,2,3,11	account of specifications, component drawings	20%
2	Learn how to apply problem solution learned in material mechanics to the design of machine elements under actual conditions through axle and bearing design. Also, be able to design axle related elements. (Mech B-1, Mech C-1, Mech D1).	1,2,3,4,13	account of specifications, component drawings	15%
3	Understand braking mechanism as an essential element for output motion control in machinery, be able to design brakes suitable to output. (Mech B-1, Mech C-1, Mech D1)	1, 2, 3, 4, 5, 6	account of specifications, component drawings	15%
4	Be able to adjust designs based upon whether the systematic structure of the entire machine and the coordination between components meet basic specifications, upon review of inter-component interference, and based upon the results of that review through creation of an overall design. (Mech B-1, Mech C-1, Mech D1)	1, 2, 3, 4, 5, 6, 12	overall design drawing	20%
5	Be able to create technical drawings of designed components. (Mech C-1, Mech D1)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,12, 13, 14, 15	Drawing	30%

[Plans and Contents]
1. The purpose of mechanical design, explanation of hand winches: discuss of what this class will cover in regards to other related courses, and the purpose and scope of the course. Discuss how not only efficiency, economic efficiency, and functionality are important in mechanical design, reduction of environmental burden and consideration of safety is also important. Actual issues will be explained. Wire rope selection and winding drum design seminar – "Assignment 1: Wire rope and winding drum design": Through selecting wire rope, learn the workplace safety regulations and understand that mechanical design must conform to societal norms. Regarding winding drums, explain the calculations based on winding load and lifting height and how to determine specifications.
2. Gear design 1, design seminar – "Assignment 2: Gear design and gear configuration drawings": Explain reduction ratio, tooth number proportion and the methods of determining basic spur gear particulars. Also, discuss related strength design methods.

3. Gear design 2, design seminar – “Assignment 2: Gear design and gear configuration drawings”. How to draw gear configuration drawings, and explanation of methods of confirming the existence of interference between gears and winding drums. Also, methods of handling interference.
4. Design seminar “Assignment 3: Axle and bearing design”: Discussion on types of axles needed for basic specifications. Strength calculations considering support methods and load measurement for each axle, and how to determine shaft diameter.
5. Brake mechanism design, design seminar “Assignment 4: Brake mechanism design and Schematics”: How to calculate the brake elements to control axle torque, and explanation on how to design brake-related components. Explanation of mechanical design considering safety using the safety ratio of rivet joints. Outline of assembly drawing, and discussion of how to confirm the existence of other forms of interference.
6. Design seminar “Assignment 5: Creating overall design drawing”: Explanation on how to create an overall design drawing that shows the configuration of all the major components. Discussion on how to confirm the existence of interference between each component, satisfaction of design specifications, operability, etc.
7. Design seminar “Assignment 6: Handle shafts, handle shaft gear drawing”: Creating technical drawings based in results of calculation using CAD (Until class 10)
8. Design seminar “Assignment 7: Intermediate axis, intermediate axle main gear technical drawing”
9. Design seminar “Assignment 8: Winding drum gear technical drawing”
10. Design seminar “Assignment 9: Winding drum technical drawing”, submit edited calculation statement, component drawings, and overall design drawing.
11. Gear pump design 1 – Explain the mechanism of gear pumps, explanation of design policy “Assignment 10: Gear pump design”.
12. Gear pumps design 2. Gear pump design “Assignment 11: Gear pump design drawing” Create a design drawing showing the designed gear pump components, check for interference.
13. Gear pump design 3
Explanation of methods of calculating strength of drive axles. Creating technical drawings using CAD. (Until class 15) “Assignment 13: Gear and drive axle technical drawings.”
14. Technical drawing seminar “Assignment 14: Drive cover technical drawing”
15. Technical drawing seminar “Assignment15. Ear case technical drawing”
[Keywords] Machine Design and Drawing, hand winches, Gear pump,CAD
[Textbooks and Reference Books] “Textbook of Mechanical design drafting Manual Winch”, Takuo Nagamachi, CORONA Publishing CO.LTD, ”New edition JIS Mechanical Drawing”, Takeo Yoshizawa, MORIKITA Publishing CO.LTD
[Evaluation] To be able to take the final evaluation for all the design and draft exercises problems required to be submitted. The person in charge of the class shall check each submitted problem and make call outs on those errors then return the submitted problem. The student shall correct the errors based on the call outs and then re-submit the drafts.
The final grading shall be done in accordance with the table shown in the goals and objects. The passing criteria shall be 60% at least of the overall points.
[Related courses] Mechanics of Materials I, Machine Kinematics, Fundamentals of Machine Design, Steel materials, Fundamentals of Mechanical Drawing.
[Course requirements] Students must have made the grade of Fundamentals of Mechanical Drawing. Also Students have preferably taken Mechanics of Materials I, Machine Kinematics, Fundamentals of Machine Design, Steel materials.
[Remarks] This course covers the following mechanical course learning & education objectives: “(B) Essential understanding of events and application of specialized knowledge” (B-3), “(C) theoretical thinking” (C-1), and “(D) System design ability” (D-1).

機械工学実習　Practical Training in Machining
[Instructor] Each teacher
[Credits] 2
[Semester] 3rd year-Fall-Wed 4,5
[Course code] T1Q040001, T1Q040002
[Room] Mechanical Practice Workshop
[Course enrollment] 40
[Candidate] 3rd year of Department of Mechanical Engineering
[Course description] Develop an awareness of safety in machine operation of various processing methods as well as experience in the field. But the lecture is irregular with a training factory move this year.
[Course objectives] Actually experience the production technology and processing technology which is the fundamentals of manufacturing, learn various methods of workmanship, understand the step of processing things and develop the "engineer sense" in production design and production planning.
[Plans and Contents] There are round objects, objects on the plane, and the shape of complex objects such as machine parts. Processing of round objects using a lathe, finish grinding in order to further improve the accuracy of the plane and the plane machining by milling, and experience working with complex shapes, such as electrical discharge machining. In addition, the student can also try their hand at gas welding and electric welding for bonding the mechanical parts. In these processes, because the automatic machines with the Numerical control (NC) are increased, NC programming will also be studied.
The following example shows a case wherein it starts from Lathe training,
1.Lathing Work class 1: Safety explanation, normal lathe structure, operating instructions and basic operations. Making a single-flower vase – machining external diameter, machining ends, drilling, threading (taps).
2.Lathing Work class 2: Making a single-flower vase – machining external diameter, machining ends, stepping, slotting, drilling, threading (dies)
3.Lathing Work class 3 :Making a single-flower vase (Finishing work) machining external diameter, taper turning, stepping, slotting.
4.Milling machines 1: Explanation of machine operations, immobilizing material, attaching tools, cutting, measuring dimensions, scribing.
5.Milling machines 2: Immobilizing material, attaching tools, cutting, measuring dimensions.
6.Milling machines 3: Immobilizing material, attaching tools, cutting, measuring dimensions beveling, file finishing.
7.Machining center class 1: Outline of features and mechanisms of NC machining, demonstrations with actual machines, learning NC programming and seminar. Explanation of the free Assignment "Plate with original design," free assignment design proposal.
8.Machining center class 2: Learning NC programming and seminar, explanation how to make program to create piece for free assignment, manual programming for the free assignment.
9.Machining center class 3: Check the free assignment program using CAM software, use the machining center and make the book for the free assignment piece.
10.Welding 1: Oxyacetylene gas welding (steel plate welding).
11.Welding 2: AC arc welding (Steel plate downhand welding).
12.Welding 3: TIG welding (Aluminum, stainless downhand welding), MAG welding (steel plate downhand welding).
13.Electric discharge machining 1: The principles and history of electric discharge machining, video outline of electric discharge machining, edit assignment data with CAD/CAM and forming NC programs, network transfer of NC data.
14.Electric discharge machining 2: Die-sinking electric discharge machining – explanation of die machining, outline of die-sinking electric discharge machines, work layout, control system operation, setting processing conditions, programming, processing.
15.Electric discharge machining 3 Explanation of wire electric discharge machine, explanation of control system operations, work fixing and layout, setting processing conditions, processing, review, report.
16.Summary Exam: Simple exam will cover safety-related items and points about each processing method.
[Keywords] Manufacturing, Machining, Machine Operation, Metal Materials, Machine Elements, Mechanics of Materials, Design and Drafting.
[Textbooks and Reference Books] Textbook; Machining start from elementary - Master firm foundation: K. Hirata, Nikkan-Kogyo-Shinbun-Shya (in Japanese) . Separately, prints will be distributed.
[Evaluation] Evaluated based upon state of completion of item fabricated during practical training, procedures used during fabrication, operating report, assignment report, and exam.
[Related courses] Fundamentals of Machine Drawing
[Course requirements] Students must have taken Fundamentals of Mechanical Drawing
[Remarks] There will be guidance during the summer holidays, and safe training will be conducted. (Dates posted separately) In order to produce the actual underlying problem of the CAD drawing performed by the machine, should be completed and data must be created. In addition, in order to work safely and prevent personal injury, work clothes and shoes (purchased specified) are to be worn during working hours and carefully focus on the student's actions.

