COLLEGE OF ENGINEERING

ADMINISTRATION TEAM

HANYANG UNIVERSITY

Classification : Basic Major

Engineering Mathematics 1

Course Code:	COE3051	
Credits	Class Hr	Lab Hr
3	3	0

This course is the first part of two semester course sequence of Engineering Mathematics 1 and 2. In this course, students will study Ordinary Differential Equations and various solution methods. Many physical laws and relations can be expressed mathematically in the form of differential equations, and many engineering problems appear as differential equations. Therefore, understanding the properties of ODEs and their solution methods are fundamental in dealing with various engineering and science problems. The study of ODEs includes modeling physical systems and topics such as: solution of first-order ODEs by analytical, graphical and numerical methods; linear ODEs, especially second order ODEs with constant coefficients; undetermined coefficients and variation of parameters solution method; sinusoidal and exponential signals; complex numbers and exponentials; Fourier Series, periodic solutions; delta functions, convolution, and Laplace transform methods; systems of differential equations: eigenvalues and eigenvectors; Critical Point Analysis and phase plane diagrams.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Basic Major

Engineering Mathematics 2

Course Code:	COE3052	
Credits	Class Hr	Lab Hr
3	3	0

This course is the second part of two semester course sequence of Engineering Mathematics 1 and 2. This course covers the analysis of complex analytic functions and the selected introductory topics of linear algebra. Complex analysis has many applications in heat conduction, fluid flow, electrostatics, and in other areas. Most functions in engineering mathematics are analytic functions, and their study as functions of a complex variable leads to a deeper understanding of their properties and to interrelations in complex calculus. Topics of complex analysis includes: complex numbers and functions, complex integration, conformal mapping, Cauchy Integration theorem, derivatives of complex functions, Power Series, Taylor Series, Laurent Series, and Residue Integration. For selected topics of linear algebra, students will study following key computations and ideas behind them: solving Ax = b for square systems by elimination; complete solution to Ax = b; vector spaces, basis and dimension; properties of determinants leading to the cofactor formula; and eigenvalues and eigenvectors.

Frequency of Course Offering: Every Spring
Prerequisite: None

COLLEGE OF ENGINEERING

DEPARTMENT OF ARCHITECTURE

HANYANG UNIVERSITY

Classification : Core Major

Case Study of Architectural Design

Course Code: ARD4012		
Credits	Class Hr	Lab Hr
3	3	0

This course introduces basic concepts and techniques of large scale architectural project planning and development. An important role of an architect is to foresee the future needs of a society and to propose architectural solutions accordingly. Students are asked to take this role of an architect. During the course, students identify societal needs at various levels and propose term projects that could meet the needs. This course aims to develop students` skills for large scale architectural project planning and development. Students should learn to use various computer based presentation tools, develop speech and communication skills, learn to work as a team, develop an ability to foresee and identify social needs and provide solutions through architectural means. The goal is for students to develop in-depth understanding and knowledge required for large scale architectural project planning and development. This class offers an opportunity to understand the state-of-the-art issues related to mega project development such as new city development, old town center renovation, inter-city mix for enhanced growth, etc.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Basic Major

Design Fundamentals 1

Course Code: ARE4086		
Credits	Class Hr	Lab Hr
3	3	2

The Design Fundamentals 1 course is an introduction to architectural design with particular emphasis on conventions and principles of architecture, visual and verbal communication skills, formal analysis, design process, spatial composition, architectural promenade, basic program distribution, and elementary constructional and environmental responses. This course introduces students to the basic concepts and methods of architectural design. The fundamental techniques of architectural communication and representation, such as sketching, drawing and model building, will be introduced and explored. Throughout the semester, the structural, functional and aesthetic dimensions of architecture will be examined and issues of environmental perception, meaning and criticism will be considered in class.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Basic Major

Design Fundamentals 2

Course Code:	ARE4087	
Credits	Class Hr	Lab Hr
3	3	2

In Design Fundamentals 2 course, students will aim for understanding of "architectural elements', which are fundamental factors not only creating architectural space and form, but also accommodating functions. Among various architectural elements, the class will focus on five components – a roof, a wall, a ceiling, a floor, and steps. Also, the scope of design exercises will be from a simple structure for the immediate environment of the individual to those for small social groups. The studio is dedicated to develop 2 projects per semester: 1) a team project designing a wearable free-market booth that adapts at least two people, and 2) an individual project designing a "PLAY" Cube.

Frequency of Course Offering: Every Fall
Prerequisite: Design Fundamentals 1

Classification : Core Major

Architectural Design Studio 01

Course Code:	ARE4088	
Credits	Class Hr	Lab Hr
6	6	6

The Architectural Design Studio 01 focuses on foundation of architectural thinking through organizing diverse conditions and comprehensive understanding of all the conflict. Also, by utilizing diverse media, the studio demands the skill for space composition and spatial understanding. In this course, studio works are devoted to a series of investigative probes and exercises on various tectonics based on Cartesian grid, fundamental architectural element and context, Human scale vs. building scale, the relationship between Void and Solid. Throughout Architectural Design Studio 01, students will: 1) acquire analytical ability, 2) propose creative alternatives with comprehensive understanding, and 3) realize the idea with reasonable consideration. While doing these processes, students will produce and present various types of architectural documents and reports.

Frequency of Course Offering: Every Spring
Prerequisite: Design Fundamentals, Presentation Fundamentals

Classification : Core Major

Architectural Design Studio 03

Course Code:	ARE4092	
Credits	Class Hr	Lab Hr
6	6	6

It is the main goal of Architectural Design Studio 03 for students to understand that site planning is not simply locating building on the ground but a new way of planning outer spaces. Through the practices for locating building on complex situation, students realize that outer spaces are not a remaining open space determined by planning inner spaces but a positive open space which generates affluent inner spaces. In the process, students will practice architecture with a view of urban context. Also, the design of dwelling units both reflects and determines the way people organize and use our living environments, interface with nature, consume limited resources, and choose to relate to neighbors. During the semester, designing dwelling units which constitute the predominant built form in our communities will be a major project.

Frequency of Course Offering: Every Spring
Prerequisite: Architectural Design Studio 02

Classification : Core Major

Architectural Design Studio 04

Course Code:	ARE4093	
Credits	Class Hr	Lab Hr
6	6	6

As one of the Core studio, Architectural Design Studio 04 will aim for students to understand that architecture is not only an independent building on the ground but also a relationship in urban context. Through the research and analysis, students will practice the ability to design architecture with fulfilling function as well as taking a role in the context. Topics to be covered in the course are: 1) analysis and programming, which includes collecting various information and precedents related to architectural design problem and writing a program based on the result of the analysis; 2) Barrier Free Design for diverse building users including the elderly, the infirm, and the handicapped; and 3) design of addition/alternation, repair, and maintenance. Key words for this course is Renovation, Architectural regeneration, Architectural structure system, and Cultural complex.

Frequency of Course Offering: Every Fall
Prerequisite: Architectural Design Studio 03

Classification : Core Major

Architectural Design Studio 05

Course Code:	ARE4095	
Credits	Class Hr	Lab Hr
6	6	6

The Architectural Design Studio 05 deals with publicity of urban street spaces by designing of a mixed use of private and public architecture at the core space of the Seoul. The course will focus on seeking communal values instead of mere aesthetic value of architecture. One of the main goals of this studio is to discuss ways to create publicity in terms of social, spatial and urban landscape level as a single private building entity, yet as a strong catalyst into a whole city. In the tectonic point of view, this studio requires integrated design of structural, MEP and facade system for students' projects. The followings are important points that can be considered in the students' projects: historical axis of Gwanghuamun Plaza; ecological axis of Junghak stream; landscape axis of Bukak Mountain and Nam Mountain, etc.

Frequency of Course Offering: Every Spring
Prerequisite: Architectural Design Studio 04

Classification : Extended Major

Architectural Design Studio 06

Course Code:	ARE4096	
Credits	Class Hr	Lab Hr
6	6	6

The city, Seoul, has seen rapid growth over 60 years. However, the infrastructure in Seoul has been constructed and expanded by only efficiency and functionality without careful thoughts about the city identity as well as the historical context. In this studio, important assignment in this environment and under post capitalism is to propose an alternative idea of urban regeneration for urban living space, and to preserve and utilize the local cultural heritage from the past. The target of the studio is to study about metrology of urban master planning with regard to transforming currently abandoned modern industrial areas into the new urban core of future generation. Throughout the course, students are expected to design programs which combine residential, commercial, cultural aspects with their own ideas.

Frequency of Course Offering: Every Fall
Prerequisite: Architectural Design Studio 05

Classification : Extended Major

Architectural Design Studio 07

Course Code:	ARE4097	
Credits	Class Hr	Lab Hr
6	6	6

The objective of this course is to enable students to synthesize all previous course work by addressing and providing a solution for a design problem defined in Architectural Studies. Students are expected to achieve a high level of competence in an Architectural design project that integrates Form, Functions, Aesthetics and Relationships with Urban Contexts. The projects should reflect thoroughness in attention to aesthetic and technical aspects of design including construction, building systems, lighting and materials, as well as application of environment and behavior knowledge. The projects should aim for well-developed solutions, rich in details that celebrate innovation, imagination, and creative solutions for human existence. This thesis studio is built upon the premise of the complex state of contemporary culture where its heterogeneity stemming from diverse epistemological approaches are much recognized. Because an absolute knowledge can no longer exist within the global culture, it will be very important to build up students' insight for social and architectural issue within their individual interest.

Frequency of Course Offering: Every Spring
Prerequisite: Architectural Design Studio 06

Classification : Extended Major

Architectural Design Studio 08

Course Code:	ARE4098	
Credits	Class Hr	Lab Hr
6	6	6

This course will co-operate with the studio from Delft University. With Delft studio, students will share the architectural ideas and the ways to execute design from different cultural background as well as diverse perspectives. The first project on Seoul with the title "A Dwelling Biography" deals with the heart of its domestic environment: the dwelling. Then, the second research will continue to question the scale of the architectural intervention for a megacity like Seoul. Rather than focusing on the dwelling as heart of the domestic environment, this project will venture into the internal access routes that are transforming Seoul from an open horizontal city into an enclosed three-dimensional megacity, such as connecting the underground subway with the skyscraper's roof terrace without ever having to go outside.

Frequency of Course Offering: Every Fall
Prerequisite: Architectural Design Studio 07

Classification : Core Major

Architecture Research 1

Course Code:	ARE5003	
Credits	Class Hr	Lab Hr
3	3	0

This course will host a rich and varied lecture series that serves to both reinforce and expand skills students have evolved so far in terms of thinking about how architecture is conceived, developed and communicated. Besides the lecture series, it exposes students to research methodologies and diagrammatic strategies used for an analysis of works of architecture, approaches to design and key texts. These will act as case studies to learn about the conceptual ideas, formal/spatial principles, material systems and operative design strategies employed in making of architecture. The rigorous consideration of precedent and design research methods fosters a deeper connection of students' work with the discipline, better enabling them to position their ideas within a larger conceptual discourse while giving them the methodological tools to prepare them for undertaking of a research and design thesis.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Construction Engineering Design

Course Code:	ARE5011	
Credits	Class Hr	Lab Hr
3	3	0

This course covers several types of construction and its methods which are basic to architectural construction. Temporary construction, earthwork, reinforced concrete construction, steel construction, brick construction, water proofing, and damp proofing will be discussed. Furthermore, basic concepts on the strategic methods applied to productive analysis and development will also be studied. Fundamentals for construction management such as procurement system, Work Breakdown Structure, cost estimation and control, scheduling and other managerial functions will be covered as well. Relevant literature review will follow, and by analyzing the literatures, students will be able to present a theoretical framework including categories and aspects by which the real site can be investigated. By the end of the course, students are expected to include organization structure, procurement system, WBS and CBS, and the actual sequence in 3D digital model in their projects.

Frequency of Course Offering: Every Fall
Prerequisite: Non

Classification : Core Major

Construction Economy

Course Code:	ARE5016	
Credits	Class Hr	Lab Hr
3	3	0

This course deals with a general process of strategic planning and management of private development project in architectural business of construction industry. First, the course covers the theory of private development project in general. Then, various kinds of case studies are discussed such as big MXD project, theme park project, hotel and resort project, retail project, office project, residential project, etc. Moreover, this course emphasizes how to approach to real work by examining case studies. Main study objectives of this course are: 1) to study the planning and project management of private development project through related theories and case studies of real projects, and 2) to acquire the abilities required by discussing the current projects in Korea and overseas in depth.

Frequency of Course Offering: Every Spring
Prerequisite: Architectural Design

Classification : Extended Major

Landscape Theory and Design

Course Code:	URE4006	
Credits	Class Hr	Lab Hr
3	3	0

The Landscape Theory and Design course explores the theoretical aspects of design process through a series of readings, investigation, and analysis about modern and contemporary architects in search of their design manifestos. By understanding how architects convey the ideas through not only in built forms but also in drawings and writings, students will be able to recognize the purpose of architecture as a cultural artifact. Throughout the semester, the course aims to define following questions related to design manifestos such as what the meaning of an architectural manifesto is, why architects need them, and how architects establish their own architectural ideas, visions, and disciplines through manifestos.

Frequency of Course Offering: Every Fall
Prerequisite: None

COLLEGE OF ENGINEERING

ARCHITECTURAL ENGINEERING

HANYANG UNIVERSITY

Classification : Core Major

Engineering Mechanics

Course Code:	ARE2021	
Credits	Class Hr	Lab Hr
3	3	0

As a beginning course offered to students in Department of Architectural Engineering, this course emphasizes the knowledge needed to understand the relationship between the forces and moments acting on the structure. The course will demonstrate how structures are to be idealized and analyzed in the engineering sense. Generally, this course concerns with rigid objects in static and dynamic equilibrium, as well as simple modeling of real materials which undergo deformation (i.e., non-rigid). Important concepts in this course are the equilibrium conditions with forces and moments in two- and three-dimensional spaces. Topics in this course include: the statics of particles; moments and equivalent systems of forces; equilibrium of rigid bodies; distributed forces; analysis of structures; forces in truss; and bending of beams. In addition, the issues related with the rigid body dynamics, such as kinetics and kinematics of a particle and a body are included.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Construction Engineering Design

Course Code:	ARE5011	
Credits	Class Hr	Lab Hr
3	3	0

This course introduces basic construction technologies of modern construction job site. Objectives of this course are: 1) understanding construction industry and delivery processes; 2) understanding organizations of construction projects including primary contractors, specialty subcontractors, design and engineering firms, and authorizing government bodies; 3) understanding basic construction methods used for foundation work, skeleton work, exterior and interior work, etc.; 4) developing English presentation and communication skills; and 5) learning and improving abilities to work with digital medias including PowerPoint, 3D Max, Revit, etc. Students are required to visit job sites and explore the subjects stated above during the semester. Students will work as a team. Presentation and discussion on the studied subject will be made each week for each team.

Frequency of Course Offering: Every Spring
Prerequisite: None

COLLEGE OF ENGINEERING

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

HANYANG UNIVERSITY

Classification : Core Major

Hydrology

Course Code:	CIE3007	
Credits	Class Hr	Lab Hr
3	3	0

Hydrology has evolved as a science in response to the need to understand the complex water system of the earth and help solve water problems. This hydrology primer gives students information about water on Earth and humans' involvement and use of water. Also, Hydrology is the scientific study of the movement, distribution, and quality of water on Earth and other planets, including the hydrologic cycle, water resources and environmental watershed sustainability. In this course, various topics on hydrology is studied. The study topics are: hydrologic cycle; hydrologic meteorology; precipitation; streamflow; evaporation and evapotranspiration; ground water flow; surface runoff; unit hydrograph; hydrologic and hydraulic routing; statistics in hydrology; and application of hydrology for the design of hydraulics structures. The goal of this course is to understand the hydrological cycles and to be able to solve real-life problems.

Frequency of Course Offering: Every Spring
Prerequisite: Hydraulics

Classification : Core Major

Concrete Engineering & Lab. Tests

Course Code:	CIE3011	
Credits	Class Hr	Lab Hr
3	2	2

The largest manufactured products of construction material in the world today is concrete. Thus, design and construction engineers naturally need to know more about concrete than about other materials of construction. This class covers a wide spectrum of topics in modern concrete technology that should be of interest to practicing engineers. This course concentrates on the fundamental properties such as workability, strength, durability, volume change, creep, etc., of fresh and hardened concrete. This course also contains the specifications and properties of not only the special concrete used for some purpose, but also precast concrete. The goal of this course is to learn the fundamental properties of concrete materials, such as cement, aggregate, through laboratory experiments. Also, various test methods that contain both theory and practice will be introduced.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Construction Economy

Course Code:		CIE3033
Credits	Class Hr	Lab Hr
3	3	0

The primary objective of the course to help students acquire the principles required for systematic evaluation of economic performance in relation to the design, construction, and operation of constructed facilities, considering the characteristics of industry and domestic and international status. Various techniques to achieve decision making in terms of cost performance of long-term construction projects are discussed. Also, to achieve the objective of the course, this course is designed to introduce students the concepts and methods necessary for choosing the most suitable alternative in relation to the life cycle cost of engineering projects in construction. The course leads students both to understand the importance of the economic point of view of engineering subjects, and to get proficient in evaluating the economic efficiency of engineering proposals.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Environmental Chemistry and Lab

Course Code:		CIE3073
Credits	Class Hr	Lab Hr
3	2	2

The primary objective of this course is to understand the physico-chemical and biological processes that transform water pollutants in the natural and industrial environments, and to practice these processes in the environmental measurement laboratories. This course brings into focus the aspects of chemistry that are valuable for solving environmental problems, and it lays a groundwork of understanding in the area of water and wastewater analysis. The course will serve students to the basis in all environmental engineering practice and research. Students will learn the general chemistry, physical chemistry, equilibrium chemistry, organic chemistry, biochemistry, water and wastewater analysis and biological processes. In the accompanying laboratory sessions, students will also have hands-on experience to design the wastewater treatment processes and analysis of water and wastewater.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Hydraulics and Laboratory

Course Code:		CIE4011
Credits	Class Hr	Lab Hr
3	2	2

The flow in a closed conduit and an open channel will be studied in this course. The topics include: uniform flow in an open channel, specific energy, manning equation, water surface profiles in gradually-varied flow, hydraulic jump, friction factor in a pipe, drag and lift, etc. Also, in this course, the basic concept of hydraulics based on fluid mechanics will be instructed in detail. Main contents include conservation of mass and momentum, friction factor and uniform flow in open channel flow, water surface profiles in varied flow, design of contraction and expansion, similitude theory, sediment transport and advection diffusion of pollution in open channel flow. The laboratory experiments include mass conservation theory, the Bernoulli theory, the friction coefficients in closed conduits, static and dynamic hydraulic pressures, weir experiment, hydraulic jump on mild slopes, and lift and drag force.

Frequency of Course Offering: Every Fall
Prerequisite: Fluid Mechanics or Fluid Dynamics

Classification : Core Major

Engineering Mechanics

Course Code:		COE2051
Credits	Class Hr	Lab Hr
3	3	0

The Engineering Mechanics course is divided into two parts: 1) Statics, the study of objects in equilibrium, and 2) Dynamics, the study of objects in motion. In the beginning of the course, the class focuses on vector, force, and moment which are fundamentals to study related fields. Based on these topics, this course also demonstrates the properties of section and the equations of equilibrium derived in Statics. Then, the focus moves to the basic dynamics theory, such as moments of inertia, virtual work and potential energy, motion of a point, and Newton's second law. Finally, this course offers the concepts of energy and conservation of energy in large part from the study of classical mechanics and the principles of impulse and momentum. Topics to be covered in this course will be applied directly to various fields of engineering.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Fluid Dynamics

Course Code:		MEE3007
Credits	Class Hr	Lab Hr
3	3	0

The objective of this class is to teach students about mass, energy and momentum conservation laws in fluids. Specific topics that will be covered are: physical properties of fluids, fluid statics, fluid kinematics, similitudes, analysis of fluid flows using control-volume and other approaches. Students who take this course are also expected to be instructed on issues such as: elementary mechanics of fluids with emphasis on analysis; equations of motion; momentum and energy principles; surface and form resistance; real flow and dynamic similitude; elementary fluid mechanics with emphasis on engineering applications; enclosed conduit flow and open-channel flow; fluid measurements; and introduction to computational fluid mechanics.

