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COLLEGE OF ENGINEERING

The College of Engineering in Kookmin Univ. was founded in 1974 following the Korean government's policy for the development of industries. The College started with three departments, the Department of Metallurgical Engineering, the Department of Mechanical Engineering, and the Department of Civil Engineering. Since its foundation, the College of Engineering has continuously expanded its fields of study, establishing the Department of Mechanics and Design Engineering in 1976, the Department of Electrical Engineering in 1978, and the Department of Automotive Engineering in 1992. In 1997, the six departments were consolidated into four schools, the School of Advanced Materials Engineering, the School of Mechanical and Automotive Engineering, the School of Civil and Environmental Engineering, and the School of Electrical Engineering. For a great epoch-making jump in 2006, there was another significant condensation into 3 schools with similar characteristics, the School of Advanced Materials Engineering, the School of Mechanical and Automotive Engineering, the School of Civil and Environmental Engineering. In each school, multiple major fields of study are offered to students, and the courses in each major are taught in the most advanced areas by faculties with the highest academic knowledge and research experiences. The College of Engineering has produced numerous engineers and researchers of the highest expertise, and they have in turn made substantial influence on the developement of technology and on the growth of economy of Korea. The College will continually expand its academic and research capabilities, by hiring faculties of extraordinary ability and by continuously getting equipped with state-of-the-art facilities, so that students can be provided with the most up-to-date and top-quality engineering education.

SCHOOL OF ADVANCED MATERIALS ENGINEERING

The school of Advanced Materials Engineering in Kookmin Univ. was established in March 1974 as department of metallurgical engineering. In 1992, the department was renamed as department of metallurgical and materials engineering to enlarge the full spectrum of materials application. In 1997, our department was developed into school of metallurgical and materials engineering, composed of major in

metallurgical engineering and materials engineering major. At 2002, the school name was changed to school of advanced materials engineering, divided into two majors to cover all the aspects of materials' studies process design engineering major and materials engineering major. In 2007, all the majors were reunified into an advanced materials engineering major.

○ Educational Objectives of Advanced Materials Engineering

The goal of our school is to educate students who will become pro-active leaders in the field of materials related industry by utilizing their knowledge of materials engineering.

○ Goals of Advanced Materials Engineering Program

The highly developed industrial and technologically informative society needs ever the most creative engineers. For fulfilling these needs, the primary goal of our school is to produce engineers who can lead the exploitation of new technology in the fields of materials engineering. We offer the educational objectives, which our students have to possess as follows.

- Solve engineering problems by using fundamental engineering analytical methods and knowledge of material engineering.
- Apply their technologies to practical use by combining knowledge of materials engineering and knowledge of other fields.
- Learn the informatiue and practical abilities of performing their works at international societies.
- Properly express their thoughts and communicate effectively.

○ Educational Structure of Advanced Materials Engineering

The two majors are merged together in the year 2007. On the basis of accreditation criteria, suggested by ABEEK, an advanced program for bachelor of advanced materials engineering has been offered, which is separated from general program.

Advanced Materials Engineering Major

In the 21st century, the highly developed industrial and technologically informative society needs ever the most creative engineers. In accordance with the societal needs, our education system includes stimulating and challenging courses on the fundamental theory and applications of advanced engineering materials. We are focusing on establishing an advanced training cradle, which yields proactive leaders with a high expertise and an ability to contribute to improving technology and economy of our nation. After graduating from our school, students can take jobs in various industrial companies and research institutes including ferrous, nonferrous, mechanical, shipbuilding, automobile, electronic, and aerospace industries.

Also, our school offers MS and PhD courses for the students who are willing to take graduate courses.

- **Seminar in Special Topics (2)**

  Through communication between the instructor and the students, motivation and curiosity for science will be elevated. In addition, relationships among junior and senior students will be activated. This course will be an opportunity for students to prepare their professional goals. Depending on the instructor in charge, the title of this class can be modified such as Seminar, Research, Workshop, or Internship, and other heads.

Basic Courses

- **Physical Chemistry of Materials (3)**

  This is a basic course for understanding the chemical properties of materials, the transformation of substance, equilibrium, etc., introducing the concept of energy. The reaction kinetics is also studied primarily about the basic affecting factors on the chemical reaction.

- **Mathematics for Materials Science I (3)**

  This course is an introduction to some of the main mathematical techniques in engineering (particularly in Materials Science Engineering). It is intended to provide some background that goes beyond basic calculus, which covers from

linear algebra and vector calculus to Fourier analysis. Model problems commonly found in Materials Science and Engineering will be studied. Applications are emphasized throughout.

- **Modern Physics (3)**

The goal of this course is to understand modern physical concepts including relativity, particle properties of waves, wave properties of particles, atomic structure, quantum mechanics, quantum theory of the hydrogen atom, and band theory. Understanding modern physics will bring students some basic concepts for research on structural and electronic properties of materials.

- **Modern Chemistry (3)**

In this course, the principles and basic concepts for the understanding of various chemical properties having materials are studied. In particular, the content of this course include the molecular structure, chemical bonding, chemical analysis, and reaction mechanism correlated with materials.

- **Thermodynamics (3)**

This is a fundamental course for obtaining the knowledge of phase equilibria and the behavior of materials. The content of this course include auxiliary functions, statistical thermodynamics, behaviors of solutions, the equilibrium of chemical reactions, and thermodynamics of phase diagram, etc.

- **Basic Lab. I to Advanced Materials (3)**

In this lab course, understanding the basic physical properties of materials and measurement instruments are introduced. Through experiments and practice, students can learn the principles and operations of various experimental tools for characterization of basic physical properties of materials.

- **Mathematics for Materials Science II (3)**

This course provides some of the main mathematical techniques in engineering with particular emphasis on Materials Science Engineering. It is intended to provide some background that goes beyond basic calculus, which covers from partial differential equations, complex analysis and numeric analysis to statistics.

Model problems commonly found in Materials Science and Engineering will be studied. pplications are emphasized throughout.

- **Crystal Structure and Imperfections in Solids (3)**

  The subject treats crystal structure and imperfections in solids. The course aims to relate the topic with material strength and deformation for better understanding of mechanical properties of engineering materials. This course reviews basic crystalline structures and introduces point, line, and two dimensional defects in crystalline. Topics include cubic and hcp structures, structure of dislocation, stress field reaction of dislocation, the relation of point defect, dislocation and the two dimensional defect. Strengthening mechanisms based on the dislocation are also discussed.

- **Phase Equilibria and Microstructure (3)**

  The concept of phase equilibria, the analysis and the application of phase diagram has been introduced. The theories of diffusion and solidification will be introduced. Mainly, how to use basic theories of phase equilibria, diffusion and solidification to the industrial application will be studied.

- **Mechanics of Materials (3)**

  Mechanics of materials deals with the mechanical behaviors of materials when they are loaded. Topics include force and moment, the relationship between stresses and strains, mechanical matters on deformation, compression, torsion, bending, beam deflection, and buckling in a practical manner. This course may provide the fundamentals of elasticity and plasticity as well as the theoretical background of mechanical metallurgy and deformation processing.