機械工学実習　Practical Training in Machining
[Instructor] Each teacher
[Credits] 2
[Semester] 3rd year-Fall-Fri 4, 5
[Course code] T1Q040003, T1Q040004
[Room] Mechanical Practice Workshop
[Course enrollment] 40
[Candidate] 3rd year of Department of Mechanical Engineering
[Course description] Develop an awareness of safety in machine operation of various processing methods as well as experience in the field. But the lecture is irregular with a training factory move this year.
[Course objectives] Actually experience the production technology and processing technology which is the fundamentals of manufacturing, learn various methods of workmanship, understand the step of processing things and develop the "engineer sense" in production design and production planning.
[Plans and Contents] There are round objects, objects on the plane, and the shape of complex objects such as machine parts. Processing of round objects using a lathe, finish grinding in order to further improve the accuracy of the plane and the plane machining by milling, and experience working with complex shapes, such as electrical discharge machining. In addition, the student can also try their hand at gas welding and electric welding for bonding the mechanical parts. In these processes, because the automatic machines with the Numerical control (NC) are increased, NC programming will also be studied.
The following example shows a case wherein it starts from Lathe training,
1. Lathing Work class 1:　Safety explanation, normal lathe structure, operating instructions, basic operations. Making a single-flower vase – machining external diameter, machining ends, drilling, threading (taps).
2. Lathing Work class 2:　Making a single-flower vase – machining external diameter, machining ends, stepping, slotting, drilling, threading (dies)
3.Lathing Work class 3 :　Making a single-flower vase (Finishing work) machining external diameter, taper turning, stepping, slotting.
4. Milling machines 1: Explanation of machine operations, immobilizing material, attaching tools, cutting, measuring dimensions, scribing.
5. Milling machines 2: Immobilizing material, attaching tools, cutting, measuring dimensions.
6. Milling machines 3: Immobilizing material, attaching tools, cutting, measuring dimensions beveling, file finishing.
7. Machining center class 1: Outline of features and mechanisms of NC machining, demonstrations with actual machines, learning NC programming and seminar. Explanation of the free Assignment "Plate with original design," free assignment design proposal.
8. Machining center class 2: Learning NC programming and seminar, explanation how to make program to create piece for free assignment, manual programming for the free assignment.
9. Machining center class 3: Check the free assignment program using CAM software, use the machining center and make the book for the free assignment piece.
10. Welding 1: Oxyacetylene gas welding (steel plate welding).
11. Welding 2: AC arc welding (Steel plate down hand welding).
12. Welding 3: TIG welding (Aluminum, stainless down hand welding), MAG welding (steel plate down hand welding).
13. Electric discharge machining 1: The principles and history of electric discharge machining, video outline of electric discharge machining, edit assignment data with CAD/CAM and forming NC programs, network transfer of NC data.
14. Electric discharge machining 2: Die-sinking electric discharge machining – explanation of die machining, outline of die-sinking electric discharge machines, work layout, control system operation, setting processing conditions, programming, processing.
15. Electric discharge machining 3 Explanation of wire electric discharge machine, explanation of control system operations, work fixing and layout, setting processing conditions, processing, review, report.
16. Summary Exam: Simple exam will cover safety-related items and points about each processing method.
[Keywords] Manufacturing, Machining, Machine Operation, Metal Materials, Machine Elements, Mechanics of Materials, Design and Drafting.
[Textbooks and Reference Books] Textbook; Machining start from elementary - Master firm foundation: K. Hirata, Nikkan-Kogyo-Shinbun-Shya (in Japanese) Separately, prints will be distributed.
[Evaluation]　Evaluated based upon state of completion of item fabricated during practical training, procedures used during fabrication, operating report, assignment report, and exam.
[Related courses] Fundamentals of Machine Drawing
[Course requirements] Students must take Fundamentals of Mechanical Drawing
[Remarks] There will be guidance during the summer holidays, and safe training will be conducted.　(Dates posted separately) In order to produce the actual underlying problem of the CAD drawing performed by the machine, should be completed and data must be created.　In addition, in order to work safely and prevent personal injury, work clothes and shoes (purchased specified) are to be worn during working hours and carefully focus on the student's actions.

塑性加工　　Plastic working
[Instructor] Hideo Koyama
[Credits] 2
[Semester] 3rd year-Fall-Mon3
[Course code] T1Q042001
[Room] Bldg. ENG- 9-107
[Course enrollment] 60
[Candidate] Students of Faculty of Engineering, and Specially Registered Non-Degree Student
[Course description] By giving the material deformation to form the desired product, the role and characteristics of plastic working will be outlined. Describes the nature of the material properties first, and then describes the characteristics of various processing. The lecture will be explained while showing a forming process of the actual product as possible, so that they know the difference between plastic working and other processing.
[Course objectives] In addition to understanding the deformation behavior and characteristics of the material, the student will also learn the examples of actual processing features of each processing method together with the deformation properties of the material. Finally, this lecture aims for a broad knowledge on developments of production method for new products.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to explain the roles and characteristics of processing methods using plastic deformation in industrial products as a whole.	1, 2, 3	Interim exam	10%
2	Be able to theoretically explain material improvement due to plastic deformation.	1, 2, 3	Interim exam	10%
3	Be able to explain various forming methods utilizing plastic deformation	4, 5, 6, 7	Interim exam	20%
4	Organize and understand various secondary forming operation types and characteristics.	9, 10, 11, 12, 13, 14, 15	The end-of-term exam	40%
5	Gain knowledge of existing processes, and new cutting edge processes.	11, 12, 13, 14, 15	Report	20%

[Plans and Contents]
1. Role and characteristics of plastic working – Learn about the role and characteristics of plastic working processes, which play a very large, necessary role in industrial products, and the classification, history and development of various plastic working methods.
2. Material structure and mechanical properties – Review structure and mechanical properties, metal crystal plasticity and heat treatment of materials used in plastic working, and gain an understanding of the necessary mechanical concepts and mechanical analysis.
3. Material transformation due to plastic deformation and its uses – Plastic working can essentially be defined as the improvement of material quality through plastic deformation, but students will also learn material improvement through cold working, thermo-mechanical treatment, residual stress, and composites.
4. [Forming fabrication] Plate rolling, rolling theory – Learn plate rolling deformation mechanics, pressure distribution in rolled material, and simple rolling theory, and understand the fundaments of rolling.
5. [Forming fabrication] Rolling machine types and regulation – Learn about the various machinery used in rolling, about deformation of rolling machine exposed to high temperatures and pressures, and about overall methods of control.
6. [Forming fabrication] Shape rolling, groove rolling, hot tube rolling – Learn about pipe material fabrication, groove rolling and universal rolling as examples of shape rolling.
7. [Forming fabrication] Extrusion & drawing – Learn about extrusion and drawing as typical methods of fabricating shaped material, lines and bars, and learn about the mechanical way of thinking and new technologies.
8. Mid-term exam – The mid-term will test the material learn in the previous classes. The date of the exam is subject to change.
9. [Secondary fabrication: Blocks, wire, tubes] Overall evaluation of the mid-term exam. And the outline of forging technologies.
10. [Secondary fabrication: Blocks, wire, tubes] Forging – Learn the mechanical way of thinking for various forging technologies, new cold forging technologies used to bring material to near net shape, and future technologies.
11. [Secondary fabrication: Blocks, wire, tubes] Secondary fabrication of tubes and wire, plate shear – Learn about secondary fabrication process for various formed materials and, about the mechanical way of thinking and about the equipment related to important pre-fabrication shearing work.
12. [Secondary fabrication: Blocks, wire, tubes] Bending and straightening – Learn mechanical analysis methods for material deformation behavior, working limits, and accuracy in bending, and processing principles and equipment for straightening.
13. [Secondary fabrication: Blocks, wire, tubes] Drawing and Bulging – Learn about analysis methods, accuracy, fabrication design,and degree of processing with a focus on the press deep-drawing process used in the fabrication of beverage cans, etc.