Frequency of Course Offering: Every Spring
Prerequisite: Calculus, Engineering Mechanics

Classification :

Course Code:		
Credits	Class Hr	Lab Hr

COLLEGE OF ENGINEERING

DEPARTMENT OF URBAN PLANNING

HANYANG UNIVERSITY

Classification : Compulsory General Studies

Career Development 1

Course Code:	GEN5029	
Credits	Class Hr	Lab Hr
1	1	0

The Career development 1 is a course dedicated to the 'personal career' of students, which provides privileged moments of reflection and dialogue between the students and the instructor. Each session will be an opportunity for students to gather and share the experiences and reasons which has led them to be interested in the field of urban planning and engineering. During the semester, students taking this course will be required to present his or her personal journey including both curricular and extra-curricular activities, and to clarify his or her expectations in terms of civic planning. Developing students' understandings and aspirations on urban planning is one of the key objectives of this class. By the end of the course, students are expected to present the acknowledgement of city scape, public art, urban design, and city policies.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Urban Design Practice

Course Code:	URE1007	
Credits	Class Hr	Lab Hr
3	2	2

The objective of the Urban Design Practice class is to understand urban space and urban design and foster basic knowledge of urban planning. It is designed to bring comprehensive understanding of the field of urban design that demands both engineering-scientific thinking and the human-sociological knowledge grounded upon overall understanding of the human and the society, and that has direct effect on the living environment of many and unspecified individuals. First, this course provides exercises of understanding cities and architectural space through diverse media. Second, it develops an ability to embody the space in one's own way according to one's understanding. Third, it offers opportunities to learn common representation techniques of urban planning. To this end, students will fulfill a total of four tasks targeted at a variety of media and various scales of space during the semester.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Urban Design 1

Course Code: URE3011		
Credits	Class Hr	Lab Hr
4	4	0

Urban Design 1 is one of the core courses in urban planning and engineering. This studio class intends to complete urban design practice for residential area. Although this course will cover basic theories and urban design practices for residential area, it emphasizes field survey and analysis, drawing and design, model development, and master plan. The course will help students to learn not only the whole urban design process for residential area, but collaboration, communication, and presentation skills for their final outputs. Students will be guided to understand urban design theories and principle for residential unit exploring a variety of residential areas through field survey and analytical frameworks such as SWOT (Strength, Weakness, Opportunities and Threats). Upon understanding basic theories and principles of urban design for residential areas, student will apply their knowledge and skills for the final project which includes urban design practice and model development in the selected residential area.

Frequency of Course Offering: Every Semester
Prerequisite: Fundamentals of Urban Design

Classification : Core Major

Urban Design 2

Course Code: URE3012		
Credits	Class Hr	Lab Hr
4	2	4

Urban Design 2 is one of the core courses in urban planning and engineering. This studio class intends to complete urban design practice for mixed use or commercial area including Transit-Oriented Development (TOD). Although this course will cover basic theories and urban design practices for commercial or mixed use areas, it emphasizes field survey and analysis, drawing and design, model development, and master plan. The course will help students to learn not only the whole urban design process for commercial or mixed use areas, but collaboration, communication, and presentation skills for their final outputs. Students will be guided to understand urban design theories and principle for residential unit exploring a variety of commercial district and mixed use areas through field survey and analytical frameworks such as SWOT (Strength, Weakness, Opportunities and Threats). Upon understanding basic theories and principles of urban design for commercial or mixed use areas, student will apply their knowledge and skills for the final project which includes urban design practice and model development in the selected residential area.

Frequency of Course Offering: Every Spring
Prerequisite: Fundamental of Urban Design

Classification : Core Major

Urban Design 3

Course Code:		URE3021
Credits	Class Hr	Lab Hr
4	2	4

Urban Design 3 is a core course in the Department of Urban Planning and Engineering. This class focuses on urban regeneration, which is for physically deteriorating area. During the past several decades, mega-cities in Korea have experienced the deteriorations of physical environment with socio-economic decline in the inner city area. New urban and residential development projects in the periphery of metropolitan areas are driving the decline of existing cities by moving population and employment to suburban areas. Therefore, this class aims to revitalize the declining areas of the city by using the urban design tools. Based on a comprehensive understanding of urban regeneration theories and applications, the course select case study area of urban regeneration project and actually complete urban regeneration project during the semester. Through this class, students will be aware of the significance of urban regeneration project and understand the process of urban design application for urban regeneration.

Frequency of Course Offering: Every Spring
Prerequisite: Urban Design 1 or Urban Design 2

Classification : Extended Major

Landscape Planning

Course Code:		URE4017
Credits	Class Hr	Lab Hr
3	3	0

This course concerns an initial approach of the landscape planning to capture a new environmental imperatives that the majority of planning professions face today. As an ancient and innovative approach, the study of landscape planning provides the understanding of environmental requirements for the construction of private and public realms. This course helps to constructively and positively deal with the ecological crises, social conflicts, and environmental foot-print of the space making to be able to adjust the expertise of our future sustainable biosphere. The primary focus of this course is the assimilation of the landscape planning as a full-fledged analysis approach into the surroundings. Landscape planning is discussed in its historical process and global concept, and then, the focus is driven back to its local prerogatives to enable the student to understand the establishment of spaces depending on the milieu in which it operates.

Frequency of Course Offering: Every Spring
Prerequisite: Fundamentals of Urban Planning

COLLEGE OF ENGINEERING

DEPARTMENT OF EARTH RESOURCES AND ENVIRONMENTAL ENGINEERING

HANYANG UNIVERSITY

Classification : Core Major

Mineralogy and Petrology

Course Code: MME2007		
Credits	Class Hr	Lab Hr
3	3	0

The earth is composed of rocks, gases, and water with biota. The basic inorganic solid component is rocks of which is composed by minerals. The initial six weeks are assigned to mineralogy and the others to petrology. The lecture of mineralogy includes crystal structure, chemical and physical characteristics, and analytic methods. Crystal structure of mineral deals mainly symmetry, atomic bonding, and growth and defects of crystals. Formula calculation, exsolution and mineral stabilities based on mineral chemistry will be addressed. X-ray mineralogy and optical properties are explained for mineral identification. Lecture of petrology includes genesis and occurrences of igneous rocks, sedimentary rocks and metamorphic rocks. Phase rules will be introduced. Structural characteristics and chemistry of various rocks will be discussed. Rock classifications based on mineralogy and distinct textures will be given.

Frequency of Course Offering: Every Spring
Prerequisite: General Applied Geology

Classification : Core Major

Soil/groundwater Contamination & Remediation

Course Code: MME2056		
Credits	Class Hr	Lab Hr
3	3	0

This course provides an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternative energy sources, related technology and their application. The students will explore society's present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and nuclear energy, and then focus on alternative and renewable energy sources such as solar, biomass (conversions), wind power, geothermal, and hydro. Energy conservation methods will be emphasized. It also provides the details of renewable resources, energy conversion techniques and applications of solar, wind, biomass, geothermal, hydro-electric, wave and tidal energy technologies. More emphasis is given to bioenergy technologies to convert biomass into fuels, energy, chemicals and bioproducts.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Mineral Economic Evaluation

Course Code: MME3016		
Credits	Class Hr	Lab Hr
3	3	0

Students taking this course will explore the engineering knowledge and wisdom for the exploration, production and transformation of energy and mineral resources. For the successful exploration and production of energy and resources, an appropriate, reasonable investment decision is highly important. In this perspective, this course covers fundamental theories in resource engineering economics to provide economic indicators for the investment decision. In particular, the concept and analysis methods on discounted cash flow, net present value, internal rate of return, and maximum sustainable risk to analyze the economic feasibility of a resource project will be discussed. Risk management methods such as expected monetary value, scenario analysis, and Monte-Carlo simulation will also be covered. Empirical practice for a hypothetical energy and resource project will be assigned as a team project.

Frequency of Course Offering: Every Fall
Prerequisite: Principles of Resource Economics, Resource Market Analysis

Classification : Extended Major

Resource Market Analysis

Course Code: MME3062		
Credits	Class Hr	Lab Hr
3	3	0

Energy and resources are essential factors for the prosperity of an economy. Moreover, Korea imports over 96% of energy from overseas. An appropriate forecasting of international resource markets based on theoretical and practical methods is thus highly important. To analyze international energy and resource markets, fundamental econometrics will be discussed throughout the course. Besides ordinary regression models, time-series analysis techniques such as co-integration, error correction model, and vector autoregressive model are discussed to analyze economy-wide aspects. Students will investigate the history and development of international energy (oil, gas, coal, and uranium) and resource (minerals and metals) markets. Based on the investigation results, an empirical research topic will be setup as a team project. Using R software, rigorous but interesting programming practice as well as theoretical discussions will be conducted.

Frequency of Course Offering: Every Fall
Prerequisite: Principles of Resource Economics

Classification : Core Major

Drilling Engineering

Course Code: MME3063		
Credits	Class Hr	Lab Hr
3	3	0

The impact of drilling engineering and operations management on the overall success of E&P projects cannot be understated. Drilling and well construction costs can range from 30 to over 60 percent of upstream development costs. It is clear that success in managing all phases of drilling activity is a necessary condition for good performance and repeatable long term success. The purpose of this course is to educate the next generation of petroleum drilling engineers on the technical and economic issues facing today's well drilling organization, and on the quantitative methods needed to rigorously evaluate these issues. This course introduces Petroleum Drilling Systems, including fundamental petroleum engineering concepts, quantities and unit systems, onshore and offshore drilling and well engineering, drilling rig components, drilling fluids, pressure loss calculations, casing, well cementing, and directional drilling.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Soil Contamination/Remediation

Course Code: MME3065		
Credits	Class Hr	Lab Hr
3	3	0

The purpose of this course is to study soil and groundwater contamination due to metals and organic/inorganic contaminants, and remediation. The course will identify the contaminants, contamination and its significance to the subsurface environment, physical/chemical/biological interactions of the contaminants under the subsurface environments, and distribution and mass transport of those contaminants. The course will explore environmental soil chemistry, microbiology, inorganic chemistry, and aquatic chemistry to address the most advanced technologies to remediate and manage the soil and groundwater contamination by metals and organics/inorganics. Students will be requested to conduct a group term project to explore the practical application of appropriate remediation technologies for site specific conditions.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Geophysical Exploration 2

Course Code: MME3066		
Credits	Class Hr	Lab Hr
3	3	0

Students will explore the exploration of earth resources using potential methods. The course consists of three main themes: gravity, magnetic, electric and electromagnetic exploration methods. In gravity method, main topics are gravitational field, gravitational potential, density of rock minerals, shape of the earth, inner structure of the earth, measurements of gravity, correction of gravity data, anomaly of gravity, and analysis of gravity data. In magnetic method, main topics are magnetic field of earth, magnetic susceptibility of rock minerals, intensity of magnetization, remanent magnetism, change of geomagnetism, and analysis of magnetic anomaly. Finally, in case of electric and electromagnetic method, electric properties of rock minerals, SP method, resistivity method, induced polarization (IP) method, magnetotelluric method, and EM method. In addition, GPR method will be introduced.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Petroleum Production Engineering

Course Code: MME4008		
Credits	Class Hr	Lab Hr
3	3	0

The purpose of this course is to cover the essentials of the behavior of the gas/oil mixtures in the reservoir, wellbore, and surface line and the necessary calculations, analysis and evaluation of the productivity and performance of wells including a summary of multiphase vertical flow correlations and artificial lift systems. The overlying theme of the topics is to follow the flow of fluids from the reservoir/well interface through the well and surface facilities, with emphasis on learning the hardware components and their functions and importance. Topics include: important steps involved in petroleum production engineering; reservoir performance as it pertains to well inflow; well hardware and completions-connection of the well to the reservoir and the surface; fundamentals of single phase fluid flow in pipe (vertical, horizontal, angled); multiphase flow in pipes; decline curve analysis; surface equipment-safety valves; chokes; separation and metering; artificial lift methods – rod pump, gas lift, ESP, workover and stimulation methods; and surface facility: storage, separators, emulsions.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Reservoir Geophysics

Course Code: MME4069		
Credits	Class Hr	Lab Hr
3	3	0

Students will examine the geophysical methods to characterize the reservoir and estimate the reserves. This course consists of three main themes: geophysical logging, AVO analysis, Seismic attribute analysis. In geophysical logging, the properties of the earth are measured with depth after borehole is drilled. In this course, the basic principles of electric, nuclear, acoustic, fluid logging will be explored. In addition, the methods for evaluating the formation using logging data will be introduced. AVO analysis, which is a method that identifies the hydrocarbon in pores by analyzing the variation in the amplitude of reflected waves with offset, and Seismic attributes, which are values extracted mathematically from seismic data will be discussed. Seismic attributes help in interpreting seismic image and calculating the reserves of oil or gas in the reservoir.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Mass Transport Processes

Course Code: MME4066		
Credits	Class Hr	Lab Hr
3	3	0

This course covers the fundamentals of mass transport of chemicals between air, water, soil, and biota. The main theme of this course is divided into three subject areas: mass transfer theory, transport processes related to engineered reactors, and mass transport phenomena in the natural environment. The focus will be on chemical calculations particular to dilute systems, with emphasis on quantifying chemical transport rates and distributions in natural and engineered environments. Special topics of interest for geo-environmental engineers include biofilm models, bioreactors, chemical partitioning in thin fluid film bioreactors, and fate of anthropogenic chemicals from spills and discharges into the environment.

Frequency of Course Offering: Every Other Spring
Prerequisite: None

COLLEGE OF ENGINEERING

DEPARTMENT OF ELECTRONIC ENGINEERING

HANYANG UNIVERSITY

Classification : Core Major

Data Structures

Course Code:		CSE2010
Credits	Class Hr	Lab Hr
3	3	0

In computer science, it is very important to organize information that can facilitate searching, updating, inserting, and deleting data. This course introduces various data structures, such as linked list, stack, queue, heap, binary search tree, balanced trees, and graph, which can organize data of various time and space complexity. Abstract data types will also be covered, including operations of searching, inserting, and deleting elements in each data structure. The main goal of this course is to learn how to design and select efficient data structures and operations. Students will learn how to compare data structures in terms of time and space complexity. In addition, students will have opportunities to learn how these data structures can be applied for solving computational problems. In the accompanying laboratory sessions, students will also have hands-on experience to implement data structures using the C programming language.

Frequency of Course Offering: Every Spring
Prerequisite: Discrete Mathematics, C Programming

Classification : Extended Major

Microprocessor

Course Code:		CSE2011
Credits	Class Hr	Lab Hr
3	3	0

This course is an introduction to the structure, assembly language, and interface of microprocessors. Microprocessors and microcontrollers are at the center of most computer hardware systems, including desktop computers, smart phones, and embedded systems. They perform procedural logic, calculate arithmetic, and manage the devices connected to the system. These functions can be directed using assembly language. This course gives an overview of the registers, bus system, and system of interrupts used by a typical microprocessor. Examples of RISC and CISC Architectures, such as Intel 8086, ARM, and 8051 are introduced, and the assembly languages used by these microprocessors are studied. This course includes a laboratory component, where the 8051 assembly language is studied in detail. The laboratory culminates in a final project, where several devices are coordinated together, creating a larger system.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Circuit Theory 1

Course Code:	ECC1004	
Credits	Class Hr	Lab Hr
3	3	0

This course covers fundamental concepts and methods for analysis and design used in entire branches of electrical engineering such as Communication Systems, Computer Systems, Control Systems, Power Systems and Signal Processing Systems and more. The lectures are focused on "the Time Domain Analysis." Students will study following topics: voltages and currents in resistive circuits; Kirchhoff's Laws, Nodal and Mesh analysis, linearity, Thévenin's and Norton's Theorems and Source transformation, Maximum power transfer; etc. After successfully studying the course, the students will be able to: 1) determine the voltage and current in simple resistive networks containing dependent and independent sources by applying a variety of techniques, such as nodal analysis, mesh analysis, source transformation, superposition, and Thévenin's and Norton's equivalent circuits; 2) determine natural, forced and step responses of RL, RC, and RLC circuits; 3) solve circuit problems containing operational amplifier; and 4) carry out the analysis of simple AC circuits.

Frequency of Course Offering: Every Spring
Prerequisite: Differential Equations, Introductory Physics

Classification : Core Major

Circuit Theory 2

Course Code:	ECC1006	
Credits	Class Hr	Lab Hr
3	3	0

This course deals with sinusoidal steady-state analysis, AC circuit power analysis, polyphase circuit, complex frequency and Laplace transform, circuit analysis in the s-domain, frequency response and two port network. In sinusoidal steady-state analysis, the concept of phase is introduced, and the circuit analysis using phase concept is reviewed. In AC power analysis, several type of powers in AC circuit are examined. In polyphase circuits, various polyphase systems are explained. In complex frequency and Laplace transform, the course introduces the concept of complex frequency, and the new analysis method based on Laplace transform. In circuit analysis in the s-domain, several analysis methods in the s-domain are introduced. In frequency response, the response characteristic in resonance circuit is reviewed, as well as the bode diagram. The design of basic and advanced filter is performed, too. In two-port networks, the two port system is introduced, and several parameters such as admittance, impedence, hybrid and transmission are explained for better understanding the two port system.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Signals and Systems

Course Code:		ECE3008
Credits	Class Hr	Lab Hr
3	3	0

This course introduces basic concepts in (continuous-time and discrete-time) signals and systems and their associated mathematical and computational tools. The spectral analysis of periodic and aperiodic signals using Fourier Series and Fourier transform is discussed for both continuous-time and discrete-time signals. The purpose of this course is to provide a common background for subsequent coursework in the study of communications, electronic circuits, filter design, digital signal processing, and control. The contents of this course include linearity and time-invariance, convolutions, Fourier representations (Fourier series and Fourier transformation), Laplace transform, and Z transform, along with their applications to communication systems, filters and equalizers, and linear feedback systems. Also, the general concepts on causality and stability, related with linear time-invariant systems, are considered.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Optoelectronics

Course Code:		ECE4024
Credits	Class Hr	Lab Hr
4	3	2

Light has some unique characteristics such as extremely fast propagation velocities and non-interference characteristics to Electromagnetic (EM) waves, and can be used as a signal source for broad-band and high-speed communication systems. Moreover, optical and optoelectronic devices are currently researched and applied as high efficient lighting sources and sensors in various industrial fields. Optoelectronics is one of the fusion electronics courses, and it is based on the basic knowledge of EM waves, Modern Physics, and Semiconductor Physics. The course will cover the Electromagnetic theory, the basic theory of Quantum Physics, and the basic operating principles of Semiconductor light-emitting diodes (LEDs), Lasers and Photodetectors. In the accompanying laboratory sessions, students will also have hands-on experience to measure the behaviors of electro-magnetic waves and semiconductor lighting sources.

Frequency of Course Offering: Every Fall
Prerequisite: Semiconductor Devices, Electro-magnetics

Classification : Extended Major

Digital Communication

Course Code:	ECE4058	
Credits	Class Hr	Lab Hr
4	3	2

This course introduces the fundamentals of modern digital communication system analysis and design techniques. This course covers topics including baseband modulation and passband modulation techniques, optimum receiver design, coherent and noncoherent detections, error performance analysis, and multiplexing/multiple access scheme including spread-spectrum multiplexing/multiple access and orthogonal frequency division multiplexing/multiple access. At the end of the semester, the course will also cover some practical modern communication systems such as 3G, 4G work based on multiplexing/multiple access scheme. In addition to the classical theories described above, the course will also include some fundamentals of vehicular communications as an important application of the digital communication theories.

