Course Description

Advanced Mechanical Engineering Laboratory
This course provides advanced mechanical engineering curriculum through various experiments in areas such as thermal/fluid engineering, vibration/control theory, mechanical design, manufacturing process, and solid mechanics.
Advanced Mechanical Engineering Instrumentation
This course deals with instrumentation systems for research and development in mechanical engineering with emphasis on uncertainty analysis as well as on practical skills for data acquisition/reduction procedure.
Design of Experiments
This course deals with principles of the design and statistical analysis of experiments. Some special topics such as response surface method and robust parameter design method are introduced.
Computer Aided Applied Mathematics
The students study the fundamental mathematical theories needed for the mechanical engineering researches, and then raises the practical problem solving ability by using computer softwares equipped with symbolic calculation. The topics include the differential equations, vector and tensor, matrix and linear algebra, and so forth.
Advanced Thermodynamics
This course helps students to understand advanced principles of thermodynamics such as materials properties, ideal gas, entropy, free energy of Gibbs and Helmholtz, chemical potential, state equation, Maxwell equation related with the 1st and the 2nd laws of thermodynamics,
Applied Thermal Engineering
This course provides an ability to apply basic understanding of Fluid Mechanics and Heat Transfer by means of theoretical analysis, numerical simulation, and experiment. A variety of applications are introduced such as automobile, bio, micro, and energy systems.
Advanced Heat Transfer
This course helps students to understand advanced principles of heat transfer by conduction, convection, or thermal radiation. Students learn the basic equations and their applications of thermal conduction, forced and free convection, phase change and heat exchangers.
Advanced Thermal System Design
Students learn the basic theories and their practical applications for analysis and optimal design of thermal systems.

Advanced Heat Exchanger
Students learn the basic principles for various heat exchangers such as evaporator, condenser, cooling tower, dryer, and heat pump, and study their practical applications for thermal and mechanical design of heat exchangers.
Energy Conversion Engineering
Students learn the basic principles for energy conversion from one type to another, and study the latest energy conversion methods as well as the conventional energy conversion cycles.
Advanced Air Conditioning
Students study the basic properties of humid air and learn the basic principles and their practical applications for various air conditioning equipments.
Cooling Design of Electronic Equipment
This course helps students to understand the design and analysis method for each cooling technology of electronic equipment. It also covers the recent research trend of electronic equipment.
Convective Heat and Mass Transfer
This course focuses on understanding of advanced principles of heat and mass transfer by internal, external, natural, and forced convection. Both principles and applications are studied in this course.
Advanced Fluid Mechanics
In this course, the following subjects are covered: governing equations for fluid motion, ideal-fluid flows (potential flows), viscous flows of incompressible fluids, low-Reynolds number flows, boundary layers, buoyancy-driven flows, and some spectial topics.
Viscous Fluid Flow
This course introduces students to viscous flows. The course begins with specific cases where exact solutions are possible. Similarity solution methods are then used to solve various problems. Approximate methods are subsequently dealt with, and topics associated with stability, transition, and turbulence are briefly explained.
Theory of Turbulence
In this course, we first cover the equations of fluid motion, statistical description of turbulent flows, and mean-flow equations. Then, we study the free shear flows, scales of turbulent motion, and wall flows. Finally, we describe turbulence modelling and simulation through the direct numerical simulation, eddy-viscosity models, and large eddy simulation.

Computational Fluid Dynamics
Computational Fluid Dynamics (CFD) is a field of fluid mechanics in which fluid flows encountered in engineering applications are analyzed and predicted using numerical methods. In this course, the following subjects are covered: basic concept of fluid flow, introduction to numerical methods, solution of Navier-Stokes equations, complex geometries, turbulent flows, efficiency and accuracy improvement, and some special topics.
Turbomachinery
This course provides basic design theories and test procedures for axial-flow and centrifugal turbomachines such as compressors, pump, and turbines.
Advanced Gasoline Engine
This course emphasizes on gasoline engine and helps students to learn the gasoline engine operating characteristics, thermodynamic analysis, fuel, the flow phenomena of cylinders, combustion phenomena.
Advanced Diesel Engine
This course emphasizes on diesel engine and helps students to learn the diesel engine operating characteristics, thermodynamic analysis, fuel, the flow phenomena of cylinders, combustion phenomena.
Advanced Combustion Engineering
This course emphasizes on the flow phenomena of cylinders, combustion phenomena, atmospheric pollution, etc. Course Description
Advanced Solid Mechanics
Fundamentals of solids mechanics are treated from the continuum mechanics view. The content of the solid mechanics in undergraduate school is extended and generalized to the graduated level.
Finite Element Method
Finite element analysis used in engineering fields is introduced. Fundamental concepts of finite element analysis are introduced with 1-D and 2-D problems. Numerical integration, differentiation, interpolation, extrapolation, error analysis are also introduced to deal with finite element analysis of engineering problems.
Advanced Mechanics of Composite Material
This course introduces materials and their applications, anisotropic elasticity, failure theories, and hydrothermal behavior of fiber reinforced composites. The optimal design of laminated composites based on their structure-property relationship is covered. It also covers the structural analysis and the evaluation of mechanical properties of composites.