14.[Secondary fabrication: Board] Rotational molding and die fundamentals – Learn about the fundamental points and finishing processes of rolling and spinning, and about incremental forming, cutting-edge processing methods and molded contours.
15.[Secondary fabrication: other] Dies, joints, composites – Learn about dies and the characteristics of various welding methods and other methods of mechanically joining two materials.
16. Final Exam – Comprehensive examination on material from lectures after the mid-term exam. Results will be posted the following week.
[Keywords] Plasticity, Plastic working, Deformation, Rolling, Extrusion, Drawing process, Forging, Sharing, Bending, Drawing, Expanding, Spinning, Incremental forming, Micro forming, Welding
[Textbooks and Refrence Books] “Introduction on Plastic Working”; Japan Society of Technology of Plasticity, Corona-sha (in Japanese).
[Evaluation] To achieve a credit, students must have over 60points of total score. The score is consist from interim exam(40 points for full mark), the end-of-term exam(40 points for full mark) and report(20 points for full mark) Also the qualifications of candidacy for an exam is an attendance of more than 4/5 to the lecture .
[Related courses] Mechanics of plasticity (T1Q034001), Mechanical Machining (T1Q029001), Precision Machining (T1Q046001)
[Course requirements] Students have preferably taken Material Science (T1Q010001), Mechanics of Materials I (T1Q012001), Steel Materials (T1Q014001), Mechanics of Materials II (T1Q021001), and Mechanics of plasticity (T1Q034001).
[Remarks] This course is evaluated under mechanical learning objectives and related subject flow: “(F) flexible thinking and systematic approach.”

熱流体工学　Thermo-Fluid Engineering
[Instructor] Masahiro Takei
[Credits] 2
[Semester] 3rd year-Fall-Mon2
[Course code] T1Q043001
[Room] Bldg. ENG- 17-213
[Course enrollment] 90
[Candidate] Students of Faculty of Engineering, and other Faculties.
[Course description] The student will learn about the dramatic change in the flow, taking into account the density variation in the flow that deals in fluid dynamics, the student will also learn about the main law of thermodynamics associated with the amount of flow through the medium state and know the dramatic change in the flow by taking in account the density variation in the flow that runs and about how to obtain the analytical solution and the numerical solution of the equations describing the flow. Incorporate the changes in the amount and density state, and even find an overview of computational fluid dynamics to know the basis of so-called compressible fluid dynamics.
[Course objectives] Through mathematical formulas, understand how the main laws of thermodynamics are tied into fluid flow. Gain an understanding of the fundaments of compressible hydrodynamics and specific examples.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understanding fundaments of thermodynamics	1	The end-of-term exam	15%
2	Understanding heat flux flow in the nozzle	3,4	The end-of-term exam	15%
3	Understanding liquid air two phase flow	5,6,7,8	The end-of-term exam	15%
4	Understanding flow in duct	9	The end-of-term exam small test	15%
5	Understanding wave properties / pressure spread properties	10	The end-of-term exam small test	15%
6	Understanding probability phenomenon of flow #1	11	The end-of-term exam	10%
7	Understanding probability phenomenon of flow #2	12,13,14,15	The end-of-term exam	15%

[Plans and Contents] The first law of thermodynamics and other fundaments of thermodynamics, thermal air currents, flow in a nozzle, fundaments and characteristics of two-phase gas-liquid flow, outline of measuring techniques, PIV, ultrasound flow velocity distribution measuring techniques, basics of multi-phase flow measurement.
1. What are the fundaments of thermodynamics?
2. Fundamental items related to thermal air currents
3. Flow in a nozzle
4. Multi-phase flow types and characteristics
5. Two-phase gas-liquid flow fundaments
6. Two-phase gas-liquid flow statics
7. Two-phase gas-liquid flow dynamics
8. Uniform two-phase gas-liquid flow
9. Flow in pipes
10. Wave properties/Pressure propagation characteristics
11. Probabilistic flow phenomena
12. Outline of measuring techniques
13. PIV
14. Ultrasound flow velocity distribution measuring techniques
15. Multi-phase flow measurement
16. Exams
[Keywords] Hydrodynamics, Thermodynamics, Partial differential equation
[Textbooks and Reference Books] Manabu Iguchi [The basics of heat fluidics] Asakura Publishing Co., Ltd
ISBN: 978-4-254-23121-2
[Evaluation] Seminars, Report, the end-of-term exam
[Related courses] Fluid Mechanics I,II, Fluid Mechanics I Seminars I, II, Thermodynamics.
[Course requirements] Students must have taken Fluid Mechanics I, II and Thermodynamics.

バイオメカニクス　Biomechanics
[Instructor] Hao Liu, Kenichi Tsbota
[Credits] 2
[Semester] 3rd year-Fall-Tues3
[Course code] T1Q044001
[Room] Bldg. ENG- 17-213
[Course enrollment] 75
[Candidate] Students of Faculty of Engineering, and 3rd year of Department of Mechanical Engineering, and those from other departments and schools who are permitted specifically.
[Course description] The student will learn about the fundamentals of biomechanical phenomena in biological systems of flying and swimming animals and human being, which invovles anatomic morphology and dynamics of cells, living tissues and organisms, mechanical structures and functions in biological systems, biomechanics in insect & bird flights, swimming biomechanics, hemodynamics of the cardiovascular system and etc.
[Course objectives] The student will learn the basic mechanical phenomena of forms and structures, functions and mechanisms as well as biological functions of an organism. In particular, the student will get to understand the fundamentals of living tissues and organisms, involving contents of 1) the mechanical properties such as strength and deformation; the motions, flows and mechanics associated with swimming and flying-inspired systems; 3) the biofluiddynamics of blood flow in the cardiovascular system (maroc-hemodynamics in heart, arterial and venous blood vessel and micro-hemodynamics in capillary and cells); 4) the elasticity and in vivo dynamics of joint and spinal muscles and skeletal system; 4) the energy of an organism such as the metabolism of heat and work; and the adaptive, remodeling and optimal procedures in biological systems.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Overview of biomechanics. Understand the anatomy, organs and other structures in living organisms, and mechanical properties such as deformation and strength.	1, 2, 8	Interim exam	15%
2	Learn about motions, flows and mechanics in living organisms of swimming and flying animals.	3,4,5,6,7	Interim exam, the end-of-term exam	30%
3	Learn about flows and stresses associated with blood flows in heart, arteries and veins and relating to capillary and cells in the cardiovascular system.	8,9,10,11,12, 13	Interim exam, the end-of-term exam	40%
4	Understand metabolism in organisms (energy, heat, and work), optimal design in living tissue and functional adaptation in body structures.	14,15	The end-of-term exam	15%

[Plans and Contents]
1. Overview of biomechanics. An introduction to mechanical phenomenon in living organisms.
2. Forms, structures and mechanical properties of living organisms, and their mechanics-based fundamental functions.
3. Undulation, hydrodynamics and energetics in animal swimming including organisms from bacteria to dolphins.
4. Powered and unpowered flights, aerodynamics and energetics in insect and bird flapping flights including gliding, soaring and flapping-wing flights.
5. Bio-inspired mechanical systems and biomimetic of animal swimming and flying.
6. Multi-layered features and multi-physical functions of the circulation system from gene, molecular, cell, tissue to organism.
7. Fundamentals of blood flows in heart, arterial and venous systems and in micro-circulation.
8. Physiological flows, hemodynamics, propagation and reflection of blood pressure waves, steady and pulsatile flows in rigid and elastic pipes. Interim exam.
9. Internal structures and mechanical characteristics of cells.
10. Passive and active motions and deformations of cells.
11. Structures and mechanical characteristics in muscular system.
12. Joint friction and lubrication in skeletal structures, and mechanical characteristics and pathology of marrow.
13. Metabolism of energy, heat and work in living tissues.
14. Living tissue functional adaptation and remodeling.
15. Optimal design and its application to biomedical engineering. The end-of-term exam.
[Keywords] Biology, Living organism, basic mechanics, cell, tissue, blood flow, bone, swimming, flying, biomimetic, optimal design
[Evaluation] Evaluation will be given by regular reports(30%) and the end-of-term exam (70%)which will be totally 100 points. To achieve a credit, a total score must be over 60 points.
[Related courses] (Introduction to Physics I and II), Mechanical Dynamics, Mechanics of Materials, Fluid Mechanics, Thermodynamics, System Control
[Course requirements]　Students have preferably taken related subjects.