Frequency of Course Offering: Every Spring
Prerequisite: Random Process, Communication Systems

Classification : Core Major

Digital Logic Design

Course Code:	ECN1001	
Credits	Class Hr	Lab Hr
4	3	2

This course provides fundamentals in design and analysis of the operation of digital gates. The main goal of this course is to examine how to design and optimize combinational digital circuits and sequential digital circuits. Topics will include representation of information, binary arithmetic and arithmetic-logic unit, switching algebra, combinational network analysis and design, sequential network analysis and design, registers and counters, various programmable logic devices, asynchronous circuit analysis and design, and basic digital interface. This course also provides an experimental program for 2 hours every week. Students should perform building and testing weekly-topics using several experimental tools in the program. The topics are logic gates, Boolean algebra, Karnaugh map, MUX and DeMUX, encoder and decoder, latch and flipflop, counter and register, etc.

Frequency of Course Offering: Every fall
Prerequisite: Circuit Theory, Electronic Circuits

Classification : Extended Major

Operating Systems

Course Code:		ELE3021
Credits	Class Hr	Lab Hr
4	3	2

This course covers a historical and practical overview of various operating systems concepts. An operating system is a central software component of general purpose computer, as well as many special purpose computers. The operation of hardware that would otherwise be overly complex, is simplified and standardized with an operating system. This course begins with a review of several historical operating systems, such as CP/M, Palm OS, and Mac OS. These operating systems inspired the introduction of many common operating system features, and these features will be studied in this course. These include process management, memory management, file systems, disk management, multitasking, multi-threading, inter-process communication, deadlock avoidance, virtual memory, input/output device management, multiple users, and security. The features are commonly found in modern operating systems, including Microsoft Windows, Macintosh OS X, and Linux. The course includes a laboratory component, where the Linux operating system is studied in depth.

Frequency of Course Offering: Every Spring
Prerequisite: C Programming

Classification : Extended Major

Integrated Circuit Devices

Course Code:		ELE3067
Credits	Class Hr	Lab Hr
3	3	0

The dramatic impact of integrated circuits (ICs) on engineering, conversion electronics and on the broader society continues to grow within passing years. Currently IC circuits contain over the tens-of-millions of active devices on a chip with breaking of Moore's law. The main goal of this course is for students to learn about fundamental and advanced device physics, and fabrication process for nano-electronic devices with update of new concept semiconductor devices. In this course, students will learn about the advanced semiconductor electronics and silicon technology. Based on the pn junction, student will examine the operation principle of BJT and MOSFET. This course will cover the volatile memory devices including DRAM and nonvolatile memory including flash and near future concept new memory devices such as Resistive change memory (ReRAM), Phase change memory (PCRAM), Spin-torque magnetic random-access-memory (STT-MRAM).

Frequency of Course Offering: Every Spring
Prerequisite: Physics of Solid-state Electronics

Classification : Core Major

Electronic Circuits 1

Course Code:		ELE3074
Credits	Class Hr	Lab Hr
4	3	2

In this course, students will explore the basics of the electronic circuits which are essential building blocks of modern society. The course first covers the operational principle of electronic devices such as pn junction diodes, BJT and MOSFETs. Then, it proceeds to the design and analysis of electronic circuits using those devices. In this course, the focus is on the study of various amplifiers which are key building blocks of analog electronic circuits. This course is comprised of lectures (3 hours per week) and lab experiments (2 hours per week). Furthermore, students are expected to get detailed understanding of circuit operation through computer simulation assignments.

Frequency of Course Offering: Every Spring
Prerequisite: Circuit Theory 1, Circuit Theory 2

Classification : Core Major

Electronic Circuits 2

Course Code:		ELE3075
Credits	Class Hr	Lab Hr
4	3	2

Based on the basic understanding on microelectronics obtained through the class "Electronic Circuits 1", this course covers detailed techniques of electronic circuits with the emphasis on the integrated circuits implementation. The course deals with various schemes such as cascading, current mirroring to improve the performance of amplifiers. The course also explores differential circuits which are very important in most of the analog circuits. Then students will analyze the operation of circuits as functions of frequency. One of the most important topics covered is feedback. The course will examine why we use feedback in electronic circuits and how we implement various feedback circuits in real situations. The course is wrapped up after studying power stages, analog filters, and digital CMOS circuits. This class includes experimental labs which provides opportunity to implement various circuits in line with the lecture schedule.

Frequency of Course Offering: Every Fall
Prerequisite: Electronic Circuits 1

Classification : Core Major

Digital Signal Processing 1

Course Code:		ELE3076
Credits	Class Hr	Lab Hr
4	3	2

This course covers the basic and fundamental digital signal processing techniques in time and frequency domain. Analog-to-digital signal conversion, symbolization of digital signal will be discussed in detail. Also, the course will focus on sampling and reconstruction of continuous time signals, characterization and properties of discrete time signals and systems, computation of discrete time Fourier transform and its properties. Especially, the relationship between time domain and frequency domain is examined. The purpose of this course is to provide a common background for subsequent course work in the study of Digital signal processing. The contents of this course include digital signal filtering, analysis of discrete-time Fourier transform and its difference, FIR/IIR filter design techniques, and derivation of Laplace transform and Z transform.

Frequency of Course Offering: Every Spring
Prerequisite: Signals and Systems

Classification : Core Major

Digital Signal Processing 2

Course Code:		ELE3077
Credits	Class Hr	Lab Hr
4	3	2

This course covers the basic and fundamental digital signal processing techniques in time and frequency domain. Analog-to-digital signal conversion, symbolization of digital signal will be discussed in detail. Also, the course will focus on sampling and reconstruction of continuous time signals, characterization and properties of discrete time signals and systems, computation of discrete time Fourier transform and its properties. Especially, the relationship between time domain and frequency domain is examined. The purpose of this course is to provide a common background for subsequent course work in the study of Digital signal processing. The contents of this course include digital signal filtering, analysis of discrete-time Fourier transform and its difference, FIR/IIR filter design techniques, and derivation of Laplace transform and Z transform.

Frequency of Course Offering: Every Fall
Prerequisite: Signals and Systems, Digital Signal Processing 1

Classification : Core Major

The Physics of Solid-state Electronics

Course Code:	ELE4077	
Credits	Class Hr	Lab Hr
3	3	0

This course introduces the basics of the semiconductor materials and devices. To understand semiconductor devices and update the new devices and their applications, students will explore the basic concepts of the quantum mechanics theory about solid-state materials and the details for the device physics. The main goal of this course is to develop the basic tools with which students can later learn about newly developed semiconductor devices and applications. To achieve this goal, students must understand basics of semiconductor materials and conduction processes in solids. At first, the course will cover the crystal properties and growth of Si based semiconductors including basics modern physics. The origin of energy band and various terminologies will be defined. Finally, student will adopt their fundamental knowledge to analyze of pn junction.

Frequency of Course Offering: Every Spring
Prerequisite: Modern Physics

Classification : Extended Major

Introduction to Information Display Engineering

Course Code:	ELE4083	
Credits	Class Hr	Lab Hr
3	3	0

This course covers the current display trends and various display technologies. The thin-film-transistor liquid crystal display and organic light-emitting display as well as future display technologies such as flexible displays and holography will be introduced. Also their operating principles, device structures, materials, and driving methods are simply explained. The following subjects are covered: overview of display industry; light properties (polarization, reflection, refraction, and transmission) and their theoretical analysis (linear algebra for matrix representation); liquid crystal and liquid crystal displays; organic light-emitting displays; flexible displays; three dimensional displays, transparent displays, and the other future displays. Optionally, the human perception for color including the color coordinate systems and some emerging technologies presented in some current display conference are introduced. In addition, if circumstances allow, students will be given opportunities to visit the display industry.

Frequency of Course Offering: Every Spring
Prerequisite: Fundamental Physics

Classification : Extended Major

Display Electronics

Course Code:		ELE4084
Credits	Class Hr	Lab Hr
3	3	0

Driving methods and circuits are key technologies that greatly affect the performance of flat panel displays (FPDs). Research and development of these technologies require knowledges of circuit analysis and design as well as thorough understanding of FPDs. This course explores fundamentals of driving methods of major FPDs including STN-LCD, TFT-LCD, OLED and PDP first, which are the most widely used FPDs, and proceeds to circuit design for those displays. Particularly, this course focuses on both TFT-LCD, which is currently most successful, and AMOLED, which draws great attention as a next-generation display. For TFT-LCDs, advanced driving technologies for high-quality images and low-power consumption is covered on the basis of fundamentals of driving methods, and the differences of the driving technologies according to the applications such as large-screen TVs and mobile devices are also dealt with. This course emphasizes the principle and limitation of each driving method and pixel circuit, which provides the foundation for finding novel driving methods and pixel circuits. Then, after dealing with basic DAC and buffer amplifier circuits, which are key subblocks constituting driver circuits, advanced design techniques for FPD applications are also covered.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Computer Networks

Course Code:		ENE4019
Credits	Class Hr	Lab Hr
3	3	0

This course introduces the basic concepts of computer communications. It covers the basic concepts of computer networks starting from LANs (local area network) to WANs (wide area networks). The course introduces how LAN, MAN (Metro Area Network), and WAN can exchange information among stations attached to them. Also the basic concepts of addresses in computer networks will be covered such as MAC (media access control), SAP (service access point), IP (Internet Protocol), and port addresses. In addition, flow controls and error controls in various layers as well as mechanisms of MAC and logical link layers will be introduced. New concepts such VLAN, VPN, and Internet will be also covered including internet protocols from IPv4 to IPv6 with routing algorithms. Other selected topics include: transport layer concepts, basic core functionalities, protocols, and standards related to computer networks; concepts such as connection oriented and connectionless; network devices such as bridges, hubs, routers, and various switches.

Frequency of Course Offering: Every year
Prerequisite: None

Classification : Extended Major

Semiconductor Devices

Course Code:	ENE4029	
Credits	Class Hr	Lab Hr
3	3	0

MModern information technology is based on the transistor and integrated circuits. This course introduces semiconducting devices for undergraduate electrical engineers, other interested students and practicing engineers who wish to update their understanding of modern electronics. Students will need to have a strong background in physics to a level of understanding that will allow them to read much of the current literature on new devices and application. One of the basic purposes is to provide students with a sound understanding of existing devices such as junction, field-effect transistors, bipolar junction transistors and optoelectronics devices so that their studies of electronic circuits and systems will be meaningful. Another key purpose of this course is to develop the basic tools with which they can later learn about newly developed devices and applications.

Frequency of Course Offering: Every Fall
Prerequisite: Physics of Solid State Electronics

Classification : Extended Major

Analog Circuit Design

Course Code:	ENE4039	
Credits	Class Hr	Lab Hr
3	3	0

The goal of this course is to cultivate students with analog circuit design skills and techniques by learning the fundamental theory of the analog circuits and exercising practical design examples. The course will mainly focus on analog circuit design with key design factors, design methodologies, performance analysis, and practical issues in analog circuit design. The topics of this course are basic MOS device physics, single-stage amplifiers, and differential pairs. Moreover, this course will cover in-depth knowledge and design techniques of the analog integrated circuits such as operational amplifier, feedback topology, various biasing techniques including current mirrors, frequency response characteristics of broadband amplifiers, and precision voltage references. Also, analog circuits such as bandgap references, switched-capacitor circuits, analog-to-digital converters (ADCs) and digital-to-analog converters (DACs) will be studied. This course requires basic knowledge of circuit theory, solid-state electronic devices, and electronic circuits.

Frequency of Course Offering: Every Fall
Prerequisite: Circuit Theory, Electronic Circuits

Classification : Extended Major

Optical Communications

Course Code:		EWE4023
Credits	Class Hr	Lab Hr
3	3	0

This course provides the basics of all communications infrastructures. Optical communications are not only the core building block in inter-telecommunication offices or inter-continental communications networks, but also indispensable components in wireless communications network and access networks. In this course, the focus of the study is on the principle of operation of optical fibers, laser diodes, LEDs, photo-diodes, which are important components that constitute optical communication systems. Furthermore, the course will cover how to design optical transmission systems using these components. Recently, optical communications systems are evolving from point-to-point transmission systems to true optical networks. In this course, students will explore the characteristics of optical networks.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Random Process

Course Code:		ITE3013
Credits	Class Hr	Lab Hr
3	3	0

The course presents the fundamentals of probability theory and random processes needed by students in communications, signal processing, computer science and other disciplines. Topics include: axiomatic probability theory; discrete and continuous random variables; functions of random variables; generating functions and transform methods; inequalities, bounds and large deviation theory; convergence and limit theorems; random processes; spectral representation; Gaussian processes; stationarity and linear system analysis; Poisson and birth-death processes; Markov chains; random walks, Brownian motion, diffusion and Ito processes. This course will greatly help students in the understanding of topics such as detection/estimation, stochastic geometry, statistical inferences, and many engineering related advanced research themes.

Frequency of Course Offering: Every year
Prerequisite: None

Classification : Basic Major

Linear Algebra

Course Code: MAT2003		
Credits	Class Hr	Lab Hr
3	3	0

This course covers the basic subjects on matrix theory and linear algebra. Students will study useful topics for other disciplines such as systems of equations, vector spaces, determinants, eigenvalues, similarity, and positive definite matrices. Specifically, students will study following key computations and the ideas behind them: 1) Solving Ax = b for square systems by elimination, 2) Complete solution to Ax = b, 3) Basis and dimension (bases for the four fundamental subspaces), 4) Least squares solutions (closest line by understanding projections), 5) Orthogonalization by Gram-Schmidt (factorization into A = QR), 6) Properties of determinants, 7) Eigenvalues and eigenvectors, 8) Symmetric matrices and positive definite matrices, 9) Linear transformations and change of basis, and 10) Linear algebra in engineering (graphs and networks, Markov matrices, Fourier matrix, Fast Fourier Transform, linear programming).

Course Offered: Every Spring
Prerequisite: None

Classification : Core Major

Numerical Analysis

Course Code: MAT3008		
Credits	Class Hr	Lab Hr
3	3	0

Numerical methods became indispensable and extremely powerful tools for various types of problem-solving techniques capable of handling large systems of equations, nonlinearities, and complicated integral problems. This course is designed mainly for electrical engineering major students. The topics that will be covered are various types of errors commonly occured in numerical procedures, roots of equations, linear algebraic equations, eigenvalues and eigenvectors, curve fitting and interpolation, numerical differentiation and integration, initial value problems for ordinary differential equations, and boundary value problems for ordinary differential equations. Students are expected to complete a significant amount of programming assignments in order to improve their understanding and programming skills in solving engineering problems numerically.

Frequency of Course Offering: Every Fall
Prerequisite: Linear Algebra or Instructor's consent

Classification : Extended Major

Modern Physics

Course Code:		PHY2008
Credits	Class Hr	Lab Hr
3	3	2

Modern Physics deals with the essential scientific discoveries of the late 19th century to the early 20th century which have led to the science and technology of the modern age. The concepts about nature in the late 19th century began to change as engineering enabled new experimental methods to discovery and understanding unexplainable phenomena. This lecture will guide students through the discoveries of modern physics and how it has led to the current understanding of nature. For understanding the limit of classical physics to examine the quantum phenomena, the course introduces the special relativistic theory and quantum physics. The course discusses the special relativistic theory, the particle properties of waves, the wave properties of particles, and the atomic structure. Students will examine the method of solving the Schrodinger equation for getting the eigenvalues and the Eigen functions, and investigate the quantum phenomena where one dimensional Schrodinger equation was applied to several kinds of potentials. Additionally, the course deals with the potential application of next generation quantum structures such as Nano semiconductors.

Frequency of Course Offering: Every year
Prerequisite: None

Classification :

Course Code:		
Credits	Class Hr	Lab Hr

COLLEGE OF ENGINEERING

MAJOR IN SOFTWARE

HANYANG UNIVERSITY

Classification : Core Major

Principles of Programming Languages

Course Code:		ENE4014
Credits	Class Hr	Lab Hr
3	3	0

This course provides an introduction to fundamental concepts in programming languages such as taxonomy and characteristics of modern programming languages. Also, students will learn how to describe a programming language, what the important language constructs are, and how they are implemented in real systems. The course will examine the different paradigms of programming and other important issues such as concurrency and exception handling as well. By taking this course, students will enhance their understanding on the languages they are using, and will be able to learn new programming languages with ease. This course will help students to achieve the following objectives: 1) understand the important features of various programming languages, and their similarities and differences; 2) learn the formal methods of describing the syntax and semantics of programming languages; and 3) learn the characteristics and differences of imperative, object-oriented, functional, and logic programming languages.

Frequency of Course Offering: Every Spring
Prerequisite: C programming, Object-oriented programming, and System programming.

Classification :

Course Code:		
Credits	Class Hr	Lab Hr

COLLEGE OF ENGINEERING

MAJOR IN COMPUTER SCIENCE AND ENGINEERING

HANYANG UNIVERSITY

Classification : Core Major

Data Structure

Course Code:		CSE2010
Credits	Class Hr	Lab Hr
3	2	2

In computer science, it is very important to organize information that can facilitate searching, updating, inserting, and deleting data. This course introduces various data structures, such as linked list, stack, queue, heap, binary search tree, balanced trees, and graph, which can organize data of various time and space complexity. Abstract data types will also be covered, including operations of searching, inserting, and deleting elements in each data structure. The main goal of this course is to learn how to design and select efficient data structures and operations. Students will learn how to compare data structures in terms of time and space complexity. In addition, students will have opportunities to learn how these data structures can be applied for solving computational problems. In the accompanying laboratory sessions, students will also have hands-on experience to implement data structures using the C programming language.

Frequency of Course Offering: Every Spring
Prerequisite: Discrete Mathematics, C Programming

Classification : Extended Major

Computer Graphics

Course Code:		CSE4020
Credits	Class Hr	Lab Hr
3	2	2

This course introduces the principles of computer graphics and interactive graphical methods for problem solving. Topics include raster graphics, color models, anti-aliasing and texture, image-space and object-space methods, 3D homogeneous coordinates, perspective, illumination models, depth cueing, hidden line elimination, morphing and other techniques. Basic computer graphics algorithms for creating graphics applications such as games and authoring tools will be covered. In addition, this class will explore the 3D application programming interfaces (APIs) such as OpenGL and DirectX, and will also introduce the modeling, rendering and animation techniques used in 3D modeling tools such as 3DS Max and Maya.

Frequency of Course Offering: Every year
Prerequisite: Java, C++

Classification : Extended Major

Computer Network

Course Code:	ENE4019	
Credits	Class Hr	Lab Hr
3	3	0

This course provides comprehensive coverage of computer networks. It is intended to provide students an understanding in the Internet and its corresponding TCP/IP protocol architecture as examples. It covers the advanced concepts such as Hyper-Text Transfer Protocol (HTTP), TCP congestion control, IP routing and firewall. Details of the protocol layers of the Internet are explained, as well as hardware and software associated with the Internet, including the application, transport, network layers. Students will perform a couple of projects of suggested topics to understand some practical aspects of the principle concepts. The purpose of this lecture is to improve students' knowledge about computer network, especially architecture and protocol as well as basic concept of the Internet. Based on these concept, students can have the ability to implement and utilize the network algorithm and program over the Internet. Students also learn the concept and capability through experimental projects.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Algorithm and Problem Solving

Course Code:	ITE2039	
Credits	Class Hr	Lab Hr
3	3	0

In this course, students first explore basic sorting algorithms such as insertion sort, selection sort, merge sort, heap sort, quicksort, counting sort, and radix sort. In addition, how to analyze the time/space complexities of algorithms by substitution/recursion-tree methods and O-notations will be discussed. Students also review dynamic programming techniques to solve assembly-line scheduling, rod cutting, matrix-chain multiplication, and longest common subsequence problems. Greedy algorithms to solve activity selection problem and Huffman code generation are studied. Finally, the course covers graph theory and graph algorithms. They are basic graph definitions, adjacency lists, adjacency matrices, breadth-first search, depth-first search, discovery/finishing time, edge classification, topological sort, connected components, disjoint-set operations, minimum spanning trees, and single source shortest paths, and all-pairs shortest paths.