- **Basic Lab. II to Advanced Materials (3)**

  Student project teams experience basic experiments on physical, chemical and thermal properties of materials and their relationship with the microstructures. Emphasis on teamwork, project management, communications and computer skills, and hands-on work at KMU laboratory shops. Teams document their progress and final results by means of bi-weekly written reports. Instruction and practice in oral communication is provided.

- **Capstone Project I in Advanced Materials (3)**

  Engineering problems, which could be applicable to different industrial sectors, of advanced materials engineering are to be solved. Problem solving undertakes during discussion and researching by the team of students, professors and experts from industries.

- **Computer Modeling (3)**

  This course provides the basic concepts of computer modeling in materials science and engineering. It covers techniques and software for simulation, data analysis and visualization, continuum methods to study fundamental physical phenomena encountered in the field of materials science and engineering.

Major Courses

- **Introduction to Advanced Materials (3)**

  This course provides an overview of Materials Science and Engineering as a basis for understanding how structure/property/processing relationships are developed and used for different types of materials. Topics also include the defects in materials, diffusion phenomenon and deformation methods.

- **Introduction to Advanced Materials Processing (3)**

  Topics include the basic theories on the manufacturing process, properties, working and application of various materials including metals, ceramics and polymers. Broad knowledge on the advanced materials will be handled as preliminary subjects prior to the main course.

- **Surface Engineering (3)**

  The purpose of this subject is to understand the fundamental principles of surface engineering, the process of treatment, and evaluation techniques. Topics include the basic theory of electrochemistry, plating, anodizing, conversion coatings, the physical vapor deposition, the chemical vapor deposition, characterizing of films, and batteries, etc.

- **Introduction to Ceramics (3)**

  Definition and crystal structures of ceramic materials are fundamental topics and different kinds of bonding and defect structures are advanced subjects in this course. In addition, it includes effects of crystal structures and defect structures on their physical properties.

- **Mass Transport and Microstructures (3)**

  This course is intended to be an introduction to the field of transport phenomena for students of engineering and applied science. It covers the subjects of momentum transport (viscous flow), energy transport (heat conduction, convection, and radiation), and mass transport (diffusion). In this treatment the media in which the transport phenomena are occurring are regarded as continua, and very little is said about the molecular explanation of these processes. Surely, the continuum approach is of more immediate interest to engineering students, although it should be emphasized that both approaches are needed for complete mastery of the subject. Knowledge of the basic laws of mass, momentum, and energy transport has certainly become important, if not indispensable, in engineering analysis. In addition, this class may be of interest to some who are interested in physical chemistry, solid physics, meteorology, and biology.

- **Production and Refining Process Engineering of Metals (3)**

  Topics include the basic theories on the processing of iron and non-ferrous metals thermodynamics, reaction rate theory, and solidification. The course also covers the iron and steel making process and non-ferrous metals production process as well as the technology for preventing pollution.

- **Mechanical Behavior of Solids (3)**

  This course introduces the basic concept of deformation and fracture of engineering materials. The strength and deformation is one of the most important materials characteristics of structural materials for broad application in industry. The effects of microstructure and defects of materials on deformation and fracture are treated on the basis of materials science. Topics include elasticity and plasticity theory, strengthening mechanisms of metals, tensile behaviors, fracture, and fatigue.

- **Phase Transformations in Materials (3)**

  The microstructure of condensed matter is dependent upon temperature, pressure, thermal history, and other variables. Microstructure of the materials can cause dramatic variations in their properties. An understanding of the development of microstructure in metals, rooted in thermodynamics, crystallography and kinetic phenomena is essential for the materials scientist. The topics also include surface effects, nucleation and growth kinetics, solidification, diffusionless solid state transformation, and microscopic theory of phase transition.

- **Electrons in Solid States (3)**

  This course provides the analysis of charge carrier movement in solids and understanding of the electrical, thermal, magnetic, and optical properties of solids. From this course, students can learn electronic properties of various electronic materials.

- **Corrosion Science and Engineering (3)**

  This course is designed for a comprehensive treatment of the fundamentals of corrosion and its control in metals and alloys, treating the review of electrochemical principles, thermodynamics, and kinetics associated with corrosion reactions. Topics also include the discussion of Poubaix diagrams, polarization of electrode reactions, passivity, pitting, and crevice corrosion, methods of corrosion prevention such as anodic and cathodic protection, inhibitors, protective coatings, and the proper alloy selections of particular corrosive environments.

- **Design and Evaluation Lab. I to Advanced Materials (3)**

  Student project teams experience advanced experiments on physical, chemical and thermal properties of materials and their relationship with the microstructures (heat treatment, tensile tests, optical microscopy, etc.). Emphasis on teamwork, project management, communications and computer skills, and hands-on work at KMU laboratory shops. Teams document their progress and final results by means of written reports every four weeks. Instruction and practice is provided in oral communication.

- **Computational Materials Science (3)**

  This course introduces advanced computer modeling methods in materials science and engineering using discrete particle systems and continuum fields. It covers techniques and software for statistical sampling, simulation, and uses statistical, quantum chemical, molecular dynamics, Monte Carlo, mesoscale and continuum methods to study fundamental physical phenomena encountered in the fields of computational physics, chemistry, mechanics, materials science, biology, and applied mathematics. A term project allows development of individual interests. Students are mentored by members of CMS Lab.

- **Transport Phenomena (3)**

  Newtonian fluids, the Navier-Stokes equation, turbulent flow, the Bernoulli equation, transport of heat by conduction, transport of heat by convection, and transient heat flow are topics covered in this course.

- **Electric, Magnetic, and Optical Properties of Materials (3)**

  Fundamental properties of advanced engineering materials has been introduced in this course. It covers electrical, magnetic, and optical properties and their applications.

- **Polymer Science and Engineering (3)**

  This course introduces the concept of structure, synthesis, physical/chemical properties of polymer materials which is one of most important characteristics for material applications in industry. Topics include elastic and plastic theory, strengthening mechanism of polymer materials, tensile behavior, and structure.

- **Plastic Deformation of Metals (3)**

  The elastic and plastic behaviors of metals under applied force are discussed in this course. The principles and techniques of plastic working are also introduced. The capability of machinery is described. Fracture and cutting sequences are taught, and prevention methods are discussed.

- **Joining Science and Engineering (3)**

  This course is designed to understand the theories and methods of joining, and

joining related phenomena. Topics covered are the microstructural and mechanical changes of weldments due to welding, its heat treatment, heat transfer of welds, solidification phenomena of welds, the defects and cracks in weldments as well as the heat-affected-zone, and the methods to prevent joining from cracks.

- **Ferrous Materials (3)**

  This course is designed to understand the properties of steel and alloy steel as major engineering materials. Topics include heat treatment, the variety of steel, and the application of ferrous materials.

- **Surface and Interface Science (3)**

  This course surveys the basic concepts of surface and interface free energy, various phase transitions on the surface and interface such as surface roughening, surface reconstruction, etc. Goals of the course also include the understanding of reaction rate on the surface and interface, physi- or chemi-sorption, the role of stress in thin film growth, etc.

- **Aerospace Engineering Materials and Processes (3)**

  Development of the aerospace industry requires new materials with high-temperature resistance, and extremely low density. This course is designed to give an introduction of the properties and applications of special alloys and composites for aerospace applications. Deformation and fracture of metallic alloys at high temperature are intensively treated, and superplasticity and composite materials are also explained. Other topics include fabrications of high-temperature and low density alloys, as well as their research trends related with industry.