トライボロジー　Tribology
[Instructor] Hiroshi Mishina
[Credits] 2
[Semester] 3rd year-Fall-Fri3
[Course code]T1Q045001
[Room] Bldg. ENG- 17-213
[Course description] Tribiological phenomena (friction, wear, and lubrication) are caused at the contacting surfaces of materials. This phenomenon not only depends on the mechanical properties of the solid, it is largely dependent on the physicochemical properties of the solid surface. The lecture will be about the applied technology and further explanation of the phenomenon of specific surface and properties caused by the phenomenon of friction and wear on the surface of a solid understanding of the nature.
[Course objectives] The student will learn the surface phenomena occurred at the frictional surface in the machine elements to maintain the function over a long period of time, while understanding the nature of the solid surface, also understand the nature of tribiological phenomena (friction, wear, and adhesion) occurring between the two solid materials, and lubrication technology.
The student will also learn about the fabrication of the thin film surface PVD, such as CVD.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand the physical properties of solid surfaces.	1, 2, 3	Report or exams	25%
2	Understand friction and abrasion processes and characteristics as fundamental phenomena of tribology.	1, 2, 3, 4, 5, 6, 7	Report or exams	30%
3	Understand principles of lubrication (boundary lubrication, fluid lubrication) principles and biotribology.	7, 8, 9, 10,11	Report or exams	25%
4	Surface construction technologies as tribological application.	12, 13, 14,15	Report or exams	20%

[Plans and Contents]
1. Solid body surfaces
2. What happens when solid bodies come into contact?
3. Clean surfahere to each other.
4. Nature of friction phenomena
5. Nature of wear phenomena
6. How do friction and wear change depending on environment?
7. Technology that control friction and wear.
8. What potential does lubrication have?
9. Boundary lubrication and fluid lubrication
10. Reynolds equation and fluid lubrication theory
11. Artificial joints and bio tribology
12.PVD Surface creation technologies: PVD
13 CVD Surface creation technologies: CVD
14. Solid lubrication and thin film lubrication
15. Technologies using friction, wear, and lubrication
[Textbooks and Reference Books] not yet determine (Instruction will be given in lectures)
[Evaluation] S ubmission of the report or exams.

精密加工学　Precision Machining
[Instructor] Noboru Morita
[Credits] 2
[Semester] 3rd year-Fall-Wed3
[Course code]T1Q046001
[Room] Bldg. ENG- 17-112
[Course enrollment] 90
[Candidate] Especially Registered Non-Degree Student, those in 3rd and 4th year of Electronics Mechanical Engineering Department, and those in Frontier Science Program and other faculty and Department permitted to take lectures.
[Course description] Grinding is one of the important methods, precision machining sequence as production technology and cutting. While systematically learning and practicing the principles of grinding method, the lecture is to understand the methodology applied to the manufacture of precision parts. In addition, the student will learn the methods for processing abrasive lapping, honing, super finishing, such as the Law Principles and Applications.
[Course objectives]1. The student will understand the principles and features of the grinding process. 2. The basic phenomenon and its measurement method of grinding. 3. The theory of law grinding. 4. Basic knowledge about the application of the principles of law and abrasive machining.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand the principles and characteristics of grinding techniques.	1,2,3,4	Small test，interim exam	25%
2	Understanding fundamental grinding phenomena and measurement methods.	5,6,7,8	Small test，interim exam	25%
3	Understand theoretical application of grinding.	9,10,11,12	Small test，the end-of-term exam	25%
4	Acquire the basic knowledge regarding abrasive machining principles and applications.	13,14,15	Small test，the end-of-term exam	25%

[Plans and Contents]
1. Purpose of precision machining, outline of grinding, comparison to machining
2. Types and structures of abrasive wheels and abrasive grain, types and characteristics of bonding material
3. Machining mechanism of abrasive grain, contact arc length and chip length
4. Significance, scale effect, and methods of measuring grinding force.
5. Grinding temperature, abrasive grain grinding point temperature, and methods of measuring grinding temperature.
6. Definition and indication of surface roughness, surface generation mechanism, measurement of surface roughness
7. Silicon wafer fabrication technology that uses grinding processing.
8. Mid-term summary
9. Grinding surface damage and its causes, effects and suppression such damage in order to make it functional
10. Relationship between grinding mechanism and dimensional precision, various methods of measuring affected flow layer
11. Abrasive grain wear and abrasion mechanisms, and the effect of grinding conditions and dressing of grinding wheels
12. Grinding wheel wear and grinding performance, determining grinding stone longevity and truing, grinding ratio
13. Reality and application of grinding, machinable materials and grinding conditions, grinding fluid
14. Principles and application of abrasive machining (lapping, honing, superfinishing)
15. Hard disk substrate fabrication technologies using abrasive machining.
16. The end-of-term exam
[Keywords] Precision machining, Grinding, Grinding wheels, Surface integrity, Abrasive machining
[Textbooks and Reference Books] Kakougaku-kiso　(2) [Grinding and Abrasive Machining] Kawamura,Yano, Higuchi,Sugita(kyouritsu-syuppan)
[Evaluation] Evaluation Methods is as listed in Purposes and Objectives, and Evaluation Criteria is comprehensive evaluation of small test (total 40%), and interim exam / end-of –term exam (total 60%). To achive a credit, overall scoure must be over 60points.
[Related courses] Mechanical Machining, Plastic working, Experiment of Mechanical Engineering
[Course requirements] Not particularly
[Remarks] This course is mainly evaluated under mechanical learning objective “(D) System design ability.”

インターンシップ　Internship
[Instructor] Each teacher
[Credits] 2
[Semester] 3rd year Spring-Fall Intensive
[Course code] T1Q048001
[Room]
[Course enrollment] There is not the limit in particular, but adjustment with "the acceptance" is necessary.
[Candidate] Only students of Department of Mechanical Engineering
[Course description] School experience is a training experience in companies such as off-campus, Rikuru - port activities and part-time experience is not possible. Although as a rule, the period would be during the summer vacation of 3-4 years, class hours can also be conducted during spring break. The implementation period would be 2 weeks, then if extended would be more than 45 hours.
[Course objectives] Can be based on field experience in companies such as off-campus, to foster professionalism. Furthermore, by comparing the knowledge and capabilities required by the field contents and the learning or the like, classroom so far, we can increase the motivation for future studies.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to use engineering technology to improve society.			30%
2	Implement problem finding and problem resolution abilities in examples.			20%
3	Gain practical skills based in logical thinking learned during lectures.			40%
4	Practical engineering theory.			10%

[Plans and Contents] Students will submit a company experience plan to the instructor beforehand and upon completion will submit an internship work experience diary. They will submit an internship work experience evaluation report provided by their supervisor at the company they interned at, and will be interviewed.
1. Internships are generally run during summer vacation after third or fourth year, but are also possible during spring vacation or outside normal course hours.
2. Implementation period is two weeks or more than 45 hours of work.
[Keywords] Manufacturing, corporate activities, internship, factory practical training, professional awareness
[Textbooks and Refrence Books] Not particularly
[Evaluation] Comprehensively evaluated based on internship work experience diary and internship work experience evaluation report, together with the instructor interview.
[Remarks] Those who wish to have internship must <<not>register. Regarding the individual who has satisfied the evaluation criteria and performs the internship, after the procedures of the teacher, he will be registered. In addition, for internships, it is possible to take the number of units, even if none have reached the maximum, (The units are not counted in the limitation on the number of registered units).

流体力学演習ＩＩ　　Practices in Fluid Mechanics II
[Instructor] Hao Liu
[Credits] 1
[Semester] 3rd year-Spring-Wed 1alternate week 1,3
[Course code] T1Q049001
[Room] Bldg. ENG- 17-214
[Course enrollment] 100
[Candidate] Students of Faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student and 3rd year Students of Mechanical Engineering and Frontier Science program and those from other Departments and schools who are permitted specifically.
[Course description] Description and basic equations of fluid phenomena, Stream function and velocity potential of ideal fluid, Characteristics of laminar and turbulent flows, Example of the analytical solutions to the Navier-Stokes equations, Basis of boundary layer theories, and the fundamentals of fluid mechanics shall be systematically taught.
[Course objectives] The students will have a basic understanding of fluid phenomena involving mathematical description of governing equations and analytical theories as well as their applications in engineering. In particular, the lectures provide examples of simple analytical solutions regarding typical basic equations, and the students will be able to explain the fundamentals of fluid dynamics such as hydrodynamic velocity potential and stream function, vortex and circulation, laminar and turbulent flows, boundary layer and drag forces.