Frequency of Course Offering: Every Fall
Prerequisite: Data Structure

Classification : Extended Major

Data Science

Course Code:		ITE4005
Credits	Class Hr	Lab Hr
3	3	0

In this course, students study the techniques that extract useful knowledge effectively from big data and their application to a variety of business. Data Science is an inter-disciplinary field representing the confluence of several disciplines, including algorithms, database systems, data warehouse, machine learning, statistics, and data visualization. This course will cover the principles, algorithms, implementations, and applications of data science. Specific issues dealt with in the course will be association rules, similarity search, classification, clustering, prediction, text mining, and web mining. The primary objective to this course is to 1) understand the concepts of data mining, 2) study a variety of its related techniques, 3) understand its applications, 4) analyze real-world data by using commercial data analysis tools, and 5) achieve programming skills related to data analysis techniques.

Frequency of Course Offering: Every Spring
Prerequisite: Data Structures, File Structure, Databases

Classification : Basic Major

Discrete Mathematics

Course Code:		MAT2020
Credits	Class Hr	Lab Hr
3	3	0

In the Discrete Mathematics course, students will learn mathematical structures that are discrete, and study how to apply them. The course introduces mathematical reasoning such as logic and proof, which is the foundation for solving computational problems logically and mathematically. In addition, combinatorial analysis is introduced to improve basic techniques of counting. As the basis concept of data structure, various discrete structures, such as sets, relations, graphs, and trees are introduced, which describe discrete objects and their relationships. Student will also learn algorithmic thinking, which includes writing pseudocodes, analysis of complexity, greedy approach, dynamic programming, and recursive algorithm. In this course, students will be given several assignments to have hands-on experience of solving problems by using mathematical structures.

Frequency of Course Offering: Every Fall
Prerequisite: None

COLLEGE OF ENGINEERING

DEPARTMENT OF INFORMATION SYSTEMS

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Classification : Basic Major

Data Structures

Course Code:	APA2054	
Credits	Class Hr	Lab Hr
3	3	0

How to represent real world problem and program its solution efficiently in computer systems are main topics of this course. Commonly used data structures such as arrays, linked-lists, stacks, queues, trees, sorting algorithms, and graphs, and graphs will be introduced with practical examples. The basic principles of algorithm analysis are studied. The course provides a comprehensive introduction to data structures and algorithms, including their design, analysis, and implementation. Selected topics include: efficient algorithms and data structures in a language-independent setting; a number of standard data structures and algorithm design approaches; formal analysis of algorithms; and program design and implementation. There are midterm and final exams for this course. There will be midterm and final exams along with several written and programming assignments.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

International Business

Course Code:	BUS3009	
Credits	Class Hr	Lab Hr
3	3	0

The International Business course is an introduction to global business studies. Today's business world is no longer finite to a certain country or region. Proper understandings on the global economy, world-wide stakeholders, and foundation for creating and managing an international company are some of the countless aspects required to become a part of our globalized business world. Throughout the course, students will learn the trends of the global business environment changes and the business strategies of global companies. Students, during the semester, will also learn various functional aspects of international business such as issues in trade, finance, but more specifically international technology transfer, multinational company management and business paradigm shifts.

Course Offered: Every Fall
Prerequisite: None

Classification : Basic Major

Introduction to Computer Science

Course Code:		CSE1002
Credits	Class Hr	Lab Hr
3	3	0

The primary goal is to give students a basic introduction to fundamental concepts in computer science, algorithmic thinking, and python or java programming. This course provides an introduction to computer science for beginners (preferably, non-computer science majors) such as fundamental concepts in computer science, and algorithmic problem solving and application in other areas. The course is designed for those with very little or no experience in programming. Topics include: computer science and algorithms - algorithms and pseudocode; introduction to computer organization; binary and boolean/ Von Neumann architecture/machine and assembly languages; programming in python or java; introduction to system software; introduction to networks; Dijkstra`s shortest path algorithm/models of computation/Turing machine; computers in science and society. There will be midterm and final exams along with several written and programming assignments.

Course Offered: Every Spring
Prerequisite: None

Classification : Core Major

Operating System

Course Code:		CSE3004
Credits	Class Hr	Lab Hr
3	3	0

This course examines basic issues in operating system design and implementation. The course will provide an introduction to the basic components of a modern operating system. The operating system provides a well-known, convenient, and efficient interface between user programs and the bare hardware of the computer on which they run. Particular emphasis will be given to the major OS subsystems such as process management (processes, threads, CPU scheduling, synchronization, and deadlock), memory management (virtual memory, segmentation, paging, swapping), file systems, and networking and distributed systems (Interprocess communications). There will be midterm and final exams along with several written and programming assignments. In addition, the course will provide an opportunity to experience various operation systems using virtualization platforms.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Software Engineering

Course Code:	CSE4006	
Credits	Class Hr	Lab Hr
3	3	0

Software engineering is a very broad field, which encompasses virtually everything a person might want to know in order to develop software - software that is correct, on time, and on budget. While most of the computer science courses emphasize the technical foundations of software development, such as programming, algorithms, data structures, languages, etc, this course focuses on the pragmatic aspects, such as requirements analysis, cost estimation, design, team organization, quality control, configuration management, verification, and testing. It provides an introduction to the problems of specifying, designing, building, and delivering reliable software systems. There will be a group term project developing a non-trivial software system. Topics include: principles of requirements, design and testing, review of principles of object orientation, analysis using UML, software life cycle, design principles, design methods and tools, collaboration in software design and development, research paper presentation. There will be a midterm exam and a final project along with several assignments.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Computer Architecture 1

Course Code:	ELE3019	
Credits	Class Hr	Lab Hr
3	3	0

The two series Computer Architecture courses discuss the hardware architecture of a computer system including a processor, a memory, and I/O systems. In Computer Architecture 1, the focus is on the processor internal hardware. First, students will explore MIPS assembly language and practice assembly programming using MIPS simulator. In addition, for a given C code, it is required for students to construct an equivalent assembly code. Students will examine the processor status changes in registers as a program runs. After learning the assembly language, a logic design will be discussed including combinatorial and sequential circuits. At the end of the semester, an implementation of a MIPS processor will be covered. Students will learn about a single cycle implementation and then a pipelining implementation of a processor. Three pipeline hazards of structure, data, and control are discussed. Through a MIPS simulator, students will understand at which cycle a register is updated in a pipeline.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Computer Architecture 2

Course Code:	ELE3020	
Credits	Class Hr	Lab Hr
3	3	0

The two series Computer Architecture courses discuss the hardware architecture of a computer system including a processor, a memory, and I/O systems. In Computer Architecture 2, the course discusses components except the processor. First, students will learn about a memory hierarchy including a cache memory and a virtual memory system. After a basic cache architecture is discussed, an advanced topic for a cache will be included on a multi-processor system. For the multi-processor system, cache coherent protocols of "snooping" and "directory based" will be discussed. Then, the synchronization instructions such as "atomic exchange", "test-and-set", "fetch-and-increment", and "load link/store conditional" will be included for lock implementation. After finishing the cache memory system, a virtual memory system is shortly discussed. The storage system as well as I/O will follow the memory system topic. Towards the end of the semester, multi-processor issues such as SIMD, MIMD, and SPMD will be covered, including the modern GPGPU architecture and the programming style.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Principles of Programming Languages

Course Code:	ENE4014	
Credits	Class Hr	Lab Hr
3	3	0

The course initially gives an overview about existing families of programing languages and the concepts behind them. The course continues with an introduction into syntax and semantics of programming languages as well as axiomatic semantics as it is used for program verification. A section about concurrent programming will show the motivations and techniques for process synchronization (threads) as semaphores and monitors. A discussion of program reliability is followed by a section about exception handling. An inspection of abstract datatypes is followed by an introduction into object oriented programming and its basic concepts: information encapsulation, inheritance and polymorphism. Additionally topics on the lambda calculus as computational model and the different forms of functional programming languages will be covered. During the course participants will see many example programs in different programming languages such as Java, Pyhton, C, C++, Haskell. These examples shall give a feeling of the significance, features, advantages and disadvantages of all these languages.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Computer Networks

Course Code:		ENE4019
Credits	Class Hr	Lab Hr
3	3	0

This course introduces the principles of internetwork architecture and communication protocols underlying interoperable systems. Topics include survey of the design and implementation of computer networks and inter-networks, internet addressing and routing, address binding, control of internet congestion and flow, examples of internet protocol suites (TCP/IP), round trip time estimation, naming and name resolution, internet applications programs, the ISO/OSI model. This course provides an overview of computer networks and the Internet, application layer protocols, transport layer protocols, network layer protocols and routing, link layer protocols, network management, security/defense, Internet today. Additionally, the course will discuss on research issues in highlight, the Internet-related problems (e.g., health informatics, SNS, Internet measurement, security). There will be midterm and final exams along with several written and programming assignments.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Basic Major

Principles of Business Administration

Course Code:		GEN0044
Credits	Class Hr	Lab Hr
3	3	0

This course is an introduction to business studies that cover a lot of different areas. Students are to understand the basic principles of business companies that are major part of modern society. There are four main sectors including planning, organizing, leading, and control. Specifically, selected topics for this course are: manager and management, managerial environment, managerial issues, foundation of decision-making, foundation of planning, organizational structure and planning, human resources management, management of change and innovation, foundation of individual behavior, understanding of groups and teams, motivation and compensation for employees, leadership and trust, communication and information management, foundation of control, production management, etc. This course is fundamental to study the enhanced courses of the 2nd grade to the 4th grade related to business management.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Basic Major

C Programing

Course Code:		ITE1009
Credits	Class Hr	Lab Hr
3	2	2

The C Programing course is an introductory computer programming course, targeted to the freshman students in the Department of Information System, using C programming language. Throughout the semester, the course offers a comprehensive understanding of C programming for those students who have no prior experience of programming. From this course, students will be able to write, read, and understand computer programs using C language. Specifically, this course will cover the following topics: 1) introduction to programming and C language; 2) lexical elements, operators, and C system; 3) data types and functions; 4) flow of control; 5) arrays, pointers, and strings; and 6) structures and unions.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Basic Major

C++ Programming

Course Code:		ITE1010
Credits	Class Hr	Lab Hr
3	3	0

The course gives an introduction into the C++ programming language and object oriented programming in general. The course will start with the basics: syntax principles, variables, control constructs, arrays etc. After the basics the focus will move towards the foundations of object orientation: classes, objects and the idea of data-driven programming. This introductive part of the course is followed by a section on inheritance, polymorphism and dynamic binding. Then the course will move towards the more sophisticated aspects of C++ by starting with exception handling for managing erroneous program behavior. This is followed by a section on template based programming in C++ and an overview over the Standard Template Library (STL). During the course students will learn the differences with respect to the C programming language in all areas, where both programming languages overlap. Basic knowledge of the C programming language is a helpful requirement for participation.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Basic Major

Introduction to Information System

Course Code:		ITE1012
Credits	Class Hr	Lab Hr
3	3	0

In this course, students investigate how information systems that are created by combination of computers and telecommunication networks are utilized in organizations. The course will also look into the role of information systems in organizations as well as components that comprise information systems. Lastly the course will look at variety of different information systems in organizations. There are four main parts in this course. These are 1) organizations, management, and the networked enterprise, 2) information technology infrastructure, 3) key system applications for the digital age, 4) building and managing systems. There are so many vivid cases in this area. Thus, all students participating in this class will be composed of teams including 5 to 7 members. Each team has to prepare for one case presented in the textbook and make a presentation in front of other audiences of the class.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Web Systems Programming 1

Course Code:		ITE2020
Credits	Class Hr	Lab Hr
3	3	0

In this course, students will learn standard Programming Languages in developing applications for the World Wide Web on client-side. HTML is the programming language used to develop home pages on the Internet. CSS is used to control the style and layout of Web pages. JavaScript programming language enables adding powerful interactions to websites. Students will learn a basic understanding of HTML5, CSS3, and Javascript programming, including interacting with the HTML DOM and declaring Javascript functions. This class will address how to use them appropriately and how to combine them to build nice web page and web site. This course provides students with application programming techniques which can be applied to various devices and platforms. In particular, students will learn the up-to-date design methodologies, the relevant tools, and their application methods to create and manage information which is appropriate for Web-based computing environment. After taking this course, students will be able to create rich internet applications that use most recent client-side programming technologies.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Algorithm Analysis

Course Code:		ITE2023
Credits	Class Hr	Lab Hr
3	3	0

The course covers some basic topics on algorithms and their complexity analysis. As first topic, students will inspect the problems of sorting and will learn several significant algorithmic approaches for solving these problems. Additionally, this section comprises an introduction into asymptotic notation and a presentation of the lower bound for sorting. After sorting the focus of this course will move towards binary search trees and red-black-trees as balanced form of search trees. The final block of the course will be on graph algorithms. There the class start with the elementary algorithms breadth-first-search and depth-first-search, followed by a look into topological sorting. Then the course will see algorithmic solutions for the problem of minimum spanning trees, before finally moving towards shortest path problems. Here students inspect the Bellman-Ford algorithm as well as Dijkstra's algorithm.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Basic Major

Database System

Course Code:		ITE3016
Credits	Class Hr	Lab Hr
3	3	0

In this course, students will study the overview of databases, database management systems, and database systems, and also learn data models, database languages, and a variety of implementation techniques. The course emphasizes the database design and implementation issues, and allows students to experience the development of database applications by using commercial database management systems. Finally, the course provides the concepts and principles of the internal mechanism of database management systems. Topics include: functionality by database management system (DBMS), data model, relational model, functional dependencies & normalization, relational algebra, relational calculus, structure query language, entity-relational model, real-world database applications, hands-on experience with DBMS, database administration, need for control, security, reliability, concurrency control, and storage & data access. There will be midterm and final exams for this course.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

System Software

Course Code:		ITE3031
Credits	Class Hr	Lab Hr
3	3	0

This course introduces the cryptographic systems to protect information in computer systems. The course explains the cryptographic primitives and how to use them correctly. Students will learn how to reason the security of cryptographic constructions and how to apply this knowledge to real-world applications. The course begins with a detailed discussion of how two parties who have a shared secret key can communicate securely when a powerful adversary eavesdrops and tampers with traffic. The course will examine many deployed protocols and analyze mistakes in existing systems. The second half of the course discusses public-key techniques that let two or more parties generate a shared secret key. The course will cover the relevant number theory and discuss public-key encryption, digital signatures, and authentication protocols. Towards the end of the course, more advanced topics such as zero-knowledge, privacy mechanisms, and other forms of encryption will be covered. Throughout the course, students will be exposed to many exciting open problems in the field.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Object Oriented Programming-Java

Course Code:		ITE3032
Credits	Class Hr	Lab Hr
3	3	0

The course gives an introduction into the Java programming language and object oriented programming in general. The course will start with the basics: syntax principles, variables, control constructs, arrays etc. After the basics the focus of the lecture will move towards the foundations of object orientation: classes, objects and the idea of data-driven programming. This introductive part of the course is followed by a section on inheritance, polymorphism and dynamic binding. Then the course will more towards the more sophisticated aspects of Java by starting with exception handling for managing erroneous program behavior. This is followed by a section on concurrent programming and threads in Java, where students will learn the synchronization technique used for solving the consumer-producer problem in Java. Finally the course looks into graphical user interface programming and the model-view-controller scheme used in Java for this purpose. The course is suitable for students with basic programming knowledge.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

ERP System

Course Code:		ITE3035
Credits	Class Hr	Lab Hr
3	3	0

In our modern business world, corporations have many resources to compete against others in the market. ERP (Enterprise Resource Planning) systems extract information from these corporate assets and make it useable throughout the entire organization and its corporate value chains. Without a proper ERP system, a corporation might not get the up-to-date information essential for efficient, effective management of its businesses. ERP systems used to be very costly, but with advances in information and communication technologies, they are now affordable for even small to medium-sized companies. This course will address the basic building blocks of modern ERP systems. Topics include components, business functions, specific tools and technologies, and advanced roles of ERP systems. Students will learn the basic theories of ERP systems and the practical applications of such tools. The latest demo programs will be used to experience the power of corporate ERP systems.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Artificial Intelligence and Application

Course Code:		ITE3051
Credits	Class Hr	Lab Hr
3	3	0

This course introduces the foundations of Artificial Intelligence including search, logical induction, and different approaches to automated learning. The class demonstrates how these concepts are applied to practical problems, such as game playing, planning, language understanding, pattern recognition, and robotics. Topics include: introduction to artificial intelligence, agent model, dimensions of model, agent architectures and hierarchical control, knowledge representation, states and searching, informed search, uninformed search, DFS and BFS, IDS, best first search, A* search, search with costs, search heuristics, optimality, data mining & machine learning techniques, big data analysis, first order logic, time-series anomaly detection algorithms, and in-class presentation of recent academic publications. There will be a midterm exam and a final project (group of 2-4) along with several written and programming assignments.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Information Security

Course Code:		ITE4023
Credits	Class Hr	Lab Hr
3	3	0

This course provides an introduction to security and privacy issues in various aspects of computing, including programs, operating systems, networks, and Internet applications. It examines causes of security and privacy breaches, and gives methods to help prevent them. In this course, the up-to-date conference/journal publications will be provided and discussed. It will be held partially as a seminar-like lecture, including in-class presentation by students. Selected topics include: comparing security with privacy; types of threats and attack; defense methods; program security; non-malicious program errors; malicious code; controls against program threats; network security: network threats, firewalls, intrusion detection systems; non-technical aspects: policies, physical security, legal and ethical issues. There will be a midterm exam and a final project along with several assignments.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Ecommerce Theory

Course Code:		ITE4031
Credits	Class Hr	Lab Hr
3	3	0

This course addresses overall management issues on rapidly proliferating e-business. Lecture topics include e-business strategy, internet business models, B2C and B2B applications, and business e-transformations. Students will practice intensive case analyses for internet marketing with customer relationship management, inter-organizational information systems with supply chain management. Thus, all students will be grouped into teams of 5 to 7 members for the purpose of case study. Recent applications of pervasive computing with mobile technologies will also be discussed. Concretely, this course's main topics include introduction to e-commerce and e-marketplaces, EC applications, emerging EC platforms, EC support services. There are various new technologies' impact on business changes and new phenomena including social media's spreading and ICBM (internet of things, cloud computing, big data, mobile). The course also study these areas based on business management perspective.

Course Offered: Every Spring
Prerequisite: Principles of Business Administration, Marketing Theory

Classification : Extended Major

Information System Policy

Course Code:		ITE4047
Credits	Class Hr	Lab Hr
3	3	0

In this course, we will learn about how to control information system project development in organizations by setting up information system policy for the organization. We will also learn about how to set up such information system policy which can last mid-term as well as long-term time frame in the organization.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Introduction to Embedded System

Course Code:		ITE4049
Credits	Class Hr	Lab Hr
3	3	0

This course introduces the design of a cyber-physical system based on model. The course is composed of three parts: specification, implementation, and analysis. In the specification section, students will explore the relationship between cyber system (computer) and physical system (physics). Based on model (block diagram), the cyber-physical system will be presented. Especially, various finite state machine models and their composition will be discussed. For the implementation part, this course covers real-time scheduling issues especially in OS briefly, which includes rate monotonic and early deadline first scheduling. In addition, a scheduling anomaly will be introduced. Note that computer architecture related issues will not be covered. In the analysis section, linear temporal logic is covered. For a term project, students will specify a state diagram, program it, and run it into Lego NXT mind storm robot.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

IT and Business Strategy

Course Code:		ITE4050
Credits	Class Hr	Lab Hr
3	3	0

Competitive advantages of companies can be achieved by managing technological capabilities and constructing robust corporate strategies. Strategic management is concerned with how a firm sets its goals, selects its IT business activities, and establishes and defends its technology-based position in competitive markets. Therefore, how to practically build technology and business strategies is essential knowledge needed to be discussed through this course. The aim of this course is to understand the technology and business planning and to practice how to build the technology and business strategies using IT-based tools. Specifically, this course will cover the following topics: 1) framework of technology and business planning; 2) tools for technology (patent) analysis, and 3) tools for business analysis.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Organization Theory

Course Code:		PAD3003
Credits	Class Hr	Lab Hr
3	3	0

Fundamental organization theory and the impact of digital technologies to organization changes are addressed. Basic motivation theory, leadership, decision making, organization design is taught followed by recent organization development trends such as learning organization, knowledge management, and business reengineering. Students will submit term papers, and active participation on classroom discussion is required.