- **Semiconductor Devices and Physics (3)**

  This course is designed to understand semiconductor physics - the effects of impurities, p-n junctions, as well as contacts between metal and semiconductors. Based on physics, the characteristics of solid state devices, such as diode, bipolar transistor, and field effect transistors are discussed.

- **Design and Evaluation Lab. II to Advanced Materials (3)**

  This lab course provides the advanced understanding of general material processes

and properties as well as performing the advanced experiments related to the processes and properties of materials. Topics include semiconductor and nano-sized material processes of metals, ceramics, and polymers. Through this course, students can learn the principles and operations of various experimental tools for the characterization of advanced physical properties of materials with emphasis on the industrial applications.

- **Theory of Teaching in Mechanical & Materials Engineering Education (3)**

  The purpose of this course is to achieve the basic knowledge of metallurgy for a teacher in a vocational high school and to improve the attitude of a teacher who can lead his or her students to apply their knowledge in industry.

- **Text Research and Teaching Methodology in Mechanical & Materials Engineering Education (3)**

  In this course, text research and teaching methodology for metallurgical engineering education are studied for preparing to attain a vocational high school teacher license.

- **Capstone Project II in Advanced Materials A/B (3)**

  The purpose of this class is to provide the methods of solving the engineering problems commonly encountered in industrial applications. The instructor and students will discuss in the class the various topics related to the engineering problems to understand the phenomenon and to solve the problems.

- **Metallic Materials Processing (3)**

  Understanding basic theories about phase transformation and deformation of metallic materials and applying basic theories to industrial use will be studied. Mainly, thermomechanical processing, multi-phase materials, ultrafine-grained materials, shape memory materials will be introduced.

- **Nanostructured Materials Process (3)**

  The course is designed to understand the relationship between nanomaterials' processes and their physical properties and applications. In particular, characteristics and processing fundamentals of 0, 1, and 2－Dimensional nanostructure materials

are considered as a main subject.

- **Electron Microscopy (3)**

  This subject is designed for the understanding of the basic principle of electron microscopy and its application. Topics cover the structure of electron microscope, the interaction of electrons with materials, electron diffraction, the reciprocal lattice, Kikuchi line, contrast theory, image interpretation, special techniques, and chemical analysis, etc.

- **LCD Processing and Design (3)**

  This course is designed for the understanding of the fundamentals of LCD engineering, such as principles of LCD operation, process for manufacturing, characteristic of materials and parts, and material properties related to structure. Emphasis on materials design in relation to fundamental device characteristics.

- **Energy Storage and Conversion Materials (3)**

  This is the course to understand the electrochemical principles related with energy storage and conversion materials and how to apply those principles to the relevant industries such as primary and secondary batteries, fuel cell and hydrogen storage materials. This course covers the fundamental concepts of thermodynamics and the equilibrium and the kinetics of electrochemical reactions associated with energy conversion materials and methods.

- **Materials for Electrical Application (3)**

  This course is designed to understand the properties and fabrication of metals for resistor, cable, and heater applications. Topics also include the characterization and evaluation of electrical materials and their applications.

- **Electronic Materials Processing (3)**

  The purpose of this course is to gain an understanding of the principles and techniques of materials processing for semiconductor device fabrication. Topics include oxidation, diffusion, ion implantation, photolithography, etching, mentalization, and packaging processes for integrated circuit devices. The relationship between

the unit process and integration is also discussed.

- **Instrumental Analysis for Materials Science and Engineering (3)**

  This course is focusing on the fundamental principle of instrumental analysis, which is useful for characterizing semiconductor, ceramic, and metallurgical materials. This course is going to deal with principles and practical applications of various instruments for materials engineers.

- **Metallic Materials for Automobiles (3)**

  The basic theories used in the production of automobile parts will be introduced. Especially, the method to improve the properties of materials will be discussed by using the knowledge about phase transformation, solidification, deformation and the relationship between microstructure and mechanical properties, based on the requirements for the application of metallic materials to automobile parts.

- **Industrial Practice (3)**

  The purpose of this course is to apply the knowledge which is gained through classes to actual industrial situations. Students are required to practice at a steel making factory, ship making factory, automotive factory, heavy industrial factory or semiconductor factory. Through the practical experience, theories learned in class are more understood and confirmed. In addition, the ability to act in an industrial situation is improved.

- **Electronic Display Engineering (3)**

  The purpose of this course is to gain an understanding of the principles and techniques of materials and process for flat panel displays (EL, LCD, PDP, FED....) fabrication. Topics also include the characterization and evaluation of display materials and related technologies. Emphasis on materials design in relation to fundamental device characteristics.

- **Thin Film Processing (3)**

  The object of "Thin Film Engineering" class is not only to document what is known about thin films including multilayers, but also to promote the potential of these versatile thin films and to facilitate the adsorption of the technology by

others. The field introduced in this class is new. This class will show that thin films including multilayers represent a model platform for promoting modern research and furthermore, the intellectual distance between concept and application is minimal.

- **Nonferrous Materials (3)**

  Nonferrous metallurgy is designed for the understanding of subjects such as ore preparation, pyrometallurgy, hydrometallurgy, electrometallurgy, and the understanding of the corresponding thermodynamic principles and reaction kinetics. Metal extraction processes will be treated on nonferrous metals such as copper, zinc, lead and aluminum, including their applications.

- **Design of Materials (3)**

  This course focuses on technical economy, technology strategy and planning, optimization, materials' selection, process design, cost evaluation, engineering statistics and quality control.

- **Powder Processing (3)**

  P/M refers to a range of manufacturing and metalforming practices that are used to produce net or near-net shape parts from mixtures of metal and alloy powders. The primary commercial P/M processes for the production of parts and components are pressing and sintering direct powder consolidation by hot isostatic pressing and the densification of a preform by forging.

SCHOOL OF MECHANICAL AND AUTOMOTIVE ENGINEERING

School of Mechanical and Automotive Engineering in Kookmin Univ. was started with the Department of Mechanical Engineering in 1974 in line with the Korean government's policy for the development of industries. Since its foundation, the Department of Mechanics and Design Engineering and the Department of Automotive Engineering were established in 1976 and 1992, respectively to expand its fields of study. In 1997, three Departments were consolidated into one school, as Mechanical and Automotive Engineering with the three majors such as Mechanical Engineering, Mechanics and Design, and Automotive Engineering. In 2005, the three majors were again consolidated into one major, Mechanical and Automotive Engineering. The purpose of this consolidation was to meet the changes and requirements in the industry of mechanics and automobiles with more upgraded and practical curriculum, so that we could educate the students as the future leaders well-prepared in the fields of space and nano/bio engineering as well as automotive engineering. The new curriculum covers both specific and general areas of mechanical and automotive engineering.