Application of Finite Element Structural Analysis
This course introduces numerical techniques associated with the finite element analysis. Class contents include the approximation theory, variational principle, and Rayleigh-Ritz method with various shape functions and numerical integration techniques. Special emphases are usually placed on topics related to the structural analysis, dynamics, thermal analysis, and fluid mechanics using a commercial program of finite element analysis.
Sheet-metal Forming
The objective of this study is to understand basic concept for sheet metal forming such as anisotropy, formability and forming process.
Advanced Dynamics
This course provides a thorough, rigorous presentation of kinematics and dynamics while it uses a commercial package as an integrated tool to solve problems. Topics presented are explained thoroughly and directly, allowing fundamental principles to emerge through applications from areas such as multibody systems, robotics, spacecraft and design of complex mechanical devices.
Advanced Mechanical Vibration
This course is to teach students how to use the theoretical principles of vibration, and vibration analysis techniques, for the practical solution of vibration problems. It thus builds on students prior knowledge of vibration theory, and concentrates on the applications. A key feature is that students work on identifying and defining the problems to be solved, prior to solving them. This includes choices of assumptions, choices of measurements to be made and information to be investigated, and choices of analysis techniques to be employed. In keeping with the applied focus, the course includes practical analysis and measurement activities and a project.
Advanced System Dynamics
This course applies technical knowledge in mechanical system with an assistance of mathematics, computer program, and dynamics to lead the realization and evaluation of complex systems and its operation of systems. It also demonstrates and integrates the ability to perform user's needs for engineering goals by employing systems engineering thinking and processes.
Advanced Acoustics
This course is the branch of engineering dealing with sound and vibration. It is the application of acoustics, the science of sound and vibration, in technology. Students are typically concerned with the design, analysis and control of sound. Applicable goal of acoustical engineering can be the reduction of unwanted noise, which is referred to as noise control.
Injection Molding Design

This course covers computer design of product, mold, and processes for plastic injection molding. Use of a standard computer software (Moldflow) for the analysis of design will be taught.
LED Application Engineering
This course deals with basic theory of LED, packaging process of LED, thermal and mechanical characteristic, and optimal characteristic of LED. Also provide the system design method and applied cases such as indoor and outdoor lighting, LED backlight, broadcasting lighting, and car headlights etc.
Energy Engineering
This course helps students to widely learn forms and properties of fossil energy. Also, students can learn the forms and basic working principles of the new and renewable energy for alternating the fossil energy.
Alternative Energy Engineering
This course helps students to widely learn forms and properties of fossil energy. Also, students can learn the forms and basic working principles of the new and renewable energy for alternating the fossil energy.
Hydrogen Energy Engineering
This course helps students to widely learn forms and properties of fossil energy. Also, students can learn the forms and basic working principles of the new and renewable energy for alternating the fossil energy.
Advanced Energy Systems
This course helps students to widely learn fossil energy systems. Also, students can learn the structures and working principles of the new and renewable energy systems
Aerosol Dynamics
The objective of this study is to understand basic concept for aerosol that is defined as particle in the air. In addition, topics of transport, formation, analysis, and filtration of aerosol are considered in this course. The primary law for determining the above topics is the Stokes law which is intensively utilized throughout the semester.
Advanced Mechanics of Plastic Working 1
This course deals with the bulk forming such as forging, extrusion, drawing, rolling. Students learn the basic theories and their practical applications form this course
Advanced Metal Forming Analysis 1
This course deals with the basic theories for analysis of metal forming such as slab method and advanced theories such as implicit and explicit finite element method. This course also deals with the tribology and contact algorithm.

Advanced Theory of Inventive Problem Solving
This course deals with methodologies for finding creative solutions to technical problems. The course includes TRIZ theory, problem solving algorithms and application to real engineering problems.
Smart structure design and application
The class covers the theoretical basis, design, analysis, and manufacturing methods of the smart materials and structures for their engineering applications. A group project will be assigned to encourage hands-on experience and knowledge for the design, analysis and manufacturing processes on the smart materials and structures. Possible project topics will include the acoustic metamaterials based on the nonlinear elastic behavior of structures, smart structures based on the shape memory materials, and direct printing of smart materials/structures include sensors and actuators via 3D printing technique.
Seminar(1)
The objective of seminar is to understand state of the arts research of mechanical engineering and to improve presentation skill.
Seminar(2)
A research project is decided by a student and a professor. During two semesters, the student conducts the project under the supervision of the professor. The project could be fabrication project, design project, theory project, or experiment project.
Paper Research Work
A paper research work for master degree is decided by a student and a professor. The student conducts the paper research work under the supervision of the professor.
Advanced Paper Research Work(1)
A advanced paper research work for Ph.D is decided by a student and a professor. The student conducts the paper research work under the supervision of the professor.
Advanced Paper Research Work(2)
A advanced research work for Ph.D is decided by a student and a professor. The student conducts the paper research work under the supervision of the professor.