Frequency of Course Offering: Every Fall
Prerequisite: None

COLLEGE OF ENGINEERING

MAJOR IN ELECTRICAL ENGINEERING

HANYANG UNIVERSITY

Classification : Extended Major

Signal Processing

Course Code:	ENE4015	
Credits	Class Hr	Lab Hr
3	3	0

This course will deal with advanced theory and applications of digital signal processing. This course is offered for senior undergraduate students who have basic knowledge about signal and systems and probability theory. Throughout the semester, the course covers basic digital signal processing theory including sampling theory, frequency-domain analysis of the signal and systems, structure of the filters, filter design theory, discrete Fourier transform (DFT) and short-time Fourier transform (STFT) and time-frequency analysis of signals. Then, probability theory and random process will be briefly reviewed and more advanced signal processing techniques including Wiener filter, minimum mean square error (MMSE) estimation, adaptive filtering, digital filter bank, and array signal processing techniques will be discussed. In this course, the students will practice various signal processing applications using MATLAB and C Programming.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Modern Physics

Course Code:	PHY2008	
Credits	Class Hr	Lab Hr
3	3	0

The objective of this course is to introduce modern physics to students interested in engineering. The covered topics include: the birth of modern physics, special theory of relativity, the experimental basis of quantum physics, structure of the atom, wave properties of matter, quantum mechanics I, quantum mechanics II, the hydrogen atom, atomic physics, and statistical physics. This course aims at understanding modern physics which is background of electrical and electronic device. To complement the shortage of classical physics, various postulates and concepts have been developed and verified in both theories and experiments. This course covers fundamental knowledge a modern engineer needs to know in the modern era and helps students to build a foundation to understand the microscopic world such as atomic, molecular, material and nano structure or systems.

Frequency of Course Offering: Every Spring
Prerequisite: None

COLLEGE OF ENGINEERING

MAJOR IN BIOMEDICAL ENGINEERING

HANYANG UNIVERSITY

Classification : Extended Major

Cell Molecular Biology

Course Code:		BIO3035
Credits	Class Hr	Lab Hr
3	3	0

This course investigates cell biology at the molecular level which creates a coherent framework, and deals with the basic cellular principles and regulations of cellular biomolecules, structures, functions signaling pathways, and metabolism required to understand modern biomedical cell sciences. The course will cover introduction to cell molecules, protein functions, control of gene expression, and cell signaling at the molecular level. Topics include: storage and processing of genetic information in the cell; regulation and control of gene action; analysis of cell surface receptor/ligand binding and trafficking of cell signal transduction; receptor-mediated cell responses; metabolic pathways and control mechanism; and cell proliferation and growth. The course provides students with the basic knowledge of molecular and cellular technologies applied in a modern laboratory. By the end of this course, students will be able to convey acquired expertise in pivotal components of translational biomedical engineering to other scientists outside such fields.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Innovative Biomedical Engineering Research 1

Course Code:		BIO4061
Credits	Class Hr	Lab Hr
3	2	2

This course aims to train students on biomedical researches. In the beginning of the semester, students will each choose a topic among suggested ones. During the course semester, students will be provided with opportunities to practice developing the ideas and write a detailed research proposal of the topic they chose. Students will be deeply involved in the research projects by attempting to write research proposals. The research activities will be performed in the lab under the guidance of mentors, including the professor and graduate students. Another key activity in this course is research presentation. Students are required to present their research activities and results throughout the course. The goal of this presentation is to improve both students' research ability and their communication skills with other researchers. Various innovative thoughts and practical research experiences are acquired through this course.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Innovative Biomedical Engineering Research 2

Course Code:		BIO4062
Credits	Class Hr	Lab Hr
3	2	2

This course encourages students to obtain advanced experiences on research activities following previous course. As in the previous course, Innovative Biomedical Engineering 1, students participate in research activities, and are trained to get practical knowledge on biomedical researches. In this course, students will be trained to select proper research subject, conduct experiments, and write research papers. With advanced knowledge and experience, students are required to apply their own idea into the research project to improve the research results. Also, students are encouraged to participate in various research events, including Capstone Design competition and biomedical engineering conferences. At the end of the semester, students will be expected to submit a graduate paper with research activities and research results.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Nano-Bio Engineering

Course Code:		BIO4066
Credits	Class Hr	Lab Hr
3	3	0

Based on the development of 21st century's nanotechnology and related researches, the nano-bio technology – a cooperative field of medical science and engineering – has earned much attention as a brilliant technology which can be a solution for public health problems. In addition, the principles of the human nature can be applied to the solution for problems in engineering technology. By using the diversity of micro- and nano-structure, the application for industrial and development of smart artificial structure can be realized, which was not possible in the traditional technology. Throughout the semester, the Nano-Bio Engineering course will cover contents that are state of the art, and other topics such as R&D of nano-bio technology and its prospect and marketability.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Bioenergy Engineering

Course Code:		BIO4068
Credits	Class Hr	Lab Hr
3	3	0

The energy consumption increased dramatically during the twentieth century, and there exists an unbalanced energy management. In addition, there is a trend towards the miniaturization and portability. These energy-demanding applications require small and light power sources for the application in areas such as space exploration and implantable electrically-operated devices. The Biofuel cells potentially offer solutions to all these problems, by taking nature's solutions to energy generation and tailoring them to our own needs. Ideally, implanted devices would take advantage of the natural fuel substances found in the body, thus would continue to draw power as long as the subject lives. They take readily available substrates from renewable sources and convert them with the generation of electricity. Here in this course, the trend of research and development of biofuel cell will be discussed.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Comparative Biology

Course Code:		BNG2003
Credits	Class Hr	Lab Hr
3	3	0

This course delivers fundamental knowledge about biology as pivotal link in integrative biomedical engineering sciences. It provides insight into the intricate systems of the basic unit of life, the cell. The course will cover basic principles: cell, genes, survival, repair, growth, reproduction, development, evolution, homeostasis and thermodynamics. The covered topics will provide an understanding about the various biological aspects of biology, considering sub-disciplines of biology defined by the following studies: biochemistry; molecular biology; cellular biology; physiology; evolutionary biology; and ecology. Students will be able to obtain insights into the intricate systems of the basic unit of life, the cell – its development, evolution, genetics, homeostasis, and energy as well as phylogenetic place in its ecological environment. Students are expected to familiarize themselves with biology as key component of Biomedical Engineering and convey acquired expertise to other scientists outside such fields.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Biomedical Optics

Course Code: BNG3019		
Credits	Class Hr	Lab Hr
3	3	0

Biomedical optics is an emerging engineering field, which combine physics, mechanical engineering, electrical engineering, biology, and medicine that deals with the applications of optical science and technology to solve biomedical problems. During the initial months of the semester, the fundamental principles of optics will be introduced, including light properties, geometrical optics, polarization, interference, diffraction, and Fourier optics. For the latter part of the semester, the course will provide lectures introducing optical systems and various applications in biomedical optics, including optical microscopy, fluorescence microscopy, confocal microscopy, and optical coherence tomography. Selected topics include: fundamentals of optics; light-tissue interaction; fiber optics; photonics materials and devices; sensing and imaging techniques; and its applications in biomedical field. Also, optical diagnosis methods in various clinical fields will be investigated as well.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Bioelectromagnetics

Course Code: BNG4012		
Credits	Class Hr	Lab Hr
3	3	0

The purpose of this course is to provide a full coverage of basic principles and theories of bioelectromagnetics, including the origins of bioelectric phenomena, generation of bioelectric signals such as electrocardiogram (ECG), electroencephalogram (EEG), electromyogram (EMG), and methods for recording and analyzing biomedical signals. This course also introduces various biomedical instruments based on the bioelectromagnetic phenomena, such as magnetic resonance imaging (MRI), EEG, magnetoencephalography (MEG), electrical impedance tomography (EIT), magnetic induction tomography (MIT), microwave tomography, transcranial electrical stimulation (TES), and transcranial magnetic stimulation (TMS). Practical examples of bioelectromagnetic phenomena in brain and heart are examined as well. By the end of the course, students will be able to solve practical bioelectromagnetic problems by using finite element method (FEM), e.g., designing MRI coils, simulating volume currents inside the human head model, etc.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Biomedical Optics Instrumentation

Course Code:	BNG4016	
Credits	Class Hr	Lab Hr
3	2	2

Biomedical optics is an emerging engineering field, dealing with the applications of optical science and technology to various biomedical problems. In this course, the principles and design methods of biomedical optics instrumentation will be investigated. The course will provide lectures introducing various advanced biomedical optics systems, including confocal microscopy, two-photon microscopy, high-resolution microscopy, optical coherence tomography, near-field microscopy, adaptive optics, atomic force microscopy, and photo-acoustic tomography. Optical components for the optical instrumentations, such as lasers, scanners, photodetectors, and filters, will be provided. Students will learn how to design optical systems, especially for biomedical applications. The concept of aberrations will be covered and the design process for developing biomedical optics instrumentation will be introduced, including evaluation method of imaging quality, optimization process, and tolerancing method.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Biomedical Engineering Capstone Design 1

Course Code:	BNG4019	
Credits	Class Hr	Lab Hr
3	0	2

In this course, all students are expected to participate in the laboratory of the faculty member and learn practical work of on-going research topics. After choosing one research topic from the suggested research fields, students will write a research proposal that initiates the research project. The research activities will be performed in the designated lab in the department of Biomedical Engineering under the guidance of mentors, including the professor and graduate students who are responsible for the research project. Then, the students are required to present their research progress at the class, which will enhance their research ability as well as communication skills. The students are required to work on a creative way of how to achieve the research goal through practical participation of research work. Also, the students are encouraged to participate in various research events, including Capstone Design and conferences.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Biomedical Engineering Capstone Design 2

Course Code: BNG4020		
Credits	Class Hr	Lab Hr
3	0	2

In this course, all students are expected to participate in the laboratory of the faculty member and learn practical work of on-going research topics. After choosing one research topic from the suggested research fields, students will write a research proposal that initiates the research project. The research activities will be performed in the designated lab in the department of Biomedical Engineering under the guidance of mentors, including the professor and graduate students who are responsible for the research project. With the advanced research skills and experiences, the students are required to participate in the research project actively, by applying novel ideas and methodologies to solve challenging problems encountered in the research project. The students are required to work on a creative way of how to achieve the research goal through practical participation of research work. Also, the students are encouraged to participate in various research events, including Capstone Design and conferences.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Biochemistry

Course Code: CHM4006		
Credits	Class Hr	Lab Hr
3	3	0

The course delivers fundamental knowledge about thermodynamic principles, biomolecules, protein structure and functions, mechanisms of enzyme actions, metabolism, and genetic information in a cell. In particular, enzymatic reactions of cell signaling pathways related to discrete cellular metabolic events – anabolic and catabolic processes that satisfy the metabolic needs of the biological cell – are covered. Accordingly, this course deals with the basic cellular thermodynamic principles, biomolecules, pathways and regulation of cellular molecules, structures, functions and metabolism required to understand modern biochemistry with respect to bio-(medical) engineering. Lectures cover a basic introduction to cell molecules (amino acids, proteins, RNA and DNA), and further deepen into enzymes and enzyme catalysis, cell signaling, carbohydrate metabolism, glycolysis, citric acid cycle, oxidative phosphorylation, lipid metabolism, amino acid metabolism, photosynthesis, and nucleotide metabolism. Based on the acquired knowledge, a major focus will be given on discussions of various biomedical applications of biochemistry in the bio- (medical) engineering area.

Frequency of Course Offering: Every Fall
Prerequisite: None

COLLEGE OF ENGINEERING

DIVISION OF MATERIALS SCIENCE & ENGINEERING

HANYANG UNIVERSITY

Classification : Compulsory General Studies

Career Development I

Course Code: GEN5029		
Credits	Class Hr	Lab Hr
1	1	0

The Career Development I course aims to cover the following aspects: etiquettes of the university life; means to use the university facilities; ways to improve oneself; and provision of ideal ways to utilize the student period. It aims to broaden the 1st year students' point of view to their majors as well as the university life in general. Throughout the semester, the course will discuss studying skill including taking notes, taking exams, time management, and subject enrollment in order to guide students to achieve an ideal studying pattern, and to further set up a career path. It will also deal with basic information about diverse study areas, domestic and international social issues, and career development.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Materials Science 1

Course Code: MAE2001		
Credits	Class Hr	Lab Hr
3	3	0

The purpose of this course is to teach the basic knowledge of advanced materials by understanding the material properties and the synthesis method, and the correlation between microstructure and its characteristic. Through this information, students will be able to design and synthesize the advanced materials. The contents of this course are as follows: combining the structure of the solid; phase equilibrium; deformation and mechanical properties of a solid; the relation between the strengthening mechanism and microstructure of the material; electronic theory; the electrical conduction characteristics of the junction; magnetic properties; optical properties; and so forth. Through the course, students will acquire knowledge about: 1) crystal structure of the material; 2) defect and deformation of the material; 3) mechanical properties change with deformation of the material; 4) mass transfer, and learn the basic theory need for the development of new materials.

Frequency of Course Offering: Every Spring
Prerequisite: Fundamental Physics 1, 2 and Fundamental Chemical 1, 2

Classification : Extended Major

Materials Engineering Design 1 (URIP)

Course Code: MAE2008		
Credits	Class Hr	Lab Hr
2	0	4

In this course, intended for the first semester sophomore year, students will learn to conduct their own scientific research based on what they have studied in their freshman year. The course is divided into two sections. During the first section of the semester, hands-on laboratory lectures will be provided on four areas of materials science in order to teach basic experimental skills, data analysis. For each hands-on laboratory lecture, students will write a report summarizing what they have learned. Then during the second section of the semester, students will choose one topic among those proposed by the professors. The students will then prepare his/her own research proposal for the study and then conduct the research, analyze the data and prepare a final report. Finally students will then present their research results at the end of the term.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Electronic Device Material 1

Course Code: MAE3019		
Credits	Class Hr	Lab Hr
3	3	0

The purpose of this course is to understand the physics of semiconductors, their properties and devices, and the characteristics and operation mechanisms. It covers the concept of quantum mechanics, nonequilibrium transport phenomena, p-n junction, tunneling, surface characteristics of semiconductors, and practical examples of devices.

Frequency of Course Offered: Every Spring
Prerequisite: None

Classification : Core Major

Electronic Device Material 2

Course Code: MAE3020		
Credits	Class Hr	Lab Hr
3	3	0

This course is introduction to solid state electronic devices and optic devices for undergraduate students with a background in semiconductor physics. It provides students with understanding of the principles of operation, device structure and application for diodes, field-effect transistor, photo diode, light-emitting diode, laser, power devices such as p-n-p-n diode and insulated gate bipolar transistor, negative conductance microwave devices such as tunnel diode and gunn diode, and integrated circuit.

Frequency of Course Offered: Every Fall
Prerequisite: None.

Classification : Core Major

Physical Metallurgy 1

Course Code: MAE3022		
Credits	Class Hr	Lab Hr
3	3	0

The structure of materials is closely related to the property of engineering materials. This course investigates the relationship between structures and properties of materials and aims to interpret them physically. In class, students will develop a theory and verify them in practical examples. Specifically, this course allows students to explore the crystallographic structure of metals and learn techniques to analyze them. The course deals with the theory and characteristics of the crystal defects, and especially, the vacancies and dislocations in particular. This course covers the grain boundaries and explore the theory of the plastic deformation. Throughout the course, students will be provided with opportunities to consider the change of the material due to cold working and annealing.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Physical Metallurgy 2

Course Code: MAE3023		
Credits	Class Hr	Lab Hr
3	3	0

To help students deepen their understandings on physical metallurgy, this course discusses the structure-property relationships in metallic alloys, which are selected to illustrate some basic concepts of physical metallurgy and alloy design. Main topics that will be covered during the courses are fundamentals of annealing, spindle decomposition, nucleation, growth, and particle coarsening. Throughout the semester, this course will concentrate on structure, structure formation, and structure-properties relationships. Issues on structural features, which are grain size, interstitial and substitution solutes, precipitates, second-phase particles, and eutectoids will also be considered. Examples from advanced structural alloys and low-dimensional alloys for magnetic recording media and integrated circuits will be covered in class.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Materials Chemistry

Course Code: MAE3029		
Credits	Class Hr	Lab Hr
3	3	0

Our current technologically-advanced lifestyles are ever-dependent on advanced materials. In order to continue these developmental efforts to further improve our quality of life, a thorough knowledge of material structures, methods of synthesis, and characterization technique is essential. The Materials Chemistry course will appeal to junior or senior undergraduate students majoring in chemistry, materials science, and chemical engineering by leading them a step wiser from the introductory level chemistry. Students taking this course will be able to sophisticate their understandings of materials chemistry through a discussion of different classes of materials, and through being introduced to descriptions of how materials are used in devices and general technology in class.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Biomimetic Materials

Course Code: MAE4059		
Credits	Class Hr	Lab Hr
3	3	0

Biomimetics is the study of nature's design solutions and its inspiration for human technology, and biomimetic materials is one of the modern materials science and technology. In this course, the key objectives will be to examine nature's design solution and to get inspirations that can be applied for human technology. Also, the course will discuss on how the man-made materials and technology benefits both the nature and the humans, simultaneously. Biological organisms have achieved many remarkable solutions to engineering challenges in nature, ranging from ultra-strong fibers in spider webs to cell transport by molecular motors. Therefore, in this course, the study focus will be on identifying key design elements in the natural world and ways to replicate them in man-made materials and technologies.

Frequency of Course Offered: Every Spring
Prerequisite: None

Classification : Core Major

Thermodynamics of Materials 1

Course Code: MMS2006		
Credits	Class Hr	Lab Hr
3	3	0

This course covers the elements of chemical thermodynamics including thermodynamic laws, and discusses application of thermodynamics to materials science and engineering. In practice, the following thermodynamics concepts and definitions will be covered during the semester: 1) the first law of thermodynamics, including the concepts of internal energy, heat and work, basics of transport mechanisms and heat transfer, heat capacity, and enthalpy; 2) the second law of thermodynamics, including Carnot cycle, the concept of entropy, the statistical interpretation of entropy, thermal equilibrium and the Boltzmann equation; 3) the third law of thermodynamics, including Gibbs and Helmholtz free energies, and Maxwell relations; and 4) phase equilibrium in a one component system, reaction equilibria in gas mixtures, and the P-V-T relation of solids. Overall, this course is designed to introduce the concepts of thermodynamics applied to engineering materials.

Frequency of Course Offering: Every spring
Prerequisite: None

Classification : Core Major

Thermodynamics of Materials 2

Course Code: MMS3015		
Credits	Class Hr	Lab Hr
3	3	0

This course will cover the phase equilibria in alloy systems, free energy composition and phase diagram of binary systems, and reaction equilibria in systems containing components in condensed solutions and galvanic cells. This course aims to investigate the elements of chemical thermodynamics including thermodynamic laws, and discusses the applications of thermodynamics to materials science and engineering. Emphasis will be placed on the fundamental concepts related to the behavior of solutions, condensed phases, and gaseous phases. The objective of this course is to build on thermodynamic principles developed in undergraduate programs. Emphasis will be on the fundamental concepts related to various forms of energy, understanding of first, second, third law of thermodynamics, phase transformations and chemical reactions, and determination of the stability of materials.