Mechanical and Automotive Engineering Major

Students take this major as it is practical, and useful with high end technology for mankind and environment. After graduation, they will be able to work actively and creatively as experts and leaders in various fields of mechanical and automotive engineering. The educational focus of this major is as follows :

1) Students will learn the advanced technology and knowledge of mechanical and automotive engineering which will ultimately provide them with good capabilities to solve various practical problems related to their major.
2) Based on their advanced understanding of mechanical and automotive engineering, students will be able to develop creative capabilities to apply their knowledge to comprehensive mechanical designs.
3) Students will be trained to cultivate lifelong upgrade capability in their special areas, which is required more and more in the globalized world and in the age of information and technology.
4) Through the team work system for various projects, students will be trained to acquire professional communication skills and leadership to fulfill their responsibilities

as future experts in mechanical and automotive engineering.

Basic Courses

- **Statics (3)**

  Basic concepts of Newton's law, moment, couple, resultant, equilibrium, centroid, centers of gravity, analysis of structures, forces in beams and cables, friction, moments of inertia in areas moments of inertia in masses, and the method of virtual work are covered in this course.

- **Applied Engineering Mathematics (3)**

  This course describes application of differential equations in engineering. Topics include ordinary differential equations, Laplace transform, Fourier series, partial differential equations, integration in the complex plane, and conformal mapping.

- **Thermodynamics (3)**

  This course helps in understanding the role of thermodynamics on mechanical engineering. Definitions and basic concepts of thermodynamics, properties of pure substance, work and heat, the first law of thermodynamics, system and control volume, steady-state flow processes, heat engines and refrigerators, reversible processes, the second law of thermodynamics, entropy, and cycle efficiency are described in this course.

- **Solid Mechanics (3)**

  The mechanics of deformable solids in equilibrium which exhibit mainly the elastic behavior is taught. Specifically, the important concepts of stresses and strains are first introduced, followed by the analyses of various structural members subjected to axial loads, torsion, and bending moments in order to determine the deformation modes and the corresponding stresses produced under such external loading conditions. The design projects are to be conducted and presented by the students at the end of this course.

- **Dynamics (3)**

  Dynamics of particles history of dynamics, dimensions, rectilinear motion, plane

curvilinear motion, rectangular coordinates, normal and tangential coordinates, polar coordinates, space curvilinear motion, relative motion, Newton's second law, work and kinetic energy, potential energy, linear impulse and linear momentum, angular impulse and angular momentum, impact, central-force motion. Dynamics of rigid bodies rotation, absolute motion, relative acceleration, motion relative to rotating axes, general equations of motion, translation, fixed-axis rotation, general plane motion, work-energy relations and impulse-momentum equations.

- **Computer-Aided Mechanical Drafting (2)**

  This course provides fundamental theory in engineering drawing for expressing designer's intent. Topics include orthographic projection, dimensioning, sectioning, exploded and auxiliary views, and assembly drawings.

- **Fluid Mechanics (3)**

  This course describes the field of applied mechanics concerned with the behaviors of liquids and gases at rest or in motion. Some experimental and theoretical analysis will be included to explain fluid behaviors. In the field of theoretical analysis to describe the fluid behaviors, mathematical formulations which are based on the principles of mass conservation and Newton's second law are covered. To fulfill the objective of this course, basic concepts of fluid mechanics are applied to real problems.

- **Engineering Materials (3)**

  This course gives an introduction to the materials and their properties in mechanical engineering applications. Processing, structure and property relations in engineering materials such as metals, ceramics, polymer and composites are main topics covered in this course.

- **Numerical Analysis (3)**

  This course is intended to introduce the theories and methods that are required when finding the approximate solutions to various engineering problems of practical importance. Topics including error analysis, roots of equations via bracketing and open methods, Gauss elimination, LU decomposition, matrix inversion,

curve fitting methods involving regression and interpolation, numerical differentiations, and various numerical integration formulas are covered.

- **Creative Engineering Design (3)**

  This course provides the design fundamentals, the use of many engineering tools, and the preparation of experiment, report, and portfolio. Students carry through individual planning, design, and manufacturing about the project given.

- **Probabilities and Statistics (2)**

  This course helps students to apply mathematics to solve real-world problems dealing with probability, statistics, and data analysis. Topics include descriptive statistics, probability models and related concepts and applications, statistical estimation, and hypothesis testing.

- **Mechanical Engineering Design (3)**

  A beginning course in mechanical engineering design a review of the mechanics of materials, engineering materials, failure theories, and the design of mechanical elements (screws, keys, pins, joints, welding, and adhesive bonding).

- **Experiments in Mechanical and Automotive Engineering I (2)**

  Basic principles and experimental techniques in mechanical and automotive engineering are explored. Topics include measurement of various mechanical variables including temperature, pressure, velocity, flow rate, and thermal conductivity measurement of stress and strain measurement of variables related to various mechanical elements, observation experiment in properties/ microstructures of materials stress and strain experiment of structural elements elementary thermal and fluid engineering experiment basics of vibration modal test wheel suspension mechanism test experiment in measurement basics moment of inertia experiment basic experiment in data collection.

Major Courses

- **Programming Languages (3)**

  This course studies problem solving methods and procedures using computer.

Based on fundamental knowledge on computer hardware and software, the function and usage of C programming language are studied.

- **Fortran Programming (3)**

FORTRAN is one of the most widely used computer languages to write programs for solving problems in science and engineering. In this course, the basic grammar and structures of FORTRAN as the programming language are introduced, with an emphasis on algorithm design and program coding. The students are then expected to have the ability to develop his or her own programs to solve the engineering problems.

- **Introduction to Electrical and Electronic Engineering (3)**

This course covers fundamental theories in the electrical and electronic engineering that are required for mechanical and automotive engineers. The topics include fundamentals of electric circuits, resistive network analysis, equivalent circuits, AC network analysis, frequency response, amplifiers, and digital logic circuits.

- **Applied Thermodynamics (3)**

The second law of thermodynamics, various power cycles, refrigeration and air conditioning systems, compressors and gas turbines and chemical reactions are studied. Based on these theories, the design of thermodynamic systems is carried out to solve practical engineering problems.

- **Applied Solid Mechanics (3)**

This course is a continuation of the prior prerequisite to solid mechanics, focusing on the applications of basic concepts and principles of solid mechanics to various engineering materials and structures. Following a brief but overall review on the fundamentals of solid mechanics, the topics covered are transverse shear effects, combined loads, three-dimensional constitutive relations, stress-strain transformations, design and deflection of beams and shafts, buckling and stability of columns, and energy methods. The students should conduct the design projects and present the results before the end of this class.

- **Mechanism Design (3)**

  This course fowson the velocity, acceleration of moving parts in machine elements and mechanisms using graphical and analytical techniques. Topics covered include use of vector, graphical, and matrix methods for kinematic analysis, introduction to graphical and computer methods for kinematic synthesis of mechanisms, linkage systems, cams, gears, gear train design, and analysis.

- **Heat Transfer (3)**

  The basic modes of heat transfer, such as conduction, convection and radiation are considered in this course. The multiple dimension of steady state conduction, unsteady state conduction, the numerical analysis of heat conduction, the principle of convection heat transfer, and forced convection heat transfer are studied in this course. Heat sink design is carried out using the combined heat transfer modes of conduction, convection and radiation.

- **Manufacturing Process (3)**

  An introduction to conventional manufacturing processes casting, metal forming, cutting, grinding, welding, and the influence of the process on the final mechanical properties of a product. Emphasis is on the practical applications with various examples.