	Objectives of Subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Inviscid ideal fluids: vorticity → rot V =O (Velocity vector V) I.E. zero-vorticity flow = potential flow. Understand the fundamentals of simple flows with basic functions and inviscid flows around a cylinder. (B-3)	1, 2	Interim exam, the end-of-term exam	20,10%
2	Introduce the concept of circulation around a body (circumference integration of velocity); understand that elliptical wings and other lift characteristics can be determined using a circulation-based lift on a plane with the functional relationships between cylindrical planes. (B-3)	3, 4	Interim exam, the end-of-term exam	20,10%
3	Through some typical solutions to the Navier-Stokes equations, understand mathematical descriptions of fluid phenomena, analysis of basic governing equations and physical phenomena. (B-3)	5, 6	The end-of-term exam	20%
4	Understand the concept of boundary layer and drag forces on a body and the fundamentals of boundary layer theories. (B-3)	7	The end-of-term exam	20%

[Plans and Contents]
1. Potential flows: complex potential, velocity potential, complex velocity, Blasius' theorem and flows around a cylinder (superimposed potential solution), a corner, and a revolving cylinder with specific examples.
2. Flat plates and the Kutta condition; complex potential solutions to flat plates.
3. Pressure-and shear stress-based forces acting upon a cylinder and lift & drag forces.
4. Biot-Savart law, lift characteristics of elliptical wings, lift & drag coefficient, and their applications in a sample 3D wing.
5. Solutions to the Navier-Stokes equations with examples of flows relating to parallel plates (Couette flow, etc).
6. Flow in a pipe (Poiseuille flow), Rayleigh's flow, flows between oscillating plates based on solutions to the Navier-Stokes equations.
7. Basic analytical methods of boundary layer phenomena with a specific focus on the formulation and characteristics of boundary layers around flat plates, a cylinder and a sphere. Calculation of lift and drag forces based on viscous flows.
8. End-of-term exam
[Keywords] Reynolds number, laminar flow, turbulent flow, boundary layer, flow separation, resistance, potential flow, vorticity
[Evaluation] Evaluation will be given by regular reports(40%) and the end-of-term exam (60%) which will be totally 100 points. To achieve a credit, a total score must be over 60 points.
[Related courses] Fluid Mechanics I, II, Practices in Fluid Mechanics I
[Course requirements] Students have preferably taken Fluid Mechanics I, Practices in Fluid Mechanics I.

ロボット工学　Robotics
[Instructor] Akio Namiki
[Credits] 2
[Semester] 4th year-Spring-Fri 4, 5 alternate week1, 3
[Course code] T1Q050001, T1Q050002
[Room] Bldg. ENG-17-214
[Course description] The explanation will focus on Kinematics of the robot as basics of expertise as well as explaining the history of the robot as a general knowledge. It also introduces the current state of the video, such as state-of-the-art robot technology.
[Course objectives] To acquire the basics of robotics such as system construction, mechanical analysis, and intelligent control. Introduction to cultivate basic and applied knowledge of robotics.

	Targets of subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand the mechanisms and structure of robots and be able to explain them.	1	The end-of-term exam	20%
2	Be able to calculate robot kinematics and inverse-kinematics and the Jacobian based in link coordinate systems and homogeneous transforms.	2, 3, 4, 5	The end-of-term exam	25%
3	Be able to derive robot dynamics using the Euler-Lagrange equation. Also, understand how to calculate the Newton-Euler method.	6, 7, 8	The end-of-term exam	20%
4	Calculate robot positional control and force control systems. Be able to identify robot parameters.	9-12	The end-of-term exam	25%
5	Understand robot sensor systems, and be able to construct basic sensing systems.	13-15	The end-of-term exam	10%

[Plans and Contents]
1. Outline of robot research
2. Kinematics 1 (Mechanism, homogeneous transforms, and Link coordinate systems)
3. Kinematics 2 (Kinematics and inverse-kinematics)
4. Kinematics 3 (Jacobian matrix)
5. Kinematics 4 (Manipulability)
6. Dynamics 1 (Lagrangian approach and robot dynamics)
7. Dynamics 2 (Euler-Lagrange method)
8. Dynamics 3 (Estimation of robot parameters)
9. Robot control 1 (Position control)
10. Robot control 2 (Force control)
11. Robot control 3 (Dynamic control)
12. Robot control 4 (Advanced control)
13. Robot sensing 1 (Robot vision)
14. Robot sensing 2 (Visual servoing)
15. Robot sensing 3 (Tactile sensing and sensor fusion)
16. Exam

[Keywords] Robot, Kinematics, Dynamics, Control, Sensing
[Textbooks and Reference Books] T. Yoshikawa: Foundations of Robotics, CORONA PUBLISHING Co. Ltd.
K. Yoneda, S. Nakajima, A. Namiki: Beginners' practical design of mechatronics, Kodansha Ltd.
[Evaluation] the end-of-term exam
[Related courses] Analytical Dynamics (T1Q019001), Fundamentals of Instrumentation (T1Q025001), Introduction to Control Theory, Part II (T1Q023001), Introduction to Control Theory, Part II (T1Q038001)
[Course requirements] Not particularly

自動車工学　Automotive Engineering
[Instructor] Shigeo Sekiyama
[Credits] 2
[Semester] 4th year-Spring-Tues3
[Course code] T1Q051001
[Room] Bldg. ENG- 17-211
[Candidate] Students of Faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course description] This lecture is about the Fundamentals of Automobile Engineering. The student will learn about the basic structure and theory for (1) Generating the power (powertrains), (2) Moving (performance and transmission), (3) Stopping (braking), (4) Turning (dynamic performance) and (5) Suspending (suspension), and understanding and knowledge for each of these.
[Course objectives] The goal is technical understanding of each constructed automobile that plays an important role in social life, as the purpose of understanding and practical application of engineering, and the car being one of the products subject to the overall field of mechanical engineering. More specifically, the goal is to be able to understand and explain, the performance and power performance of the engine structure, vehicle, handling stability, braking performance on the basis of such phenomena using thermodynamics and kinetics. The student will learn of the relationship between society and the environment based on automobiles and other - also delisted in the Gazette.

	Targets of subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understanding the relationship between automobiles and society: Economy, transport, life, environment	1	The end-of-term exam	5%
2	Engineering understanding of automobile engines: understanding of thermodynamics, structure, performance, exhaust gas countermeasures, fuel.	2, 3, 4, 5, 6, 7	The end-of-term exam	30%
3	Understanding automobile motion performance and drive train structure.	8, 9, 10	The end-of-term exam	25%
4	Understanding braking dynamics and brake mechanism structures	11	The end-of-term exam	10%
5	Understanding automobile motion performance (turning performance).	12, 13	The end-of-term exam	20%
6	Understanding the effect of suspension structures and motion performance.	14, 15	The end-of-term exam	10%

[Plans and Contents]
1. The relationship between automobiles and society, and outline of automobile engineering: Automobiles and society, economy, the environment
2. Automobile engines and the basics of heat cycles 1: Learning the first and second laws of thermodynamics
3. Automobile engines and the basics of heat cycles 2: Various cycles and thermal efficiency
4. Automobile engine performance basics and structures 1: Differences between gasoline and diesel engines – power and shaft output
5. Automobile engine performance basics and structures 2: Examples of factors that influence engine performance
6. Automobile engine performance basics and structures 3: After treatment devices – supercharger basics and EGR
7. Automobile engine structures, fuel, and new methods of burning fuel: moving engine parts and motion dynamics, fuel, new ways of burning fuel
8. Automobile dynamic performance and basic design requirements: Automobile motion and dynamic performance, starting devices
9. Explanation of drive force transmission mechanisms and basic design requirements 1: Transmission structure and movement, power transfer mechanisms
10. Explanation of drive force transmission mechanisms and basic design requirements 2: Drive axles, actuators and final reduction gear mechanism
11. Braking performance: Braking dynamics and braking mechanisms
12. Motion performance (external tire forces and automobile motion dynamics 1) : tire coordinate system and 6-component force
13.Motion performance (external tire forces and automobile motion dynamics 2): Automobile coordinate system, motion equations, and motion performance (turning performance)
14. Suspensions 1: Basics of spring dynamics, suspension structure
15. Suspensions 2: Influence of suspension structures on motion dynamics
16. Final exam
[Keywords] Automobile, Combustion engine, Heat cycle, Transmissions, Engine performance, Motion dynamics, Braking, Suspension
[Textbooks and Reference Books]Printed materials and texts for each topic will be posted before each lecture.