Frequency of Course Offering: Every Fall
Prerequisite: Thermodynamics of Materials 1

Classification : Extended Major

Capstone Design Course for Senior 1 (URIP)

Course Code: MSE4003		
Credits	Class Hr	Lab Hr
3	0	3

In this course, students can develop the skills for critical problem analysis, creative solutions and technical presentations for various topics that are applicable to industry, professional research institutions and graduate study based on four years of knowledge accumulated from his or her undergraduate study. Each student chooses one group among fourteen groups that will target a specific topic. In lectures, students of each group will present and discuss about their research findings including what they have learned such as experimental skills and the technique to analyze the results. Since the main topics dealt in this class are related to the cutting-edge issues in materials science communities, there is no fixed textbook, and recent papers and news articles are adopted as references for this class.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Capstone Design Course for Senior 2 (URIP)

Course Code: MSE4004		
Credits	Class Hr	Lab Hr
3	0	3

In this course, senior students will develop the skills necessary to conduct and present scientific research based on the knowledge accumulated from his or her undergraduate study. This will include problem analysis, experimental design, specific experimental research techniques and critical thinking in order to reach creative solutions for a research problem. Each student will choose one of the sixteen research groups that target a specific research theme. These topics are designed to be applicable to careers in industry, professional research institutions and university graduate study. During the lecture all sixteen research groups will be required to make a technical presentation describing their research findings and be expected to answer questions about their research. (Note: Before graduation, senior students should take at least one of the two Capstone Design Course for Senior.)

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended major

Light Materials

Course Code: MTE3002		
Credits	Class Hr	Lab Hr
3	3	0

Materials innovation and application are increasingly important to sustain advanced manufacturing and modern methods of construction in the world. All around the world, industry is demanding new, cost-effective, environmentally friendly materials and process technologies to meet with legislation and consumer demands. In recent years, lightweight metallic materials have received much attention since the ability of these materials to integrate several functions (such as high strength and high ductility) in a single component can reduce the overall cost and weight of a structure. In addition, higher costs can be offset if the manufacturing process is made radically simple. This class is to aid good practice in the selection of lightweight metallic materials including aluminum, magnesium, copper, nickel, titanium and etc. for product design.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Modern Physics

Course Code:		PHY2008
Credits	Class Hr	Lab Hr
3	3	0

This course deals with the essential scientific discoveries of the late 19th century to the early 20th century which have led to the science and technology of the modern age. The concepts about nature in the late 19th century began to change as engineering enabled new experimental methods of discovery and understanding unexplainable phenomena. This course will guide students through the discoveries of modern physics and how it has led to the current understanding of nature. For understanding the limit of classical physics to examine the quantum phenomena, the course introduces the special relativistic theory and quantum physics. The course discusses the special relativistic theory, the particle properties of waves, the wave properties of particles, and the atomic structure. Students will examine the method of solving the Schrodinger equation for getting the eigenvalues and the Eigen functions, and investigate the quantum phenomena where one dimensional Schrodinger equation was applied to several kinds of potentials. Additionally, the course deals with the potential application of next generation quantum structures such as Nano semiconductors.

Frequency of Course Offering: Every year
Prerequisite: None

Classification : Core Major

Solid State Physics

Course Code:		PHY4007
Credits	Class Hr	Lab Hr
3	3	0

Solid state physics is concerned with the properties, often astonishing and often of great utility, which includes the energy band of electrons and the elementary excitation of solid that result from the distribution of electrons in metals, semiconductors, and insulators. This course introduces how the excitations and imperfections of real solids can be understood with simple models whose power and scope are now firmly established. The aim of this course is to give students an extended knowledge of the principles and ways to understand solid state physics. Topics covered include the structure, thermal and electrical properties of metals, semiconductors, and insulators. The subject matter supports a profitable interplay of experiment, application, and theory.

Frequency of Course Offering: Every Fall
Prerequisite: None

COLLEGE OF ENGINEERING

DEPARTMENT OF CHEMICAL ENGINEERING

HANYANG UNIVERSITY

Classification : Extended Major

Engineering Properties of Functional Polymers

Course Code:	CHE1015	
Credits	Class Hr	Lab Hr
3	3	0

In this course, students will learn a variety of applications of polymers and learn how to utilize their unique properties under different situations through fundamental components as well as modern approaches. This course will help students to develop an understanding of how to tailor polymer properties for different functional applications. Polymers exhibit new functions in addition to traditional roles for mechanical applications. Typical examples are electronic and ionic conductive polymers, which can be applied for light emitting diodes, secondary batteries, solar cells, and fuel cells. Some polymers show selective transport through polymers, which can be applied for membranes to separate gas and liquid mixtures. Optical, photonic and biomedical applications of polymeric materials have also been paid much attention recently. Thus, this class will cover the structure-functional properties relationship of polymeric materials and their applications.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Separation Process

Course Code:	CHE4010	
Credits	Class Hr	Lab Hr
3	3	0

A chemical or biochemical plant is operated in a batchwise, continuous, or semi-continuous manner. The operations may be key operations unique to chemical engineering because they involve changes in chemical composition. The key operations are 1) chemical reactions and 2) separation of chemical mixtures. Most of the equipment in biochemical or chemical plants is there to purify raw material, intermediates, and products by the separation techniques. In this course, methods for designing large-scale separation operations, which chemical engineers apply to produce chemical and biochemical products economically will be introduced. Topics included are: distillation, absorption, stripping, solid/liquid–liquid extraction, as well as newer methods such as adsorption, chromatography, and membrane separation. Based on mass and energy balance equations as well as thermodynamics, the design principles for these operations are covered for each separation operation.

Frequency of Course Offering: Every Spring
Prerequisite: Chemical Engineering Thermodynamics

Classification : Core Major

Introduction to Biochemistry

Course Code: CHM3069		
Credits	Class Hr	Lab Hr
3	3	0

The main goal of the course is for students to identify the five classes of polymeric biomolecules and their monomeric building blocks. Through this course, students will be able to explain the specificity of enzymes (biochemical catalysts), the chemistry involved in enzyme action and explain how the metabolism of glucose leads ultimately to the generation of large quantities of ATP. Throughout the course, students will obtain more detailed knowledge on how fats and amino acids are metabolized, the structure of DNA and its genetic information, DNA replication, RNA and also on protein synthesis which can be controlled at the level of transcription and translation. By the end of the class, the current issue about the biochemical basis of cancer will be brought up in order to help students to understand in details on the theories taught.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Catalytic Reaction Engineering

Course Code: CHM3078		
Credits	Class Hr	Lab Hr
3	3	0

Understanding of rector design and chemical reaction kinetics are indispensable for successful production of a variety of chemicals. However, state-of-the-art reactors in chemical industry have been operated under non-ideal conditions rather than under ideal ones. A typical example is packed-bed catalytic reactors in which a chemical reaction is initiated by the adsorption of reactant molecules on the surface of solid catalysts. Students therefore need to learn fundamental theories on reactor design and reaction kinetics for catalytic processes. In this course, catalysis, reaction mechanism, external and internal diffusion effects in heterogeneous reactions in catalytic reactors will be considered in detail. Furthermore, design equation for non-isothermal reactors operated in a steady state (e.g., adiabatic reactor and PFR/CSTR with heat effects) and an unsteady state (e.g., for initial operation and for unexpected occasion) will be covered.

Frequency of Course Offering: Every Fall
Prerequisite: Reaction Engineerin

Classification : Extended Major

Chemical Plant Design

Course Code: CHM4080		
Credits	Class Hr	Lab Hr
3	3	0

The main objective of the course is to develop students' understanding and skills in chemical process design and synthesis with techno-economic evaluation. The course not only presents the principles and design issues of chemical process design, but also provides engineering insights and guidance for choosing the most appropriate process and its design through systematic and integrated design frameworks. The course includes topics such as: 1) principles and design methods of chemical processing; 2) economic evaluation, analysis and trade-offs during process design; 3) process modeling of unit operations and simulation for overall flowsheets; 4) evaluation of process economics and performance of a design; 5) identification of process integration opportunities for the efficient use of capital and energy; and 6) understanding of utility and supporting systems in the context of process design.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Energy Materials

Course Code: CME4001		
Credits	Class Hr	Lab Hr
3	3	0

In this course, the current energy systems/structures used for the production of electricity in the world and our country will be briefly reviewed. Also, the course examine the efforts that have been made to resolve crude oil depletion and global warming. As carbon-based technologies, the course will discuss coal gasification, biofuel production, C1/C2-based chemistry, and carbon capture and storage. The importance of C1/C2-chemistry and biofuel production will be also stressed. Next, the technologies based on non-carbon sources such as fuel cells, solar cells, and energy storage systems will be also handled. Especially, the course will deal with the operation principles of fuel cell and solar energy systems and various materials used for increasing the energy conversion efficiencies in detail. Background knowledge on the electrochemistry, physical chemistry, organic chemistry would be preferred for this course, but anyone who is interested in this course is eligible for taking this course.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Computational Chemical Process Design

Course Code: CME4002		
Credits	Class Hr	Lab Hr
3	2	2

The course is designed for students to understand principles and concept of computer-aided process design methods, especially, with the application of process simulator. Students will learn hands-on modeling and simulation techniques for various unit operations as well as the overall flowsheet, while case studies and design project will be carried out to enhance students' problem-solving skills and practical techniques required for chemical process design and synthesis. The key subjects to be covered from this course are: 1) modeling and simulation of unit operations; 2) flowsheet modeling and simulation; 3) techno-economic analysis and chemical process design using a process simulator and 4) industrial case studies and design project. The course aims to develop students' understanding of and skills in chemical process design and synthesis with techno-economic evaluation as well as to understand working principles and design methods of chemical processing when process simulator is applied.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Surface and Interface Chemistry

Course Code: CTE3013		
Credits	Class Hr	Lab Hr
3	3	0

This course will explore the physico-chemical properties of interfaces which are formed at the boundary between two immiscible phases. Generally these surface properties are very different from those at bulk. The topics which will be covered in this course are as follows: 1) definition of surface properties such as surface tension, electrical aspects of surface chemistry, hydrophilicity/ hydrophobicity of surface, surface structure, surface area and other thermodynamical properties; 2) measuring and analysis techniques for each surface property; 3) modification of surface properties by using surface active agents and 4) effects of surface properties on the industrial process such as emulsion, foaming, detergency, wetting, adsorption and colloids. Surface properties are very important in nanomaterials since they have a high surface area to volume ratio. Thus, the preparations, characterizations and industrial applications of nanomaterials will also be covered.

Frequency of Course Offering: Every Spring
Prerequisite: Physical Chemistry

Classification : Extended Major

Electrochemistry

Course Code:		ICH4002
Credits	Class Hr	Lab Hr
3	3	0

Electrochemistry is a rigorous science concerned with the quantitative relations among the chemical, surface and electrical properties of systems, and has strong links to many other fields of science. Electrochemical concepts are proved to be particularly fruitful for studying and interpreting a number of important energy conversion and storage processes. This course is intended to provide comprehensive coverage of fundamentals for electrochemistry. Knowledge of basic physical chemistry is assumed, but the discussions generally begin at an elementary level and develop upward. By considering the theoretical and applied aspects of electrochemistry jointly, students can readily comprehend their intimate correlation and gain a fuller insight into this science as a whole. The lecture is composed of electrode potential, oxidation & reduction, electrolytes, potentials and thermodynamics of cells, electrode kinetics, electrochemical measurements and applied aspects of electrochemistry. The applied part of this course will outline the principles of some energy conversion devices such as rechargeable batteries, fuel cells, electrochemical capacitors and solar cells, and illustrates their practical significance.

Frequency of Course Offered: Every Spring
Prerequisite: Physical Chemistry

Classification :

Course Code:		
Credits	Class Hr	Lab Hr

COLLEGE OF ENGINEERING

DEPARTMENT OF BIOENGINEERING

HANYANG UNIVERSITY

Classification : Extended Major

Cell Biology

Course Code:		BIO2022
Credits	Class Hr	Lab Hr
3	3	0

Cells are basic units of life and knowledge on the cell division, signal transduction, growth and death, the cell interaction with environment and the cell-cell interaction contribute to the fundamental understanding of life as well as a foundation of biomedical sciences. All living organisms of one or multiple cells have common mechanisms of life including information processing from DNA to RNA and protein, energy metabolism through chemical reactions and segregation of themselves from environment through lipid bilayer cell membrane. Starting from these common and fundamental life mechanisms, cells of different organisms and tissues have variations in their cytoskeleton structure, proteome and signaling network that result in specialized cellular functions in brain, muscle, liver, intestine, etc. The class will provide students with up-to-date biochemical and molecular biological understanding of cells including their properties, structures, subcellular organelles and disease relationships.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Fundamental Immunology

Course Code:		BNG3002
Credits	Class Hr	Lab Hr
3	3	0

This course is a basic immunology course which focuses on the mechanisms that govern the immune response. This course will cover the cells, organs and molecules that mediate the innate and adaptive aspects of the immune system as they apply to infection, tumor recognition, autoimmune diseases, immunodeficiency, cancer and hypersensitivity. Lectures will be on subjects in immunology text book and students are expected to present current topics in immunology. Discussions will be focused on the mechanisms which control the immune response. General properties of immune responses including cells and tissues of immune system, lymphocyte activation and specificity, effector mechanisms, immunity to microbes, immunodeficiency, autoimmune diseases, and immune rejection in organ transplantation will be discussed.

Frequency of Course Offering: Every Spring
Prerequisite: Cell Biology

Classification : Extended Major

Nanobiomaterials

Course Code:	BTN4005	
Credits	Class Hr	Lab Hr
3	3	0

In this course, the design and tailoring of nanobiomaterials that can be used in the area of fusion technology between nanotechnology and biotechnology (NBT) will be covered during the semester. The course focuses on nanocomposites, which has been attracting enormous interest for a variety of applications ranging from packaging, automotive, electrical, biomedical, and others due to their superior thermal, electrical conduction and other properties. The course, therefore, will mainly cover topics such as: 1) chitin nanocomposites for medical applications; 2) gold nanocomposites biosensors; 3) quantum dot nanocomposites; 4) gold-polymer nanocomposites for bioimaging and biosensing; 5) Design and applications of genetically engineered nanocomposites; 6) Nanocomposites for drug delivery; 7) Nanocomposites for bone tissue engineering; and 8) Nanocomposites for tissue engineering.

Frequency of Course Offering: Every Fall
Prerequisite: Organic chemistry, Biomaterials

Classification : Extended Major

Protein and Enzyme Engineering

Course Code:	BTN4008	
Credits	Class Hr	Lab Hr
3	3	0

This course will give a broad account of enzymology and aim to put current knowledge into perspective. Studies of enzymes have ultimate goal in understanding the crucial role that these catalysts play in the metabolic processes of living organisms. The main bio-products in the bio-industry are protein medication and enzymes. In this lecture, therefore, students will learn about molecular mechanism of protein enzymes in the body through understanding the interaction between the enzymatic activity and biosynthesis of proteins that is used for clinical and industrial medications. To this end, the main topics to be covered are 1) the production of enzymatic proteins through animal cells culture, 2) purification of enzymes, 3) large scale-up of recombinant protein production, 4) enzymatic reaction, 5) production of enzymes using fermentation of microbes, and 6) application of enzymes.

Frequency of Course Offering: Every Spring
Prerequisite: Cell Biology, Molecular Biology, Microbiology

Classification : Extended Major

Applied Genetics

Course Code:		BTN4009
Credits	Class Hr	Lab Hr
3	3	0

Genetics is a study of the mechanisms of inheritance and gene action from the molecular to the organismic and population levels. Genetics deals with the basic molecular units of life, DNA and genes. Topics to be included in the present course are: Mendalian principles, molecular genetics, genetic mapping, population genetics and quantitative genetics. In addition, students will learn genetic engineering techniques such as isolation, cloning, and recombination of DNA. Also, the course will examine aspects of bioinformatics and genomics (comparative, functional, etc.), and newer molecular technologies such as next-generation sequencing and microarrays that are especially important in genomics. The course will apply our newly learned molecular techniques toward solving real biological research questions.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification :

Course Code:		
Credits	Class Hr	Lab Hr

COLLEGE OF ENGINEERING

DEPARTMENT OF ORGANIC AND NANO ENGINEERING

HANYANG UNIVERSITY

Classification : Core Major

Industrial Physical Chemistry 1

Course Code:	CHE2001	
Credits	Class Hr	Lab Hr
3	3	0

Physical chemistry is the study of macroscopic, atomic, subatomic and particulate phenomena in chemical systems in terms of the principles, practices and concepts of physics such as motion, energy force, time, thermodynamics, quantum chemistry, statistical mechanics, analytical dynamics and chemical equilibrium. Study of the physical chemistry is required for students to understand major subject as major of organic and nano engineering. This lecture covers an introduction to chemical principles including fundamental theories and applications of the 1st, 2nd and 3rd laws of thermodynamics, phase transitions, phase equilibria, solutions and chemical equilibria. Also, an introduction to theories and applications of ions in solution, electrochemical cells, and interfacial phenomena are presented. This lecture is based on the knowledge about general chemistry and general physics, so prerequisite learning is recommended.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Industrial Physical Chemistry 2

Course Code:	CHE2002	
Credits	Class Hr	Lab Hr
3	3	0

Physical chemistry is the study of macroscopic, atomic, subatomic, and particulate phenomena in chemical systems in terms of the principles, practices and concepts of physics such as motion, energy force, time, thermodynamics, quantum chemistry, statistical mechanics, analytical dynamics and chemical equilibrium. Study of the physical chemistry is required for students to understand major subject as major of organic and nano engineering. This lecture covers an introduction to physical and chemical principles including theories and applications of motion of gases, chemical reaction kinetics, theory of reaction rates, crystallography and solid states. Also, an introduction to theoretical and applied physical chemistry with emphasis on particles and waves, atomic and molecular structure, chemical bonds and molecular spectroscopy will be discussed. This lecture is based on the knowledge about general chemistry and general physics, so prerequisite learning is recommended.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Instrumental Analysis

Course Code: CHM4001		
Credits	Class Hr	Lab Hr
3	3	0

The importance of instrumental methods in conjunctions with conventional analytical methods is that a modern, well-educated scientist is the one who is capable of solving problems with an analytical approach and who can apply modern instrumentation to problems. To be such a scientist, students need to obtain information in diverse areas of science and technology. In addition, students need to understand fundamental principles of instrumental measurements and know about applications of these principles to specific types of chemical measurements, examples of modern instrumentation, and use of instruments to solve real analytical problem. This course focuses on fundamentals and applications of instrumental analysis techniques including ultraviolet-visible and infrared spectroscopies (UV and IR), nuclear magnetic resonance spectroscopy (NMR), and mass spectroscopy.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Surface and Interface Chemistry

Course Code: CTE3013		
Credits	Class Hr	Lab Hr
3	3	0

Many important and interesting reactions in the 'chemical world' around us take place at the interface between two materials, with examples to be found in areas such as heterogeneous catalysis, crystal growth, atmospheric and environmental science, and biology. The study of surfaces and interfaces is, however, far from straightforward, since the 'action' takes place in a layer usually no more than a few molecules thick, sandwiched between two bulk or ambient phases. This lecture focuses on physicochemical properties of surfaces, interfaces, and colloids. This lecture will help students to understand thermodynamics and kinetics of surface phenomena, surface tension, chemical structures at the surfaces or interfaces, capillary forces, reaction of gases on surfaces. At the completion of this course, students will be able to understand the significance of surface properties, including those of adsorbed and/or reactive surface species, for reactions at interfaces.

Frequency of Course Offered: Every Spring
Prerequisite: None

Classification : Extended Major

Optoelectronic Polymers

Course Code:		ICH4024
Credits	Class Hr	Lab Hr
3	3	0

In the earliest applications, polymers were restricted largely to a role in which they were utilized for their insulating properties. Examples here include cable insulation, valve bases, capacitor dielectrics and equipment housing/casing. With the rapid commercialization of semi-conductor technology during the 1950s, the number of potential uses for polymer materials increased significantly. The principal reason why polymers find wide application in electronics and optoelectronics is that they are good dielectric materials with readily controllable properties. More recently, many polymers have been developed that have additional intrinsic properties that make them of special interest in advanced electronics and optoelectronics applications. This lecture focuses on the fundamentals of opto-electronic organic molecules and polymers which have found applications in organic light emitting diodes (OLED), organic thin film transistors (OTFT), and organic solar cells. The operating mechanism of the devices and the latest techniques in OLED, OTFT and organic solar cell will be discussed in the class.