- **Applied Fluid Mechanics (3)**

  This course covers viscous flow in pipes including Hagen-Poiseuille flow, drag and lift by flow over immersed bodies, boundary layer analysis, differential analysis of fluid flow, potential flow, and fluid flow measurement. A brief introduction to open channel flow and compressible flow are provided in case time permits.

- **Automatic Control (3)**

  Introduction to classical control theories for linear dynamic systems. Modeling and linearization of dynamic systems. Root locus and frequency response design methods. Compensator design for designed performances.

- **Applied Mechanical Engineering Design (3)**

  The second course in mechanical engineering design design of mechanical elements as applied to machines and automotives (springs, bearings, brakes, gears, flywheels, and design applications).

- **Applied Computer-Aided Drafting (2)**

  The fundamentals of 3D commercial CAD system are taught in order to incubate(s) student's practical abilities through actual training. This course consists of coordinate system, feature modeling, curve modeling, surface modeling, and assembly modeling.

- **Experiments in Mechanical and Automotive Engineering II (2)**

  The principles and advanced techniques in mechanical and automotive engineering are explored in brief lectures and experiments. Topics include operation and performance experiment of various apparatus in thermal and fluid engineering mechanical vibration material mechanics (elastic and plastic) material test applied mechanics experiment vehicle suspension simulator shock absorber experiment steering system simulator vehicle harshness and vibration experiment vehicle safety experiment pneumatic control experiment vehicle drivetrain system simulator thermal and fluid engineering experiment electrical apparatus experiment.

- **Automotive Technical Training (1)**

  Basic automotive shop training of engine, suspension, steering, brake, and drive train.

- **Manufacturing Process Lab (1)**

  Practice of basic manufacturing processes (turning, milling, drilling, welding, measurement, etc.) to get the knowledge of machine tool characteristics and basic operations.

- **Industry Practice (1)**

  The Industry practice course proposes a practical training in an industry arranged by ABBEK program. All participants gain experience in realistic manufacturing and design processes at the pertinent department of the industry.

- **Mechanical Vibration (3)**

  Free and forced vibrations, with damping, of linear systems with one-, two- and multi-degree of freedom. Transient vibrations. Vibration measurement and evaluation. Vehicle vibration analysis.

- **Driving and Braking Systems (3)**

  This course covers the following topics vehicle drag driving force by engine power-train structure characteristics of the transmission vehicle performance the brake system structure friction characteristics of the brake system, tire and road braking performance ABS system.

- **Finite Element Method (3)**

  This course introduces the basic concepts and theories such as direct stiffness method, energy method, Galerkin's weighted residual method for finite element formulation. Applications to stress analyses and structural analyses are practiced with an educational Finite Element package.

- **Automotive Structural Analysis (3)**

  Load input and boundary conditions, the matrix method, an introduction to FEM, bar and beam element, 2-D and 3-D elements, and FEM applications to vehicle body analysis (strength, stiffness, safety, vibration).

- **Structural Analysis and Optimum Design (3)**

  An introductory course on deformation and stress analysis with constraints for mechanical, automotive, aerospace structures, bio-medical components, and electronic materials by using matrix methods, finite element techniques, and analytical or numerical optimization routines. Design objectives are failure minimization, cost-minimization and so forth.

- **Computer-Aided Design (3)**

  Fundamental theory and practical aspects of CAD system are explored. Topics include introduction to computer graphics basic freeform curves, and surfaces solid modeling systems feature-based parametric design standard data exchanges mesh generation.

- **Introduction to Elasticity (3)**

  The students who have taken the prerequisite courses of both the solid mechanics and applied solid mechanics are eligible for this course, where the exact or more accurate theoretical methods of solutions to describe the elastic behavior of engineering materials are treated. Specific topics covered include constitutive relations, state of plane stress and plane strain, St. Venant's principle, compatibility equations, Airy stress function, Navier's equations, thermal stresses and problems in polar coordinates, with applications to various boundary value problems involving beams analysis, stress concentrations due to cutout, axisymmetric problems of thick cylindrical structures and torsion. Further topics discussed are the plastic flow and the failure criteria.

- **Computational Heat Transfer and Fluid Flow (3)**

  A mathematical description of physical phenomena, the concept of numerical solution, discretization methods, construction of the numerical method, heat conduction, interaction of convection and diffusion, and calculation of the flow field as well as the STMPLE algorithm are taught in this class.

- **Thermo-Fluid Dynamics (3)**

  This course is intended to provide the foundation of thermo-fluid mechanics. Topics include hydrostatic waves, the Navier-Stokes equation, miscellaneous topics in thermodynamics, and flow with heat transfer.

- **Internal Combustion Engines (3)**

  An introduction to the automotive internal combustion engines thermodynamics, fluid dynamics, mechanics of materials, and the influence of performance and exhaust gas properties. Emphasis is on the practical applications with various examples.

- **Heat Exchanger Design (3)**

  With the best knowledge of conduction heat transfer, convection heat transfer, radiation heat transfer, condensation and boiling heat transfer, design of various heat exchangers is carried out for practical engineering applications.

- **Digital Control (3)**

  Introduction to computer implementation of controllers for linear dynamic systems. Analysis of sampled data systems. Root locus and frequency response design methods. Compensator design for desired performances.

- **Robotics (3)**

  Introduction to the fundamental principles of robot engineering. Although this course covers a fair amount of robot manipulator's mechanics, kinematics, dynamics, position and force control, and trajectory planning, it also covers the application of actuators and sensors which are the basic components of robot system. Finally student can learn the principles of microprocessor through making a small robot as line tracer system.

- **Measurement and Instrumentation (3)**

  Principles of measurement with digital sampling and spectrum analysis are introduced and measurement methods for distance, time, velocity, force and pressures are lectured in this course. In order to exercise the spectrum analysis of digitally sampled data, data acquisition softwares such as Labview, Matlab and Methmatica are used in this course. Some experimental micro-nano optic measurements of gap distance are also introduced for the real measurement skills.

- **Human Factors (3)**

  This course covers the basic concepts and techniques of work methods and work measurement. The focus of this course is on designing the jobs, work-places and tools for people, personnel systems to support production and management, and on the application of software for the workplace design.

- **Micro/Nano System Design (3)**

  Fundamental theories and advanced technologies are introduced for the recent developed nano-micro precision actuators and measurement systems. The nonlinear characteristics of the integrated micro-nano systems is also covered and their applications lay on the designs and concepts of micro-nano actuator and measure-

ment systems, semiconductor fabrications and manufacturing equipments, optical measurement systems, scanning probe microscopes and micro-nano tribology systems.

- **Theories of Teaching in Mechanical and Materials Engineering Education (2)**

  Various subjects on teaching technical high school students in mechanical engineering, such as history or the effectiveness of mechanical engineering education.

- **Text Research and Teaching Methodology in Mechanical and Materials Engineering Education (2)**

  Development of teaching materials and effective teaching methods for automotive engineering education at the industrial high school level.

- **Capstone Design I, II (3)**

  The Capstone Design proposes a practical and innovative engineering education which covers creating concrete ideas, making designs, doing simulations and manufacturing the final products for General industrial and Automobile machines. The participants for this course learn how to apply engineering design consideration such as robustness and stability and practice team-based manufacturing so as to realize the design.