[Evaluation] Evaluation based on result of final exam (more than 60%) The exam will be 90 minutes long and include 100 true or false questions. The proportion of questions related to each topic will generally follow the Proportion of Total Course Grade section found in Purpose and Objectives.
[Related courses] Thermodynamics
[Remarks] Over 80% of attendance to lectures is a precondition to achieve a credit. Over 80% of attendance is considered to be evaluated.

宇宙工学　　Space Engineering
[Instructor] Nobuaki Ishii
[Credits] 2
[Semester] 4th year-Spring-Tues2
[Course code] T1Q052001
[Room] Bldg. ENG- 17-111
[Course enrollment] 80
[Candidate] Students of Faculty of Engineering, other Faculties, and Specially Registered Non-Degree　　Student
[Course description] This lecture is divided into 3 main topics, the outline shall be described on the technology for the development of the necessary elements from the established plan to the actual project regarding technology in relation to the necessary technology, developments required to develop satellite sockets, and the conventional history of space development and achievements.
[Course objectives] To be able to get a grasp of the engineering technology related to space development, to introduce the topic of space engineering in general, such as satellite systems and space transportation system (other rocket).　The student will learn about Academic and professional basic knowledge learned in college and how actual projects are being applied.
[Plans and Contents] First, at the beginning, look back on the history of space development in Japan and the world so far, and then the results of the past and the need and significance of space development shall be described.　Next will be the explanation on the flying body related technology, such as a control mechanism for the flight configuration propulsion principle, and induction.　As a satellite-related technology, this section explains the functions and the type of satellite being requested, attitude sensor, attitude and orbit control system, etc.　Description on the difference of the orbit, orbit transfer system, using gravity planets orbit changes, such as technology (swing-by) regarding the earth orbiting satellites and spacecraft's, and we will introduce as an example the Planetary exploration plan of the actual sequence from launching up until the success of the mission.
1. History and successes in space development
2. Present state of space development in Japan
3. Purpose and necessity of space development
4. Rocket structures and propulsion principles
5. Rocket guidance control
6. Future transportation system technologies
7. Necessary technologies and verification methods in rocket development
8. Function of artificial satellites
9. Earth-orbit satellites and planetary exploration spacecraft
10. Artificial satellite orbits
11. Swing-by techniques
12. Orbital planning and mission analysis
13. Development cost and ensuring reliability
14. Ground testing and launch operations
15. Ground tracking and orbital operations
[Keywords] space development, Rocket, Flying object, artificial satellites, planetary exploration spacecraft, Swing-by techniques
[Evaluation] Report

燃焼学　　Combustion Theory
[Instructor] Kenji Satoh
[Credits] 2
[Semester] 4th year-Spring-Thurs4,5 alternate week 1,3
[Course code] T1Q053001, T1Q053002
[Room] Bldg. ENG- 17-211
[Candidate] Students of Faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course description] This lecture is about acquiring the basic knowledge, on having to improve the design and performance of practical combustor to obtain the qualities regarding combustion phenomena.
[Course objectives] To be able to obtain qualities as much as possible on the design and performance improvements of the practical combustor, obtaining and having the basic knowledge regarding the thermal phenomenon in the process of conversions of chemical energy to thermal energy. To learn the heat transport processes and chemical species, chemical reaction mechanism is the fundamentals of combustion, such as the flow on thermal theory and the theory of flame front and understands the basic theory of combustion.
[Plans and Contents]
1. Introduction
2. Chemical reaction mechanism and linked explosion theory
3. Explanation of heat transfer and thermal explosion theory, and the relationship between explosions and chemical reactions.
4. Explanation of the basic combustion equations, heat value, stoichiometric mixtures, theoretical amount of air, and the basic equivalence ratio combustion equations.
5. Chemical equilibrium computations and adiabatic flame temperature
6. Types of flame (Pre-mixed flame and diffusion flame, detonations and deflagration)
7. Properties of pre-mixed flame 1
8. Properties of pre-mixed flame 2
9. Properties of diffusion flame 1
10. Properties of diffusion flame 2
11. Burning in internal combustion.
12. Combustion in industrial furnaces.
13. Combustion emissions
14. Measurement in combustion
15. Exams
[Keywords] combustion, reaction, flame
[Textbooks and Reference Books] further notice
[Evaluation] Evaluation will be given by exams and report

卒業研究　Graduate Research
[Instructor] Each teacher
[Credits] 6
[Semester] 4rh grade-Spring-Fall Intensive
[Course code] T1Q054001
[Room]
[Candidate] 4th year of Department of Mechanical Engineering (including Frontier Science Program) and 4th year of Department of Mechanical Engineering (Mechanical course)
[Course description] The student will learn the method of experimental studies, people taking turns reading and explaining a book, through seminar, in each laboratory. Summarize the research results as the student's graduation thesis and make a presentation.
[Course objectives] The student will learn the Fundamental Method regarding research. The student can come into contact with one end of the cutting-edge of modern research. The student will be able to summarize into a report the results of the student research. The student will be able to explain easily the student's reports to other persons.

	Targets of subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to write a graduation research paper that describes the social and technological background of the research, the main technological issues, solutions, results, ripple effects, and remaining issues.			%
2	Be able to express the title and main content of the graduation research project in approximately 300 words/characters.			%
3	Be able to give an oral presentation using power point and other tools to explain the important points of the graduation research project.			%
4	Be able to provide an up-to-the-minute evaluation of how the graduation research is going, and be able to plan and implement what should be done next.			%
5	Be able to explain the thought and work put into the graduation research project thus far, or explain any planned work, to advisor and other students in the lab.			%
6	Be able to write an easy-to-understand technical paper and project proposal explaining the review and work completed (or any planned work) on the graduation research project thus far.			%
7	Be able to evaluate explain which of a number of methods and techniques was (or would be) best regarding the review and work put in to complete the graduation research project.			%
8	8. Read English and Japanese literature related to the student's graduation research project theme, grasp a basic outline, and reflect that understanding in the review and work plan. 9. Be able to think about technological concepts from various perspectives, and be able to consider the attitudes engineers should take in areas where technological judgment is necessary. 10. Be able to correctly comprehend what the student has learned thus far as specialized knowledge & ability, and be able to recognize future necessary tasks through the effort to complete the graduation research project.			%

[Plans and Contents] The contents of (research task) shall be different for each student and each individual in the group. The research topics shall be published at the beginning of the year from each laboratory (field of Education and Research) and the outline shall be explained during the Graduation Research Meeting. After that, after surveys and requests, the allocation to each laboratory is determined. Furthermore, the planning, research and methods for more information are assigned in the laboratory. Summarize the research findings as the student's graduation thesis, and it must be presented in the graduate mechanical engineering at the workshop
[Evaluation] A) [Graduation Thesis] Evaluation [20 points] _ _ 1. Is the problem name and outline (Japanese & English) appropriate written (machine E-3) __ 2. Structure (Chapter, Citation) are they organized and appropriate (machine E-2) __3.