Frequency of Course Offered: Every Spring
Prerequisite: None

Classification : Extended Major

Nano Engineering

Course Code:		ONE1002
Credits	Class Hr	Lab Hr
3	3	0

Nanoscience and nanotechnology are the hottest fields in science, business, sports, space, and the news today. The aim of this lecture is to provide a comprehensive understanding in nanoscale science and technology. This lecture is intended to help students in Dept. Organic and Nano Engineering understand the basic definition and physical/chemical phenomena in nano-world as well as practical applications. For that, this lecture covers vast range of topics as below; 1) definition of Nano; 2) history of materials; 3) nanomaterials in nature; 4) nanoscale fabrication: nanolithography and self-assembly, characterization tools; 5) nanomaterials and nanostructures: nanotubes, nanowires, nanoparticles, and nanocomposites, nanoscale and molecular electronics, nanotechnology in magnetic systems, nanotechnology in integrative systems, nanoscale optoelectronics; and 6) nanobiotechnology: biomimetic systems, nanomotors, nanofluidics, and nanomedicine.

Frequency of Course Offering: Every Spring
Prerequisite: Instrumental Analysis

Classification : Extended Major

Introduction to Quantum Chemistry

Course Code: ONE3006		
Credits	Class Hr	Lab Hr
3	3	0

In the Introduction to Quantum Chemistry course, basic concepts of quantum mechanics are introduced and utilized to explain macroscopic properties of matter in terms of microscopic (molecular) properties. The series of quantum postulates is the key to unveil the microscopic view of molecular interactions. Throughout the semester, lectures will cover the particle-in-a-box, the rigid-rotor angular momentum, molecular vibrations, the hydrogen atom (the one-electron system), many electron atoms and molecules, the spin postulate, and other advanced topics of quantum theory. For the practical approaches, ab initio and semi-empirical methods, the group theory, perturbation and variational theories, and spectroscopic applications are also introduced.

Frequency of Course Offering: Every Fall
Prerequisite: Nano Engineering

Classification : Extended Major

Bio-Inspired Nanotechnology

Course Code: ONE4006		
Credits	Class Hr	Lab Hr
3	3	0

Nature's organisms and creatures are quite complicated and well-organized for their optimal functions. Humans have always learned from nature for innovation and problem-solving to improve our lives. This course is designed for undergraduate students obtain fundamental knowledge about biomaterials and understanding for nano-related subjects, such as biomimetics and drug dievery systems. In this Bio-Inspired Nanotechnology course, many subjects including biomaterials, bio-related phenomena, biomimetics, and applications to IT and BT intelligent devices are covered. Natural or synthetic biomaterials are studied, and its applications such as controlled release technology or others are included. The course will be divided into two parts: 1) part 1: basic protein biochemistry, protein architecture, enzyme kinetics, protein synthesis, etc.; and 2) part 2: biopolymers and biosensors, protein patterning and protein chip, self-assembly of biopolymers, drug delivery system, biomimetics, recent advances in biomaterials engineering.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Organic Nano Analysis

Course Code:	ONE4008	
Credits	Class Hr	Lab Hr
3	3	0

The Organic Nano Analysis course focuses on the introduction of nano analysis techniques which can analyze nano-structure and -property of nanomaterials and nanodevices. Throughout the semester, the lectures will cover nano-structure analysis techniques such as transmission electron microscopy (TEM), scanning electron microscopy (SEM), Focuse Ion Beam (FIB), Near-edge X-ray Absorption Fine Structure (NEXAFS) and nano-surface analysis techniques. In detail, topics such as conventional and unconventional lithographic methods including Auger Electron Spectroscopy (AES), X-ray Photoelectron Spectroscopy (XPS), Ultraviolet Photoelectron Spectroscopy (UPS), Secondary Ion Mass Spectrometry (SIMS), Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM) will be discussed in classes.

Frequency of Course Offering: Every Fall
Prerequisite: Introduction to Quantum Chemistry

Classification : Extended Major

Organic Electronic Materials Nano Processing

Course Code:	ONE4011	
Credits	Class Hr	Lab Hr
3	3	0

Progress in nanotechnology depends upon the capability of fabricating nanostructures in a variety of materials with accuracy in the nanometre scale and sometimes in the atomic scale. Depending on application, there are various degrees of strong specifications, which have to be met in industrially relevant processes due to manufacturability and costs considerations as, for example, in the electronics industry. However, it appears that less demanding conditions are needed for developments in optics, sensors and biological applications. In order for progress to be made, enabling nanofabrication techniques as tools for experiments to understand the underlying science and engineering in the nanometre scale, easily accessible and flexible nanofabrication approaches are required. This course focuses on the introduction of conventional and unconventional lithographic methods including photolithography, e-beam lithography, X-ray lithography, ion-beam lithography, soft lithography, nano imprint lithography, dip-pen lithography, and block copolymer lithography. This lecture also emphasizes their applications in electronic devices.

Frequency of Course Offered: Every Fall
Prerequisite: None

COLLEGE OF ENGINEERING

DEPARTMENT OF ENERGY ENGINEERING

HANYANG UNIVERSITY

Classification : Extended Major

Polymer Chemistry

Course Code: CHM3007		
Credits	Class Hr	Lab Hr
3	3	0

Polymer chemistry is an English speaking one-semester course, which is designed for undergraduate students to provide fundamental principles of synthetic and physical chemistry of polymers. This course will start with historical overview and fundamental principles of polymers such as chemical bonding, polymer crystals, molecular weights, polymer solubility and solutions, and glass transition behavior. Building on these, we will continue to discuss a variety of synthetic routes for constructing various types of polymers. A broad range of polymerization reactions and their mechanisms and kinetics will be discussed: in detail, 1) step-growth (condensation) polymerization and 2) chain-growth (addition polymerization including radical and ionic polymerizations). The purpose of this class is to get comprehensive understanding on the molecular weight/distribution, glass transition, and synthetic chemistry of polymers.

Frequency of Course Offering: Every Spring
Prerequisite: Organic Chemistry 1, Organic Chemistry 2

Classification : Extended Major

Basic Principles and Calculations in Energy Engineering

Course Code: EGY2001		
Credits	Class Hr	Lab Hr
3	3	0

Developing the ability for numerical analysis of the process and accompanying calculation skills are the essential part of this course. The materials covered include unit conversion, behavior of gases, liquids and solids, material and energy balances, and problem solving techniques in engineering processes. The most important issue in this course is the conceptual understanding of basic principles of various processes and calculation. This course is a fundamental class that introduces principles and technologies in energy engineering, and it introduces basic process analysis and terminologies, description of physical properties and their relations, and application of the fundamental principles of physical chemistry. Special emphases are on the calculation of material and energy balances in steady and non-steady state systems. The students will be provided with the concepts that form fundamentals for all engineering course and analysis, such as dimensions, units, temperature, pressure and concentrations.

Frequency of Course Offering: Every Spring
Prerequisite: Basic knowledge of science required such as physics, chemistry, calculus etc.

Classification : Extended Major

Materials Physics and Properties

Course Code:	EGY3001	
Credits	Class Hr	Lab Hr
3	3	0

This course provides students with fundamental knowledge on the physics and properties of materials, especially inorganic materials. The course covers fundamental physical properties of ceramic materials: structure, defects, transport and microstructures. Chemical bonding and structures of common ceramic materials will be introduced in the first part. The common crystal structure of functional ionic crystal and the analysis of amorphous ceramics are also presented. In the second part, defect structure and their equilibria will be explained. Notations for the defect chemistry will be introduced. In the third part, transport in the materials will be covered shortly. In the last part, microstructure and processes critically determining the microstructure will be discussed. The topic of microstructure includes equilibrium microstructure, grain growth. The ultimate goal of this course is to help students to be familiar with the common structures of materials and the structure-property relations.

Frequency of Course Offering: Every Fall
Prerequisite: Basic knowledge of science required such as physics, chemistry, calculus etc.

Classification : Core Major

Energy Engineering Thermodynamics

Course Code:	EGY3005	
Credits	Class Hr	Lab Hr
3	3	0

This course introduces basic thermodynamic principles widely used in energy engineering. This course aims to prepare students for advanced major courses with enhanced ability of using thermodynamic fundamentals to various applications through problem-solving skill practiced in the class. Topical coverage include: the first and second law of thermodynamics, entropy, enthalpy, free energy, thermodynamic relations, heat capacity, the third law of thermodynamics, phase equilibrium in one component systems, behavior of gases, equilibrium of reactions involving gas phase, equilibrium of reactions involving pure condensed phase, behavior of solutions, Gibbs free energy-composition and phase diagrams of binary systems, reaction equilibrium in systems containing components in condensed solution and electrochemistry. The primary course objective is the conceptual understanding of 1) laws of thermodynamics, 2) enthalpy, 3) equilibrium, and 4) Gibbs free energy and phase equilibrium diagram.

Frequency of Course Offering: Every Spring
Prerequisite: Basic knowledge of science required such as physics, chemistry, calculus etc.

Classification : Extended Major

Nanoscience for Energy

Course Code:		EGY4014
Credits	Class Hr	Lab Hr
3	3	0

This course addresses nano-materials science, particularly to students majoring in energy, chemical and materials engineering. This course covers an important collection of concepts and applications describing nanotechnology opportunities across the spectrum of energy production, storage, and usage. This course aims to give comprehensive information firstly on fundamental science and characterization of various nano-materials for energy. The students will be challenged to think creatively for utilizing the materials in various nanotechnologies for next generation. The students will learn how to manage their knowledge for real industry. This course provides related knowledge for students who wish to obtain an overview in this field or to explore more on applied areas, and serves as an introductory course for senior students studying energy engineering.

Frequency of Course Offering: Every Spring
Prerequisite: Basic knowledge of science

Classification : Extended Major

Energy Conversion & Storage Materials

Course Code:		EGY4015
Credits	Class Hr	Lab Hr
3	3	0

Conversion of inconvenient energy such as solar or chemical energy into convenient one, typically electricity, plays vital role in renewable energy industry. Furthermore, the electricity produced should be stored securely and conveniently for diverse applications such as automobiles, moveable electronics, etc. In these regards, the primary objective of this course is to explore the fundamentals and the basic principles of the energy conversion and storage phenomena in electrochemical devices such as dye-sensitized and organic solar cells, fuel cells and secondary batteries. In particular, mass transport including neutral mass, ion and electron transport will be emphasized to understand the energy conversion and storage behavior, which depends on the structure of main components such as anode, cathode and electrolyte in electrochemical devices.

Frequency of Course Offering: Every Spring
Prerequisite: Physical Chemistry, Electrical Chemistry

Classification : Extended Major

Nano-bio Materials for Energy

Course Code:	EGY4016	
Credits	Class Hr	Lab Hr
3	3	0

This course focuses on the chemistry and chemical structure-property relationships of biologically derived materials in the application to nano-energy technology. Biochemistry, only particularly relevant to energy engineering, will be covered. The course provides case studies of the recent research literatures on the role of bio-molecules in synthesizing and assembling functional materials and the application to the practical devices. Class contents also include the highly efficient biological energy conversion and storage ways to introduce bio-inspired novel energy conversion and storage mechanisms as clean and renewable energy systems. Marching with the recent energy research trends for the interdisciplinary nano-bio-energy, this course will provide the basic knowledge required for the energy engineering students and introduce the recent literatures that describe the role of functional biomolecules and its application to the practical devices.

Frequency of Course Offering: Every Fall
Prerequisite: Basic knowledge of science

Classification : Extended Major

Energy & Environment Science and Technology

Course Code:	EGY4018	
Credits	Class Hr	Lab Hr
3	3	0

Recently, climate changes are a global issue that needs to be battled. Carbon dioxide emission is a critical issue, and many countries are trying to reduce the emission of this greenhouse gas. Carbon capture and storage (CCS) is the sequential process from capturing waste carbon dioxide from various sources, such as power plants operated by fossil fuel, to transporting it for storage. The goal of preventing the release of carbon dioxide emission into atmosphere is to mitigate the contribution of fossil fuel emissions to global warming and ocean acidification. This course is mainly focused on the CO2 capture technology, conversion technology as well as storage. The course will focus on the discussion on this important technology on energy and environmental issues. In this course, energy and environmental technology for greenhouse gases reduction will be covered deeply. Especially, students will have opportunities to discuss about carbon dioxide capture, conversion and storage technology.

Frequency of Course Offering: Every Fall
Prerequisite: Basic knowledge of science

Classification : Core Major

Materials Science 1

Course Code:		MAE2001
Credits	Class Hr	Lab Hr
3	3	0

The purpose of this class is to teach the basic knowledge of advanced materials by understanding the material properties and the synthesis method, and the correlation between microstructure and its characteristic. Through this information, students can design and synthesize the advanced materials. The contents of this class are as follows: combining the structure of the solid; phase equilibrium; deformation and mechanical properties of a solid; the relation between the strengthening mechanism and microstructure of the material; electronic theory; the electrical conduction characteristics of the junction; magnetic properties; optical properties; and the like. Through the course, students will acquire knowledge about: 1) crystal structure of the material; 2) defect and deformation of the material; 3) mechanical properties change with deformation of the material; 4) mass transfer, and learn the basic theory need for the development of new materials.

Frequency of Course Offering: Every Spring
Prerequisite: Fundamental Physics 1, 2 and Fundamental Chemical 1, 2

Classification :

Course Code:		
Credits	Class Hr	Lab Hr

COLLEGE OF ENGINEERING

DIVISION OF MECHANICAL ENGINEERING

HANYANG UNIVERSITY

Classification : Extended Major

Mechanism Design

Course Code:	APA4010	
Credits	Class Hr	Lab Hr
3	3	0

Every machine is devised to produce the output desired through the mechanism or the combination of mechanisms transmitting motions and forces for a given input. In the beginning of the Mechanism Design course, the class deals with what a mechanism is, what a mechanism can do, how it can be classified. The limitations of mechanisms are also discussed. Then, various methods of analyzing the motions of mechanisms are introduced. The course also treats engineering problems that involves the selection, the specifications, the design, and the sizing of cam mechanisms to accomplish specific motion objectives. Towards the latter part of the semester, the methods and applications of static force analysis and dynamic force analysis are also covered.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Computational Combustion

Course Code:	AUE4011	
Credits	Class Hr	Lab Hr
3	3	0

The contents of the Computational Combustion course includes chemical and phase equilibrium, nonequlibrium chemical kinetics, conservation equation for multicomponent species reacting systems. Also, throughout the semester, the class will discuss issues on Fick's Law, thermophysical properties, detonation and deflagration waves, regime of combustion waves. Other topics that will be included in the lectures are: laminar premixed flames, flame speed, diffusion flames and droplet combustion, conserved scalar approach, subcritical and supercritical vaporization, turbulent premixed flames, turbulent flame speed. Related subjects such as turbulent nonpremixed and partially premixed flames, ignition and extinction, flame stabilization, soot formation and oxidation, and NOx formation mechanisms will be covered as well.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Statics

Course Code:	COE2003	
Credits	Class Hr	Lab Hr
3	3	0

As one of the basic engineering courses, Statics course deals with the mechanics of particles and rigid bodies which are at rest or moving at a constant velocity. Equilibrium conditions for objects, which are subject to external forces, are studied and are applied to a number of engineering examples. The contents of this course include vector, force and moment, equilibrium conditions for particles and rigid bodies, center of gravity and centroid in 2 or 3 dimensions, moment of inertia, friction, virtual work and energy principles. Students also learn the concepts of statically determinate and indeterminate. For real world applicability, this course take structures such as trusses, beams and cables as examples, and applies the basic principles to them.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Dynamics

Course Code:	COE2004	
Credits	Class Hr	Lab Hr
3	3	0

In this course, fundamental terminologies and concepts in dynamics are first explained. How to describe the motions of a particle and rigid body is another core subject of the lecture. To describe the motion, vector notations are employed along with coordinate systems. Methods to obtain velocity, acceleration, angular velocity, and angular acceleration are introduced. Then, the course discusses the method of drawing a free body diagram. Basing on the free body diagram, equations of motions are derived. Force as well as motion information is obtained from the equations of motion. Two integral principles are introduced where the concepts of work, energy, impulse, and momentum are employed. Advantages of using integral principles are also studied. Finally, the method to analyze the three dimensional motion of a rigid body where the gyroscopic effect occurs in spatial rotational motions of rigid body systems is discussed.

Frequency of Course Offering: Every Spring
Prerequisite: Statics

Classification : Basic Major

Engineering Mathematics 3

Course Code:	COE3053	
Credits	Class Hr	Lab Hr
3	3	0

This course is designed to lead students to understand vector calculus and partial differential equations (PDEs) which are treated in all the engineering applications such as aerodynamics, aeronautics, solid mechanics, heat flow, and fluid flow. Vector calculus includes vector integral calculus and vector differential calculus. Definitely, the engineer requires a proper foundation in these areas. Vector integral calculus extends integrals as known from regular calculus to integrals over curves, surfaces, and solids, called line integrals, surface integrals and triple integrals, respectively. The beauty of vector integral calculus is that we can transform these different integrals into one another. Moreover, PDE provides the understanding of the derivations of PDEs through vector analysis and coordinate transformation. PDEs such as Laplace, diffusion, and wave equations and their solutions through the separation of variables, Fourier transform, and Laplace transform.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Strength of Materials 1

Course Code:	DME2001	
Credits	Class Hr	Lab Hr
3	3	0

In order to guarantee the safety of machines or structures, calculation methods for the deformations and stresses of structural members are studied in this course. Structure modeling techniques, the definition of stresses and strains of solids, Hooke's law, the mechanics of axial and torsion members, internal shear force and bending moment diagrams of beams, bending and transverse shear stress formula of beams will be covered. In each case of axial, torsion and bending cases, the statically determinate and indeterminate problems are discussed and studied. In addition, inelastic behaviors and residual stresses of structural members due to axial, torsion and bending moment are explored. At completion, students will be able to understand the derivation process of the each stress equations such as axial, bending, shear and transverse shear stresses considering the shape and dimensions of the structures and the applied forces.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Strength of Materials 2

Course Code: DME2002		
Credits	Class Hr	Lab Hr
3	3	0

In this course, stress and strain transformation formula, failure theories, beam design methods, various calculation methods of beam deflections, solving methods of statically indeterminate problems, column buckling and stability design method, limit design method and the various energy methods are studied. In the stress and strain transformation formula, the graphical Mohr's circle method will be covered. In the chapter of beam deflections and its statically indeterminate problem solving, an integration method, a discontinuity function method and graphical methods based on the moment-area theorem will be explored. The governing equations for buckling of columns due to various end conditions will be derived, and the related problems will be discussed. Related to the topic of energy method, students will study virtual work and Castigliano's theorem.

Frequency of Course Offering: Every Fall
Prerequisite: Strength of Materials 1

Classification : Core Major

Design and Analysis of Dynamic Systems

Course Code: DME3003		
Credits	Class Hr	Lab Hr
3	3	0

This course provides students with a capability to model a variety of linear and nonlinear dynamic systems based on lumped-parameter models and to characterize their performance in the time- and frequency-domains, which is essential for them to learn about automatic control and feedback control systems. This course basically covers modeling methods based on for mechanical, hydraulic, and thermal systems as well as electrical and electromechanical systems. Basic mathematics on Laplace transforms is also reviewed and linearization techniques such as tangential method and perturbation method are covered in order to obtain linearized models from nonlinear systems. Models based on transfer functions, state-space representations, and block diagrams are covered as well as their inter-relationships. Students use Matlab® to simulate linear and nonlinear dynamics systems. This course also explores basic time-domain responses including step-responses and frequency responses. Representing frequency responses with Bode plots is also covered.