- **Noise Control Engineering (3)**

  Engineering noise control theory. The wave equation and acoustic field variables. Sound intensity and sound power. Sound sources and outdoor sound propagation. Acoustic enclosures and barriers. Noise control strategies.

- **NVH in Automotive Engineering (3)**

  Sources of vehicle vibration and noise engine, powertrain, suspension system, chassis, tire and road. Characteristics of vehicle vibration and noise shake, shimmy, brake judder, booming noise, beats, harshness, tire noise, whistle noise, rumble noise, gear noise. relation between noise, vibration and operating parameters. relation between noise and engine combustion system.

- **Vehicle Dynamics (3)**

  This course covers the following topics vehicle comfortableness, steady-state cornering characteristics, suspension and steering system, roll-over tire characteristics, and lateral dynamics of a vehicle.

- **Advanced Materials in Automotive Engineering (3)**

  This course deals with advanced materials in automotive and aeronautical engineering. Processing, properties and application of metals and nonmetals are covered in detail and the role of advanced materials in mechanical behavior, echanics, performance and efficiency will be studied.

- **Materials and Design (3)**

  Scientific and industrial design basis for material selection problems in engineering design. Case studies may include concepts for automotive or aerospace composite structures, electronics, sporting goods, micro-nano structures, and bio-materials.

- **Vehicle Body Design (3)**

  This course fowson vehicle body design concepts, strength design, stiffness design, vibration design, light weight design, safety design, theory and the exercise of vehicle design applications. Emphasis is on body concept for design using FE modeling of thin walled structural elements. Practical application of solid/structural mechanics is considered to design automotive bodies for global bending, torsion, vibration, crashworthiness, topology, material selection, packaging, and manufacturing constraints.

- **Chassis System Design (3)**

  The detail structure of suspension and steering system of automobile vehicle are introduced. The students study the basic skills for chassis design engineers method, which is based on the vehicle dynamics. The course covers the following topics fundamental theory for vehicle dynamics, cornering compliance concept, optimization of Ride & Handling characteristics, kinematic design of suspension and steering system, compliance design component and structure design.

- **Strength and Fracture of Materials (3)**

  The failure behaviors of engineering materials and structures are studied from the standpoint of strength and fracture of materials in order to gain relevant concepts and knowledge that are useful in understanding the failure causes and preventions. In this regard, various conventional failure models and criteria are reviewed and the deformation modes due to the existence of crack-like defects are introduced, introducing the concepts of crack driving forces and fracture toughness. The fatigue behavior of engineering materials with and without the cracks and the method to predict the corresponding fatigue life are also dealt with.

- **Intelligent CAD (3)**

  This course covers the existing CAD theory and system, and discusses functions and items necessary to realize the intelligent CAD system. This course discusses Artificial Intelligence, Virtual Reality, Distributed Design Environment, and the latest CAD technology.

- **Heating, Ventilating, and Air Conditioning (3)**

  Topics include theories and applications of psychrometrics, load calculation, air conditioning/planning, as well as HVAC equipments, piping & duct design for a building. Joining a practice HVAC design is a mandatory for students. Completing this course, a student should be capable of participating in the design of a basic HVAC system.

- **Heat Engine (3)**

  This course provides the fundamentals of steam power station including characteristics of steam cycle and steam boilers, fuels and combustion, steam turbines, steam engines, condenser, and nuclear power plant.

- **New and Renewable Energies (3)**

  The theories, methods, and problems at realization of the new and renewable energy sources are lectured, which include fuel cell, geo-thermal energy, solar energy, biomass, small hydraulic energy, tidal energy, wind power, coal and crude oil gasification, refuse energy, and hydrogen.

- **Applied Design with Computational Fluid Dynamics (3)**

  Training course to experience design and analysis for heat transfer and fluid flow with educational CFD(Computational Fluid Dynamics) package, Emphasis is on practical applications with various examples.

- **Plant Engineering (3)**

  Engineering methods and management technology for plant design, construction, and operation are lectured, which include energy and power plant, environmental plant, chemical plant, etc.

- **Design of Energy Systems (3)**

  System design concepts, modeling equipment, economic considerations, equation fitting, system simulation, optimization, Lagrange multipliers, dynamic programming, geometric programming, linear programming, applications of various energy systems, and design term projects.

- **Power-Train Design (3)**

  For the automotive transmission systems, the fundamentals, practical design and intelligent control concepts of conventional manual, automatic systems and dual clutch and continuously variable systems for the hybrid and electric motor-driven vehicles are covered in this course. The mechanisms of torque converter are also introduced in order to better understand the matching concepts between engine and transmission. Basic concepts and technologies of hydraulic controls, kinematics and dynamics of epicyclic gear sets and clutches, power flows of gear trains, matching mechanisms between engine and transmission, tribo-control and lubrication circuits are studied in this course.

- **Alternative Energy Vehicles (3)**

  A study of up-to-date technologies for future alternative fuel vehicles bio-diesel, bio-ethanol, GTL(gas to liquid), DME(dimethyl ether), CNG(compressed natural gas), LPG(liquefied petroleum gas), hydrogen energy, fuel-cell, hybrid, GDI (gasoline direct injection) engine, HCCI(homogeneous charge compression ignition) engine vehicles, etc.

- **Refrigeration System (3)**

  Basic theories and design of vapor compression cycle and its components. Refrigerants and environmental issues, multi pressure system, absorption refrigeration, heat pump and energy source. A practice design of a refrigerating warehouse is an obligation of this course.

- **Automobile Air Pollution (3)**

  The evolution mechanisms of pollutant materials, the technology and equipment to reduce them, the pollution due to gasoline and diesel engines, post-processing method for the emitted gas are instructed. In addition, the trend of future automotive vehicles and the low-pollutant technology are discussed.

- **Engines and Combustion Processes (3)**

  Topics of this course include the structures and performances of gasoline and diesel engines, the types and combustion of fuels, combustion processes, automobile exhaustive pollution, and analysis of auto exhausts, with respect to the engines of automobiles and aircrafts.

- **Turbomachinery (3)**

  This course deals with energy and angular momentum considerations of turbomachines such as axial and centrifugal fans, pumps, compressors, turbines, and watermills and windmills. Emphasis are given to basic design practices using scaling law, specific speed, net positive suction head, and pump performance and system characteristics in practical fluid system applications.

- **Fluid Power System (3)**

  Introduction to hydraulic and pneumatic systems. Various components of fluid power systems. System and control design for designed performances.

- **Mechatronics Design (3)**

  This course provides mechatronics issues using simple examples of mixed electro mechanical systems. Starting with theoretical background and followed by illustrative numerical problems, we can practice the real automotive industry application problems. Finally it explores all major topics in mechatronics and

offers the computer simulation devices such as LabVIEW application.

- **Intelligent Control (3)**

  This course provides advanced intelligent control theories for the students who have basic knowledge on the automatic control system. The topics may include advanced control theories, fuzzy logic, neural network, etc. Emphasis is on the practical applications with various examples.

- **Signal Processing in Automotive Engineering (3)**

  Signal Processing is needed in every field of engineering whenever data are collected. This course covers fundamental theories in the digital signal processing. The topics include sampling, DA and AD conversion, convolution, Fourier transform, z transform, FIR filter design, and IIR filter design. Emphasis is on the practical applications with examples especially in the automotive engineering.