Social Technical background Position required in laboratories. (Machine C-2, E-1, E-2) 4. Are the results and arrival points clearly stated as a graduation thesis (machine B-4, C-2, E_2 _B) [Thesis presentation] evaluation []30 points _1. [Are the important points in the thesis transparent and appropriately written(sometimes referred to as proceedings)](machine E-2)__2. Are the contents of the thesis simplified for understanding, and is the verbal presentation easy to understand. (machine B-2, E-2)__3. Do the student understand correctly the meaning and status of the research conducted(machine E-1, F-3)__ 4. Does the student understand the proper selection and implementation process of the method carried out(machine C-2, E-1, E-2, and F-2)_ 5. Were the student able to give the correct response to a question, understand the question (machine C-2, E-2)__ 6. In the graduation research, are the student able to grasp the knowledge and skills of self-wearing expert in the field of specialty (machine C-2, F-3)__ C) Evaluation for graduate study is 50 points. Please refer to the([Graduate study notes]and[Career Development Report])__ 1. With regards to the graduate study theme, do the students understand the Japanese / English text, and is that reflected on the work and verification suggestions.(machine E-1)__ 2. Can the student easily explain at any time the contents of the conducted verification, the plane of the work and verification after that, and is the plane clearly defined in a wide field(machine B-4, C-2, E-2, and F-2)__ 3. Does the student see aggressiveness and spontaneity, ingenuity, and necessary effort of challenge in the implementation of the graduate study (machine B-4, C-2, E-1, F-2, and F-3)__4. With regards to the theme of the graduate study, were the student able to create a graduation thesis adequately describing the social background and technical research needed, major technical problems, point of the solution, ripple effect and results obtained, understand the remaining problem(machine B-3, E-1, E-2, and E-3)__5. In carrying out the graduate studies, do the student fully understand the knowledge, skills and the student's own confidence, did the student make an effort to be able to increase that knowledge, and ambition, and afterwards the challenges the student need to recognize in the future.(machine A-2,F-1,F-3)__ 6. From the view point of basic and multi-faceted, were the students able to determine or consider the attitude that the technician should have in the condition of technology. (machine A-2, C-2)__ A)B)C) If there is a score of less than 60%, it is not for both. If the scholastic portfolio is not submitted, the graduation thesis would not be accepted.

[Related courses] all subjects

[Course requirements] It is stated on[course curriculum]handed out your enrollment year.

[Remarks] This course covers the following educational achievement goals: "(A) Responsibilities based in engineering ethics" (A-2), "(B) essential understanding of events and practical application of expertise (B-2) and (B-4), "(C) Theoretical Thinking" (C-2), "(E) Self-expression" (E-1)~(E-3), "(F) Flexible thinking and systematic approach." (F-1)~(F-3)

エンジニアリングデザイン　Engineering Design
[Instructor] Each teacher
[Credits] 2
[Semester] 3rd year-Fall-Mon 4, 5
[Course code] T1Q056001, T1Q056002
[Room] Bldg. ENG-17-111, Bldg. ENG-17-112, Bldg. ENG-15-109
* 1) As a rule, the class will be finish on December.
2) There is a case that team Instructor may give a class on other days of a week.
3) First day of the class may be given in September.
[Course enrollment] 80
[Candidate] Only3rd year of Department of Mechanical Engineering (including Frontier Science Program) also 4th year of Electronics Mechanical Engineering (Mechanical Course).
[Course description] Divide the student participants into teams of approximately five students per team, and come up with design challenges (Engineering designs) in the field of mechanical engineering team. With one full-time faculty members of each team, each faculty having a relatively broad theme listed in advance such a student team for designing and manufacturing and set up specific issues and conduct them. In addition, each faculty member is to announce the results of the teams'activity in the entire presentation. However, during the agenda settings, execution and announcement, teacher cannot be strongly involved in the students actions, and must only give basic advices. Then, the Industrial design shall not be the target.
[Course objectives] In this course, the purpose is to train overall problem detecting (setting) abilities and problem solving abilities in the mechanical field of engineering through challenges of designs organized by the team. As a general rule, students would volunteer for the configuration and execution of the assignment. In this course, the student will acquire presentation skills and teamwork in addition to problem detection ability (setting) and problem solving abilities.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Gain problem finding ability in the field of mechanical engineering(A-2, C-2)	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	Statements, performance, reports	30%
2	Gain problem resolution ability in the field of mechanical engineering (A-2, D-1)	4,5,6,7,8,9,10,11,12,13,14,15	Statements, performance, reports	30%
3	Gain presentation ability (E-2)	4, ,6,7,8,9,10,11,12,13,14,15	Statements, performance, reports	20%
4	Gain teamwork skills.	4, ,6,7,8,9,10,11,12,13,14,15	Statements, performance, reports	20%

[Plans and Contents] Begins last week of September. Times and location for the first three classes will be posted on the department bulletin board in around July.
1. Design theory and Engineering Ethics 1 (Lecture)
2. Design theory and Engineering Ethics 2(Lectures)
3. Design theory and Engineering Ethics 3(Lectures)
4. After splitting into teams, each team practices problem setting/resolution
5. Each team practices problem setting/resolution
6. Each team practices problem setting/resolution
7. Each team practices problem setting/resolution
8. Each team practices problem setting/resolution
9. Each team practices problem setting/resolution
10. Each team practices problem setting/resolution
11. Each team practices problem setting/resolution
12. Each team practices problem setting/resolution
13. Each team practices problem setting/resolution
14. Each team practices problem setting/resolution
15. Each team practices problem setting/resolution
16. Presentation (Exhibition and explanation of product: late December)
[Keywords] Engineering design, Problem finding, Problem setting, Problem solving, Teamwork, Presentation
[Evaluation] Evaluated based upon daily remarks, performance and final report. Students must have a combined mark of 60% or higher to pass.
[Related courses] All Specialized basic Course and Specialized Course
[Course requirements] Students must have received more than 80 credits towards graduation by the end of the first semester this year.
[Remarks] There are several professors and associate professors of mechanical system in charge of each team, the class will end in December. It should be noted that in relation to other classes of charge, it may also be conducted beyond class times

on Mondays at 4th or 5th period. If this is done beyond class time, the students would do consultation and decide on the time. Regarding the mechanical engineering courses, this course deals On "liability under the Engineering Ethics (A)" of the learning and teaching objectives, (A-2), on the "ability to think logically (C)" tangible achievement content, Achieve concrete content (C-2), on "capability (D) System Design", Achieve a specific content (D-1), for "self-expression (E)"111, Achieve concrete content (C-2), on "capability (D) System Design", Achieve a specific content (D-1), for "self-expression (E)", and (E-2) achieve concrete content.

造形演習　Design Aesthetics(Lab.)
[Instructor] Akira Ueda
[Credits] 2
[Semester]1st year-Spring-Tues 5
[Course code] T1Y016001
[Room] Bldg. ENG-2-201
[Course description] Engineering is manufacturing, and manufacturing is a formative activity. The Design Aesthetics (Lab.) course aims to evoke students' interest in Engineering = manufacturing through several formative design projects and to awaken the individual talents in formative arts.
[Course objectives] Specific objectives of this course are as follows: (1) to cultivate the attitude to learn; (2) to develop multilateral observation skills; (3) to recognize the existence of various solutions; (4) to enhance presentation skills. In the Design Aesthetics (Lab.) course, students are required to challenge each of these 4 assignments, and continue until they achieve satisfaction. Students will learn to associate their brain and hands, and "move their hands, work up a sweat, let imagination loose, and create."
[Plans and Contents]
1. Overall guidance.
2. Assignment 1: Precision drawing using a pencil.
3. Assignment 1: Seminar.
4. Assignment 1: Criticism.
5. Assignment 2: Drawing of a solid object based on the elevation drawing.
6. Assignment 2: Seminar.
7. Assignment 2: Criticism.
8. Interim presentation
9. Assignment 3: Production of a tabletop lamp shade.
10. Assignment 3: Seminar.
11. Assignment 3: Criticism.
12. Assignment 4: Modeling of flying object.
13. Assignment 4: Seminar.
14. Assignment 4: Criticism.
15. Exhibition, summary, and criticism.
[Keywords] Observation, Thinking, Design, Presentation
[Textbooks and Reference Books] Not particularly.
[Evaluation] Evaluation is given by attendance works, and presentation.
[Related courses] Not particularly
[Course requirements] Not particularly
[Remarks] Not particularly

造形演習　Design Aesthetics(Lab.)
[Instructor] Takatoshi Tauchi
[Credits] 2
[Semester] 1st year-Spring-Tues 5
[Course code] T1Y016002
[Room] Innovation Plaza, Faculty of Engineering
[Course objectives] When awareness towards an issue leads to some form of result by an engineering means, making something with a better organized form in mind and making something without such cognition will produce very different results. Through exercise, students will learn what better organized forms are. In specific, students will be given assignments for each item shown in the course plan based on the specialized areas of the faculty member.
[Plans and Contents]
1. Overall guidance.
2. Assignment 1: Pencil sketch of a hand.
3. Assignment 1: Seminar.
4. Assignment 1: Seminar・Criticism.
5. Assignment 2：:Sketch of a solid object based on the three orthographic views.
6. Assignment 2: Seminar・Criticism
7. Assignment 3：Production of elastic band driven car.
8. Assignment 3: Seminar: Presentation of work based on the research findings.
9. Assignment 3: Production
10. Assignment 3: Presentation.
11. Assignment4: Production of a paper sandal.
12. Assignment4: Presentation of work based on the research findings.
13. Assignment4: Production
14. Assignment 4: Presentation.
15. Exhibition and criticism.
[Evaluation] Evaluation is comprehensively given by attendance, works, and the quality of presentation.
[Remarks] Wearing sandals and high-heeled shoes are strictly prohibited in Innovation Plaza, Faculty of Engineering