- **Mechatronics Design (3)**

  Discussion of various electronic control systems for intelligent vehicles, advanced safety vehicles and driver assistance systems. Design and evaluation of vehicle control algorithms.

- **Micro Forming (3)**

  This course introduces the basic plasticity theory such as yielding, J2 flow and hardening, which are necessary for the analysis of large deformation during forming operations. Then, it deals with technology for the forming processes to produce micro products, and introduces new forming technology such as LIGA and MEMS. In addition, students will practice the design procedure for the actual forming process of micro products.

- **Digital Manufacturing (3)**

  This course covers the diverse analysis methods and the simulation technology for the design integrated manufacturing.

- **Computer Aided Manufacturing (3)**

  Introduction to the use of the digital computer as a tool in manufacturing engineering.

Special consideration is given to geometric modeling, numerical-control programming, programmable logic controllers, industrial robotics, group technology, process planning, and integrated computer aided manufacturing. Three one-hour lectures per week and NC programming laboratory.

- **Computer Graphics (3)**

  This course studies fundamental principles of 2D and 3D computer graphics. Topics include graphic hardware, projection, transformation, shading, texture mapping, animation, curves and surfaces, geometric modeling, OpenGL, etc.

- **Concurrent Engineering (3)**

  Introduces the concept and history of concurrent engineering, and improves the product design and the manufacturing process from the view point of concurrent engineering, and cultivates practical usage of this engineering methodology through case studies and analysis using S/W (DFA, DFM).

- **Manufacturing Systems Design (3)**

  Study on several types of manufacturing systems that are commonly associated with the manufacturing and assembly processes. Emphasis is on the properties and manufacturing processes for polymer, ceramic, composite materials, metrology, quality control, human factors, reliability, automation of manufacturing process, concurrent engineering, and competitive aspects of economics of production.

- **Manufacturing Automation (3)**

  Study on the technology by which a process or procedure is accomplished without human assistance. Emphasis is on automation, industrial computer control, control system components, numerical control, industrial robotics, and programmable logic controllers.

- **Management Engineering (3)**

  Study representative management techniques (Activity based management, Balanced scorecard, Service profit link, Innovative team, Negotiation, etc.) for improving the productivity and competitiveness of manufacturing, service and information industries through case study and practice.

SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

Civil and Environmental Engineering occupies a prominent position as one of the major fields in the engineering profession. Civil Engineers are concerned with all aspects from conception, planning, design, construction, and operation to the maintenance of major physical works and facilities that are essential to modern life. Civil and Environmental Engineering projects are typically characterized by their scale, complexity, durability, and cost. Some examples include bridges, tunnels, costal facilities, dams, foundations, sewerage and sewage treatment facilities, water supply and purification systems, and transportation facilities.

Undergraduates majoring in civil and environmental engineering are given a firm base in mathematics, science, engineering science, and engineering design. Students participate in laboratory studies as well as classroom activities and become proficient in the use of computers for problem solving and design. In civil and environmental engineering, the courses extend across the areas of structure, geotechnical, hydraulic, environmental, and transportation engineering. The school of civil and environmental engineering offers a specialized undergraduate program accredited by ABEEK (Accreditation Board for Engineering Education of Korea).

Basic Courses

- **Engineering Mechanics (3)**

  Composition and resolution of forces, equivalent force systems, equilibrium of particles and rigid bodies, centroids and centers of gravity, analysis of simple structure, friction, and method of virtual work.

- **Engineering Mathematics II (3)**

  This course is continued from Engineering Mathematics I , and it covers sequences and series, approximation and errors, solution of equations by iteration, interpolation, numerical integration and differentiation, numerical methods in linear algebra, numerical methods for differential equations.

- **Partial Derivative (3)**

  Partial differential equations are used to formulate and solve problems that

involve unknown functions of several variables, such as the propagation of sound or heat, electrostatics, electrodynamics, fluid flow, elasticity, or more generally any process that is distributed in space, or distributed in space and time.

- **Application of computational method (3)**

  Application of computation software to solve problems in civil engineering.

- **Creative Engineering Design (3)**

  Developing ability for creative engineering design by utilizing engineering knowledge.

- **Mechanics of Materials (3)**

  The strength and elasticity of materials, the theory of stresses and strains, deformation of beams and shafts, torsion, and buckling of columns.

- **Structural Analysis I (3)**

  This course includes the elastic analysis of statically determinate frames and trusses, and calculations of deflections by the method of moment area and virtual ork, etc.

- **Soil Mechanics I (3)**

  Fundamental chemical, physical, and mechanical properties affecting the engineering behavior of soil. Identification, classification, permeability, stresses, and stress analysis of soil. Consolidation, stress-strain behavior, and shear strength.

- **Fluid Mechanics (3)**

  This subject is composed of basic mechanics which describe the motion of fluid and hydrostatics. These are prerequisites of hydraulics, hydrology and coastal engineering.

- **Environmental Science (3)**

  This course covers aquatic chemistry and microbiology. Topics include the characterization and analysis of organic and inorganic constituents in water and

wastewater, the chemical reaction, as well as the characteristics and metabolism of microorganisms.

- **Probability and Statistics (2)**

  This subject deals with various probabilistic methods and statistic methods which are useful for the analysis of experimental data sets, including basic concepts of theories and applications.

- **Civil Engineering Design (3)**

  An intensive study of one or more areas of civil and environmental engineering, with emphasis on engineering design and application.

Major Courses

- **Surveying (3)**

  For a complete survey the students are required to practise field surveying on a regular basis and to present the results in the classroom. Planning and design of surveys adoption of specifications and coordinate system and of a proper datum, selection of equipment. Care, handling and adjustment of instruments. Selection of computational procedures and methods for date presentation and for recording data. Relationship between angles and distances. Adjustment of survey measurements. Mapping and map drafting.

- **Hydraulics I (3)**

  This course is composed of basic fluid mechanics, open channel hydraulics, and pipe flow mechanics. These topics will lead to riverhydraulics and water supply engineering.

- **Water Supply Engineering (3)**

  Water quality standards and regulations. An overview of water treatment plants, design of unit operations, predesign of water treatment plants, hydraulics of plants, process control, and cost estimation.

- **Environmental Ecology (2)**

  An overview of the transformation and destruction of environmental ecology by pollution, proper controls, and solutions to minimize ecological damage. Basic principle of ecosystem, influences upon ecosystem by pollution of environment and by destruction of natural sites. Variation and destruction of ecosystem by industrialization and civilization.

- **Design of Reinforced Concrete Structures Ⅰ (3)**

  Mechanical and structural characteristics of concrete and reinforcing steel will be studied at first in this course. The instant and time dependent behavior of concrete and fundamental structural behavior of various reinforced concrete sections will be studied closely. And then reinforced concrete beams subjected to flexure, shear, and torsion will be designed based on ultimate strength design concept.

- **Structural Analysis Ⅱ (3)**

  Analysis of statically indeterminate structures, methods of slope-deflection, and moment distribution. Influence lines for determinant and indeterminate structures.

- **Structural Laboratory Test (3)**

  A study of the behavior of simple steel structural members and planning, testing and reporting. Aquisition, analysis, and presentation of experimental data.

- **Soil Mechanics Ⅱ (3)**

  The application of theory and principles in engineering practice. An introduction to geotechnical engineering in practice slope stability, retaining structures, shallow and deep foundations, and soil improvement.

- **Soil Laboratory Test (1)**

  Tests on the engineering properties of soils Atterberg limits, grain size analysis, specific gravity of soil solids, permeability, consolidation, direct-shear, CBR tests, etc.

- **Wastewater Engineering (3)**

  Process design of wastewater treatment plants, including primary and secondary treatment, advanced treatment detailed design review of existing plants, process control, and economics.

- **Experiment in Hydraulics (1)**

  This involves several applications of hydraulics with various empirical formulas. supported by laboratory scale experiments.

- **Hydraulics II (3)**

  This course involves several applications of hydraulics with various empirical formula, including wave theories, sediment transport, and unsteady open channel hydraulics.

- **Traffic Engineering (3)**

  Traffic flow theories and their applications to traffic operation and control. Measurement of traffic variables. Deterministic and stochastic models of traffic flow and traffic phenomena. Capacity analysis of freeways and urban streets. Traffic signal optimization. Pedestrian movements. Accidents analysis. Parking regulation. Relationship between the provision of transportation services and the environment air, noise, energy, and the specific localized impacts associated with large-scale construction.

- **Concrete Properties and Laboratory Test (3)**

  Experiments will be conducted in order to understand the material behavior of concrete including creep, shrinkage, and mix design. Structural behavior will be studied with crack propagation observation, the bending test, and experimental methodology.

- **Foundation Engineering (3)**

  The application of theories and the principles of soil mechanics to foundation design. Site investigations and engineering tests of evaluating subsoil conditions. Bearing capacity, stress distribution, and settlement. The design of shallow and deep foundations.

- **Design of Reinforced Concrete Structures II (3)**

  This course continues after "Design of Reinforced Concrete Structures I", and covers more profound and united knowledge about the design of reinforced concrete structural members such as continuous beams, frames, slabs, columns, footings, retaining walls, etc.

- **Design of Steel Structures (3)**

  The design of steel structures including tension and compression members, frames, plate-girders, etc. Additional topics include connections, composite beams, and fatigue and fracture concepts related to structural design.

- **Hydrology (3)**

  This subject covers understanding the water circulation system on the earth, ie. evaporation, rainfall, infiltration, and hydrologic phenomena, effective use of water resources, control of floods, and the analysis of measured data.

- **Physico-chemical Treatment (3)**

  Fundamentals of physical and chemical reaction engineering, such as coagulation and flocculation, granular filtrations, sedimentation, carbon absorption, gas transfer and membrane processes, applications for advanced wastewater treatment, activated sludge process, fixed-film processes, aerobic and anaerobic digestion, and sludge disposal.

- **Environmental Experiments (1)**

  Characterization and analysis of typical natural waters and wastewaters for inorganic and organic constituents. Selected experiments include solids, nitrogen species, oxygen demand, chlorine, alkalinity, pH, hardness, and trace analysis. Discussion of relevance of these measurements to water and wastewater engineering.

- **Urban Transportation Planning (3)**

  Definition of transportation problems in an urban socioeconomic environment. Urban transport performance and technology. Transport planning morphology. Transportation demand and activity analysis. Urban travel demand forecasting.

Characteristics of urban structures. Evaluation of transport investments. Sequential type planning processes. Good Urban movement. TSM planning. Local area traffic management. Public passenger transportation.

- **Computer Structural Analysis (3)**

  Calculus of matrix, force, and displacement methods of structural analysis. Matrix analysis of frames and trusses. Includes computer analysis of sample structures.

- **Design of Prestressed Concrete Structures (3)**

  The principles of prestressed concrete structures. Analysis and design of basic flexural members. Instantaneous and time-dependent properties of materials, prestress losses, etc.

- **Design of Earth Structures (3)**

  Soil-structure interaction such as retaining structures, earth dams, and tunnels. Earth pressure theories. Design of rigid, flexible, braced, tied-back, slurry, and reinforced walls. Stability excavation, cut and natural slopes. The basic analysis and earthquake-proof design methods of earth structures.

- **Construction Management (3)**

  Introduction to general civil engineering work.
  The fundamentals of construction planning the organization of construction sites, planning, scheduling, and cost estimation, bidding, the design of false work and shoring systems, and construction loadings. Optimization of construction processes.

- **Hydrologic Design and Management (3)**

  An introduction to the design of engineering structures which control and/or utilize runoff, emphasizing the sizing of structures to meet hydrologic uncertainity. Applies principles and techniques from several disciplines, including hydrology, hydraulics, probability and statistics. Specific techniques include flood frequency analysis risk analysis design storm techniques rainfall-runoff modeling.

- **Coastal Engineering (3)**

  This includes the mechanics of waves, tides and tidal currents, as well as sediment

transport, field measurement techniques, and the design of coastal structures.

- **Design of Water Supply Network and Treatment Plant (3)**

  Topics include the fundamentals of treatment plant design, unit operation design, computer simulation of water supply network design,and a detailed design review of eisting plants.

- **Highway Planning (3)**

  Highway characteristics. Human and vehicular characteristics. Traffic engineering studies and measurements volume, speed, and parking. Travel demand forecasting. Geometric design of streets and highways. Highway and freeway capacity. Drainage systems. Evaluation of economic and multiple criteria. Street and highway control.

- **Bridge Design (3)**

  Introducing the behavioral characteristics of various types of bridges such as the plate-girder bridge, arch bridge, suspension bridge, cable-stayed bridge, etc. Design team approach to the analysis and design of bridges in steel and reinforced concrete. Emphasis on the design of superstructures of bridges.

- **Advanced Structural Mechanics (3)**

  Static and geometrical stability and the degree of statical indeterminacy. Application to energy methods such as virtual work, minimum total potential, etc. Additional topics include basic concepts of fracture mechanics and structural dynamics.

- **Soil Improvement (3)**

  Consolidation theory. Compaction theory. Various techniques of soil improvement such as compaction, vibroflotation, precompression, sand drains, prefabricated vertical drains, lime stabilization, cement stabilization, stone columns, sand compaction piles, dynamic compaction, etc.

- **Geotechnical Design for Rail Roads and Highways (3)**

  This course includes basic design concepts of ground survey, material characteristics of road-bed, traffic-load characteristics of railroads and motor vehicles, and road-

bed structure design for railroads and highways.

- **Harbor Design (3)**

  This course is composed of a short review of coastal engineering, and design practice of harbor. Typical harbor structures are breakwaters, sea walls, and quays. Waterways should also be designed and managed properly. The structures are designed to be safe against tides, waves and tidal currents. Design practice is undertaken using numerical model packages, and CAD.

- **Water Pollution (3)**

  Topics include the cause, damage, and possible solution of water resources pollution as well as reservoir management and operation sequencing and sizing of water resources projects. Emphasis on the management of water quality and protection from water pollution. Water uses, quality standards, various materials and its changes in water cycle. Causes, damages and possible solutions of pollution of major water resources such as rivers, lakes, and dams.

- **Design of Wastewater Treatment Plant (3)**

  Topics include the fundamentals of wastewater treatment plant design, unit operation design, computer simulation of wastewater supply network design, and a detailed design review of existing plants.

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