造形演習　Design Aesthetics(Lab.)
[Instructor] Yoichi Tamagaki, Yoshihiro Shimomura
[Credits] 2
[Semester] 1st year-Spring-Tues 5
[Course code] T1Y016003
[Room] Bldg. ENG-2–atelier (2–601)
[Course objectives] When awareness towards an issue leads to some form of result by an engineering means, making something with a better organized form in mind and making something without such cognition will produce very different results. Through exercise, students will learn what better organized forms are. In specific, students will be given assignments for each item shown in the course plan based on the specialized areas of the faculty member.
[Plans and Contents]
[Evaluation]

造形演習　Design Aesthetics(Lab.)
[Instructor] YosukeYoshioka
[Credits] 2
[Semester] 1st year-Spring-Tues 5
[Course code] T1Y016004
[Room] Bldg. ENG-1- 110
[Course objectives] When awareness towards an issue leads to some form of result by an engineering means, making something with a better organized form in mind and making something without such cognition will produce very different results. Through exercise, students will learn what better organized forms are. In specific, students will be given assignments for each item shown in the course plan based on the specialized areas of the faculty member.
[Plans and Contents]
[Evaluation]

造形演習　Design Aesthetics(Lab.)

[Instructor] Ueda Edilson Shindi
[Credits] 2
[Semester] 1st year-Spring-Tues 5
[Course code] T1Y016005
[Room] Bldg. ENG-2-102
[Course enrollment] 60
[Candidate] Students of Faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course description] Engineering is manufacturing, and manufacturing is a formative activity. The Design Aesthetics (Lab.) course aims to evoke students' interest in Engineering = manufacturing through several formative design projects and to awaken the individual talents in formative arts.
[Course objectives] When awareness towards an issue leads to some form of result by an engineering means, making something with a better organized form in mind and making something without such cognition will produce very different results. Through exercise, students will learn what better organized forms are. In specific, students will be given assignments for each item shown in the course plan based on the specialized areas of the faculty member.
[Plans and Contents]
1. Overall guidance.
2. Assignment 1: Precision drawing using a pencil.
3. Assignment 1: Seminar.
4. Assignment 1: Criticism.
5. Assignment 2: Drawing of a solid object based on the elevation drawing.
6. Assignment 2: Seminar.
7. Assignment 2: Criticism.
8. Interim presentation
9. Assessment 3: Select a theme from water, fire, soil, or wind, and freely create a form
10. Assignment 3: Seminar.
11. Assignment 3: Criticism.
13. Assignment 4: Seminar.
14. Assignment 4: Criticism.
15. Exhibition

[Keywords] Observation, Thinking, Design, move their hands, work up a sweat, let imagination loose, and create Presentation
[Textbooks and Reference Books] Not particularly
[Evaluation] Evaluation is given by attendance, works and quality of presentation. Attendance 40%, Presentation 60%.
[Related courses] Not particularly
[Course requirements] Not particularly
[Remarks] Not particularly

工業技術概論　Introduction to Industrial Technologies
[Instructor] Yun Lu
[Credits] 2
[Semester] Spring-Mon5
[Course code]T1Z05400
[Room] Eng.D-Bld.17-111
[Candidate] Students of Faculty of Engineering, and other Faculties
[Course description] First, the course will discuss the development of global industrial technologies with focus on Japanese technologies, changes of people's lives caused by technologies, environment and energy situations, and the history, current situation and future of industrial technologies. The course will also provide lectures on the necessary mindset as industrial engineers, resource research, how to write technical papers, and how to give research presentation, as well as guidance on studying and report writing techniques for students majoring in science and engineering.
[Course objectives] The objective is to increase the understanding of foreign exchange student majoring in science and engineering towards the development of industrial technologies and changes of people's lives caused by technology development, environment and energy situations, and to teach students the basic abilities that are required as industrial engineers (mindset, resource research, how to write technical papers, and how to give research presentation, etc.) as well as guidance on studying and report writing techniques for students majoring in science and engineering. At the same time, the course is aimed to enable foreign exchange students to gain a better understanding on the industrial technologies of Japan and to acquire the ability to contribute to the development of industries and technologies in their home countries or to work in Japanese companies in the future.
[Plans and Contents] The lectures will be given in 2 parts. Part 1: History, current situation and future of industrial technologies (Classes 1 – 9), and Part 2: Path to becoming a researcher. To ensure a better understanding, lecture resumes will be distributed on the web and lectures will be given using a projector. Achievements will be evaluated by reports and presentation (Classes 10 – 15).
1. Orientation and discussion about course content
2. Advances in industrial technology worldwide
3. Advances in industrial technology in Japan
4. Unique industrial technology
5. Industrial technology and life
6. Industrial technology and energy, the environment
7. 21st century industrial technology
8. How to write a report
9. Assignment presentation 1
10. Basic R&D thinking 1
11. Basic R&D thinking 2
12. Resource research
13. How to write a technical paper
14. Research presentations
15. Research presentations 2
16. Research presentations 3
[Textbooks and Reference Books] Textbook is not specified. Handouts will be provided via http://apei.tu.chiba-u.jp/Luyun-HP.html. Reference books will be introduced in class time.
[Evaluation] Attendance(30%) and exercises, report (30%) and presentation (40%), the total score 60 accredited.
[Course requirements] Not particularly
[Remarks] Foreign students only, the choice subject (F30 or F36) and no credit for Japanese students(Z99).

居住のデザインと生活技術　Dwelling Design and　Living Technology
[Instructor] Yun Lu
[Credits] 2
[Semester] Fall-Fri 4
[Course code] T1Z055001
[Room] Eng.D-Bld.17-213
[Course enrollment]　about40
[Candidate] Students of Faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course description] This course will be led by grand fellow Atsushi Maruyama.
[Course objectives] In the life of a person, there are various schemes being repeated in our given environment, the various designs that lead to scales of city or region from around us cannot be done elsewhere.　For foreign students aiming to go to form a professional environment, firstly, they need to focus on design and life skills for such residence, then think of the parallel development, also, in the present, they need to understand what is being deployed.
[Plans and Contents] We would like to discuss, in seminar format, examples of native students not only in the case in Japan, regarding the technology and lifestyle design for residential, and deepen the understanding. There are also plans of visits outside the university during the term.
1. October 3 – Orientation: What does “living” mean? How have people designed living spaces thus far?
2. October 10 – What types of houses can be found now in Japanese urban and rural areas?
3. October 17 – What types of houses can be found in Japanese historical rural and fishing areas?
4. October 19 (Sunday) – On-site observation: Boso Hudokinooka Open air Museum. (Bus tour)
5. October 24 – What types of houses can be found in Japanese historical urban areas?
6. November 7 – What trends have been seen in designing dining spaces kichen and family room?
7. November 14 – What trends have been seen in designing drawing rooms to allow for social relationships?
8. November 21 – What trends have been seen in designing amusement spaces for Noh and Kabuki?
9. November 28 – What trends have been seen in designing amusement spaces in Tokyo Disney land?
10. December 5 – How people have designed tea houses and Sukiya houses facing four seasons and nature?
11. December 12 – How people have designed tea gardens and imperial villa facing four seasons and nature?
12. December 19– How people designed religious spaces in dwelling houses and community during Bon and Shogatsu?
13. January 9 – How people designed religious spaces, Temples and Shrines in community?
14. January 23 – How people designed religious monument such as five storied pagodas ?
15. January 30 – Summary and Overall Discussion
[Keywords] Dwelling house, Design, Living Technology, Mealtime, Relationship, Religious Belief
[Textbooks and Refrence Books] Textbook is not specified. Reference books will be introduced with the process of class on appropriate time.
[Evaluation] Evaluation will be given by small questionnaire with attendance sheet, presentation of the report in seminars at each research room, and the final report.
[Course requirements] Not particularly
[Remarks] Foreign students only, subject of choice(F30 or F36)and no credit for Japanese students(Z99).