Frequency of Course Offering: Every Fall
Prerequisite: Dynamics

Classification : Extended Major

Machine Elements Design

Course Code: DME3052		
Credits	Class Hr	Lab Hr
3	3	0

Mechanical engineers are associated with the production and processing of energy and with providing the means of production, the tools of transportation, and the techniques of automation. The skill and knowledge base are extensive. Among the disciplinary bases are mechanics of solids and fluids, mass and momentum transport, manufacturing processes, and electrical and information theory. Mechanical Elements Design is an introductory course in mechanical design analysis, and fundamentals of mechanical engineering design are applied to analyze, design and/or select components which are commonly used in the designs of complete mechanical systems including shafts, bearings, gear, spring, fastener, and so on. The course covers general stress analysis, failure conditions, shaft, spring, permanent and nonpermanent joint design. Understanding and practicing how to design and use such components will prepare students for more complex design and system integration tasks in industry.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Multidisciplinary Mechanical System Design

Course Code: DME4065		
Credits	Class Hr	Lab Hr
2	1	2

The course provides basic principles and design program skills of multidisciplinary mechanical systems. Many of the recent mechanical structures have multidisciplinary concepts and ideas. Therefore, mechanical engineers should be capable of analyzing and modeling various mechanical systems based on the basic knowledge of core mechanics such as solid mechanics, dynamics, fluid mechanics, thermodynamics, etc. Throughout the course, students will have chances to expand what they have learned from the books and apply it to various technologies containing mechanical structures. The field of study includes various topics such as: MEMS system design and application; semiconductor system design, fabrication and application; electrochemical energy conversion system design and application; and electrical and magnetic system design and application.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Electric Engineering

Course Code:	ELE3053	
Credits	Class Hr	Lab Hr
3	3	0

This course presents the fundamentals of electric circuits and several circuit analysis. It covers Kirchhoff's circuit laws (KVL, KCL), analysis of circuits in time domain (transient analysis) and frequency domain (sinusoidal frequency response). In the later part of this course, it covers power delivery, electromechanical energy conversion and electrical machineries. The objective of this course is to present the principles of electrical engineering and circuit analysis to non-electrical engineering students. This course delivers basic understanding of DC and AC circuits, which are the background of practical applications, such as electromechanical machinery and electrical controller. This course will cover following items: characteristics of passive components (resistor, capacitor, inductor) and power sources (AC and DC); circuit analysis method (i.e. Kirchhoff's current and voltage law); circuit analysis in time domain and frequency domain; power delivery using AC power; and application of electro-magnetic force conversion.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Electronic Engineering

Course Code:	ENE3063	
Credits	Class Hr	Lab Hr
3	3	0

This course presents the fundamentals of semiconductor devices and their circuit applications. It covers three different topics. The first part is a circuit based on semiconductor. The properties of semiconductors and the circuit based on several active components (e.g. op-amp, diode, BJT and FET). The second part is digital circuit. It covers logic gates (AND, OR.) and sequential logic module (Flip-flop). The third part is about the measurement and instrumentation, by which how one can measure physical properties of object and convert the properties into electrical signal. The objective of this course are: understanding the electrical circuit with semiconductor components; understanding the principle of digital system; learning how to use electrical circuit in sensing/actuating mechanical systems.

Frequency of Course Offering: Every Fall
Prerequisite: Electrical Engineering

Classification : Extended Major

Micro-Processor Applications

Course Code:		ENE4041
Credits	Class Hr	Lab Hr
3	2	2

This course covers microprocessor structures including the controller, ALU, memory, I/O devices and their operations. Students will study computer programming and assembly languages to handle the basic registers. This program will provide the basic knowledge for microprocessor to design its software and its applications. This course will also cover hardware architecture and the basic functions of the microprocessor, such as a pulse width modulation (PWM), analog digital converter (ADC), and controller area network (CAN) communication. Using the microprocessor, students will design the control system involving thermal devices, automotive applications, machine tools, etc. During the lab work hours, the designed control system will be implemented to evaluation board as part of a term project. Through this course and its term project, students will understand the operating principles of the microprocessor, and various microprocessor applications' software design.

Frequency of Course Offering: Every Spring
Prerequisite: Digital Logic Design

Classification : Core Major

Automatic Control

Course Code:		ENE4054
Credits	Class Hr	Lab Hr
3	3	0

This course helps students to design basic feedback-controllers for dynamics systems. It covers basic concepts on system representations in transfer functions and state-space forms, block-diagrams, and signal-flows, poles and zeros of the system, performance measures in transient/steady-state response in time-domain as well as key concepts on system stability, measures of control performance, negative feedback control, Routh-Hurwitz stability criterion, controller design based on root-locus method. It also explores many different representations of frequency response such as Nichols Chart, M- and N-circles, Bode plots, and polar plots. Basic controllers including lead-, lag-, led-lag-compensators and PID controllers are covered. Analysis on system stability based on Nyquist stability criterion is also discussed. Students use Matlab® to design and simulate a variety of feedback-controlled dynamic systems.

Frequency of Course Offering: Every Spring
Prerequisite: Design and Analysis of Dynamic Systems

Classification : Basic Major

Numerical Analysis

Course Code: MAT3008		
Credits	Class Hr	Lab Hr
3	3	0

Numerical methods are extremely powerful problem-solving tools capable of handling large systems of equations, nonlinearities, and complicated geometries. In addition, they are an efficient vehicle for learning how to use computers. Since one function of numerical methods is to reduce higher mathematics to basic arithmetic operations, numerical methods can also be a channel for students to reinforce their understanding of mathematics. This course will cover basic numerical analysis techniques including root finding, interpolation, curve fitting, numerical differentiation, numerical integration, and numerical solution of ordinary differential equations. Students will be expected to complete a significant amount of programming assignments in order to improve their programming skills. This course is designed mainly for mechanical engineering major students. The topics that will be considered are: types of errors in numerical procedure; roots of equations; linear algebraic equations; eigenvalues and eigenvectors; curve fitting; numerical differentiation; numerical integration; initial value problems for ordinary differential equations; and boundary value problems for ordinary differential equations.

Course Offered: Every Spring
Prerequisite: Engineering Mathematics 1, Computer Programming

Classification : Extended Major

Turbo-Machinery

Course Code: MDE4002		
Credits	Class Hr	Lab Hr
3	3	0

In mechanical engineering, turbo-machinery describes machines that transfer energy between a rotor and a fluid, including both turbines and compressors. While a turbine transfers energy from a fluid to a rotor, a compressor transfers energy from a rotor to a fluid. The two types of machines are governed by the same basic relationships including Newton's second law of motion and Euler's energy equation for compressible fluids. Therefore, in the Turbo-Machinery course, related topics will be covered, so that the students taking this course understand the basic concept and the classification of turbo-machines. Also, another important objective of this course is to investigate the basic theory and the application division of turbomachines using in the power plant and the aircraft propulsion.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Thermodynamics 1

Course Code:	MEE3001	
Credits	Class Hr	Lab Hr
3	3	0

The Thermodynamics 1 course aims to develop clear and concrete understanding of the basic thermodynamic principles and the capability of thermodynamic analysis for students interested in mechanical engineering. The concept of energy and transformation of energy including the first and second law of thermodynamics, thermodynamic properties, and conservation of energy for closed and open systems is introduced during the lectures. Selected topics for entropy and the second law of thermodynamics include: the entropy principle, entropy change of ideal gas, pure substance, and adiabatic efficiency of steady-flow devices. Students will have opportunities to examine the second law analysis of an engineering system, which includes availability, reversible work, and irreversibility. Throughout the semester, this course will emphasize the basic concepts, theories, and thermodynamic analyses for diverse mechanical systems.

Frequency of Course Offering: Every Fall
Prerequisite: General Physics

Classification : Core Major

Thermodynamics 2

Course Code:	MEE3002	
Credits	Class Hr	Lab Hr
3	3	0

This course aims to develop solid understanding of a variety of thermodynamic cycle systems and the capability of thermodynamic analysis of reacting mixtures and combustion for mechanical engineering students. Based on the understanding of thermodynamic principles (i.e., the 1st and 2nd laws of thermodynamics), this course covers following topics: vapor power systems including Rankine cycles with superheating, reheating, and regeneration; gas power systems including Otto cycle, Diesel cycle, Dual cycle, and Brayton cycle; refrigeration and heat pump systems including vapor compression cycle, cascade cycle, multistage compression with intercooling, absorption refrigeration, and gas refrigeration system; thermodynamic relations including Maxwell relations, theories of gas mixture and moist air; and reacting mixtures and combustion. The course will emphasize basic concepts and thermodynamic analysis for diverse thermodynamic cycles in mechanical engineering throughout the semester.

Frequency of Course Offering: Every Spring
Prerequisite: General Physics, Thermodynamics 1

Classification : Extended Major

Robot Engineering

Course Code: MEE3008		
Credits	Class Hr	Lab Hr
3	3	0

This is an introductory course in robotics whose objective is to let students understand the kinematics, dynamics and control of robots, mainly robot manipulators. It covers basic concepts in all robots such as translational and rotational motion of a single point, coordinate frames, rotations, homogeneous transform, statics, (inverse and forward) kinematics, (inverse and forward) dynamics of robot manipulators, manipulator Jacobian, kinematic singularity and redundancy, trajectory planning. How to control robotic systems using PD and PID controls and other controls such as compliance control and impedance control to deal with uncertainty in the environment will be also discussed. Also, Lagrangian equation of motion as well as 3-dimensional Newton-Euler equations of motion will be covered as a core topic of the course and exemplary robot dynamics will be driven based on them.

Frequency of Course Offering: Every Spring
Prerequisite: Dynamics, Automatic Control

Classification : Core Major

Heat Transfer

Course Code: MEE4001		
Credits	Class Hr	Lab Hr
3	3	0

The transport mechanisms of heat can be classified as conduction, convection (forced convection and natural convection), radiation, and combination of these mechanisms. With the concept on transport mechanisms of heat, the method of setting-up energy balance equation for given engineering systems, and the mathematical solution of each energy balance equation will be investigated. The course also covers the applications of energy balance equations to the design of heat transfer equipment. The objectives of this course are: 1) to cover the basic principles of heat transfer, 2) to present a wealth of real-world engineering applications to give students a feel for engineering practice, and 3) to develop an intuitive understanding of the subject matter by emphasizing the physics and physical arguments. This course is designed mainly for students majoring in mechanical engineering.

Course Offered: Every Fall
Prerequisite: Thermodynamics 1, Fluid Mechanics 1

Classification : Extended Major

Thermal Power Plant Engineering

Course Code:		MEE4037
Credits	Class Hr	Lab Hr
3	3	0

The contents of the Thermal Power Plant Engineering course includes thermodynamics review, fuels and combustion, Rankine cycle and steam turbines, and Brayton and gas turbines. Combined and cogeneration cycles, general energy conversion systems, and alternative and new energy power plant will be discussed in class as well. Other topics that will be covered throughout the semester are: thermodynamic principle of fuel cells, electrochemical reaction, catalytic reaction, charge transfer, mass transfer. Finally, students taking this course will have opportunities to discuss issues on: fuel cell modeling, alternative and new energy power plant, and state-of-art hybrid power generation technology, future power generation systems, environmental aspects of power generation.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Introduction to Aero Space Engineering

Course Code:		MEE4079
Credits	Class Hr	Lab Hr
3	3	0

The Introduction to Aero Space Engineering course aims to provide students with the fundamental knowledge on Aerospace Engineering. In the beginning of this course, video tapes and CDs will be used as instructional tools for easy understanding of the historical background of aerospace development. Then, the basic design principle for the advanced aerospace vehicles of oncoming era will be discussed in class. Major introductory topics that will be covered to achieve the study objectives in this course are: aerodynamics and flight mechanics; performance, stability and control; aircraft structure and airworthiness; aerospace propulsion; avionics; flight instrumentation; helicopters; astronautics and satellites; aircraft operation; and conceptual design of aircrafts and rockets.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Manufacturing Processes

Course Code: PME2001		
Credits	Class Hr	Lab Hr
3	3	0

This course is for students to learn an application engineering processes to produce a semi-product or final product using the mechanics learned in junior level courses. This class consists of four main themes: casting process, bulk forming processes, sheet metal forming process, and welding process. Bulk forming processes include forging, rolling, drawing, and extrusion. First, all of these processes will be taught theoretically, and then movie films are provided for students for practical concepts. During the semester, students will have an opportunity to attend exhibition shows. For practical experiences, experiments will be carried out as well. Furthermore, computer simulation such as SYSWELD software will be taught. Therefore, this course will be useful for applying the theoretical backgrounds that are learned in classroom and will be a good opportunity for students who will be in the industry in the future.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Mechanical Vibration

Course Code: PME3002		
Credits	Class Hr	Lab Hr
3	3	0

Vibration is the sub-discipline of dynamics that deals with repetitive motion of mechanical or structural elements. The goal of this course is for students to learn how to analyze vibration, using principles of dynamics. The concepts and formulations are intended to provide the skills needed for designing vibrating systems with desirable properties that enhance vibration when it is wanted and reduce vibration when it is unwanted. In this class, the topics include introduction to vibration, the free response, harmonic motion, viscous damping, energy method, stiffness. The vibration response from harmonic excitation: harmonic excitation of undamped systems, base excitation, rotating unbalance is analyzed and applied to actual systems. General forced response, impulse response function, response to an arbitrary input, response to arbitrary periodic input, transform method, response to random input are discussed with emphasis on the problem solving capabilities. Multi-degree-of-freedom systems are solved using eigen values and natural frequencies, modal analysis, and the consequent forced response solutions. Distributed-parameter systems are discussed with the topic of vibration of a string, axial, torsional and bending vibration of rod, with the solution procedures of modal analysis.

Frequency of Course Offering: Every Fall
Prerequisite: None

COLLEGE OF ENGINEERING

DEPARTMENT OF NUCLEAR ENGINEERING

HANYANG UNIVERSITY

Classification : Core Major

Overview of Nuclear Engineering

Course Code: NUE2007		
Credits	Class Hr	Lab Hr
3	3	0

Nuclear engineering includes fundamental physics and its application for utilizing nuclear energy. To practice the application of the nuclear energy, it is necessary to understand basic nuclear physics problems and related topics to the nuclear engineering. The objectives are understanding the atomic and nuclear physics, interaction of radiation with matter, and nuclear reactors and nuclear power. Specific topics in atomic and nuclear physics include fundamental particles and atomic properties, mass and energy equivalence and nuclear particles' properties, radioactivity calculations and nuclear reactions, and binding and separation energy. In addition, interaction of radiation with matter will cover neutron interactions and cross-sections, neutron attenuation and cross-section data, energy loss of neutron and fission, and gamma-ray and charged particle interaction with matter. Finally, nuclear reactors and nuclear power will be discussed in terms of the fission chain reaction and nuclear reactor fuels, components of nuclear power plants, and nuclear fuel cycles and radioactive waste disposal.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Core Major

Introduction to Nuclear Reactor Engineering

Course Code: NUE2010		
Credits	Class Hr	Lab Hr
3	3	0

This course discusses the central problem of reactor physics, which computes the neutron population throughout an extended region of space containing an arbitrary mixture of materials. The neutron population is used in physical understanding of reactor safety so that both design and operation is done intelligently. It is also used in the design of heat removal system, and fuel management. Specific topics in understanding neutron flux include neutron number density, neutron velocity, and neutron collision density. Also to understand neutron diffusion and moderation, diffusion equation is solved with physically tailored boundary conditions. In order to understand energy dependent neutron flux, group equation can be applied to thermal reactor application. Finally, reactor kinetics and reactor operation will be discussed in terms of reactivity equation and reactivity control using control rod and chemical shim.

Frequency of Course Offering: Every Fall
Prerequisite: Overview of Nuclear Engineering

Classification : Extended Major

Applied Thermal System Design for Nuclear Energy Applications

Course Code:		NUE4058
Credits	Class Hr	Lab Hr
3	3	0

This course is to learn introductory design process for various nuclear science and engineering applications. Commercial Computational Fluid Dynamics (CFD) code may be utilized to achieve satisfactory design for practical application. The major subjects are design of irradiation fuel capsule for advanced fuel test and design of versatile high temperature material irradiation system. Specific topics in designing irradiation fuel capsule for advanced fuel test include conservation equations of mass, momentum, and energy, understanding of nuclear heating including fission and gamma heating, and convective heat transfer with limitation on external cooling capability. In addition, in order to design versatile high temperature material irradiation system, students are guided to learn radiative heat transfer at high temperature gas system, simplified 1D radial heat transfer, and idealization of low and high temperature environment in the same test rig.

Frequency of Course Offering: Every Spring
Prerequisite: Overview of Nuclear Engineering, Introduction to Nuclear Reactor Engineering, Momentum and Heat Transfer

Classification :

Course Code:		
Credits	Class Hr	Lab Hr

COLLEGE OF ENGINEERING

DEPARTMENT OF INDUSTRIAL ENGINEERING

HANYANG UNIVERSITY

Classification : Core Major

Quality Management

Course Code:	BUE3021	
Credits	Class Hr	Lab Hr
3	3	0

The strategic significance of quality management has been recognized as one of key factors in a lot of practical areas in addition to the traditional scope of management for production system. As one of core business activities, the issue of economic quality management in overall business process should be well designed and implemented for more competitive business organization. In this class, students will study several key managerial issues which are embedded in various business activities such as product design, work procedure design and even process design. Also, a lot of business practices as well as the frameworks for process innovation which extend the quality management into the corporate level will be shared and discussed. In general, statistical approaches for quality management are key components for quantitative approaches to the quality management. As a result, the objective of this class is to study the frameworks for quality management and the technical quantitative approaches to implement those schemes.

Frequency of Course Offering: Every Spring
Prerequisite: Statistics

Classification : Core Major

Applied Statistics

Course Code:	COE3003	
Credits	Class Hr	Lab Hr
3	3	0

This course, which is an extension of the basic probability and statistics, covers the applicative aspects of probability and statistics. Based on basic statistical knowledges (e.g., set theory, random variables, discrete and continuous probability distributions), this course provides statistical point and interval estimations, statistical test on one population mean, two population means, categorical analysis, simple and multiple regression analysis, analysis of variance. From this discipline, the students will acquire mathematical backgrounds of probability and statistics and will be able to use these to understand the stochastic models and algorithms occurred in various industrial engineering applications. Students are required to present final projects for solving real-world problems, using probabilistic and statistical methods. Statistical data analyses will be implemented by statistical softwares such as SAS, Minitab, and R.

Frequency of Course Offering: Every Fall
Prerequisite: Probability and Statistics

Classification : Core Major

Object-Oriented Programming

Course Code: COM2018		
Credits	Class Hr	Lab Hr
3	3	0

The primary objective of this course is to help students acquire basic techniques and knowledge to develop software programs in his or her discipline using object-oriented programming. This course covers basics and details of object-oriented languages through JAVA. Initially, the course starts with variable types, control statements, functions, and class designs. Class inheritance and interface are also discussed in relation to polymorphism. Topics such as GUI APIs, serializable objects, network, and thread are investigated as well. The aim of this course is to enable students to understand object-oriented programming through JAVA and to build their own applications. This course is offered as a B-learning course in which students take one online course material per week and participate in offline course with group activity.

Frequency of Course Offering: Every Spring
Prerequisite: Computer Programming

Classification : Core Major

Data Structures

Course Code: INE2011		
Credits	Class Hr	Lab Hr
3	3	0

Data structures are an essential part in creating complex and reliable software. This course pertains to various data structures using JAVA with examples and implementations. Students taking this course should have completed a basic JAVA course, though the basics of the languages will be dealt in class. Throughout the course, selected topics will include abstract data types, stacks, queue, heap, graphs, search algorithms and so forth with emphasis on examples and illustrations. The aim of this course is to enable students to understand various kinds of data structures and apply them to real-life situations. This course is offered as a B-learning course in which students take one online course material per week and participate in offline course with group activity.

Frequency of Course Offering: Every Fall
Prerequisite: Computer Programming, Object-oriented Programming

Classification : Core Major

Mathematics for Industrial Engineering

Course Code:		INE2015
Credits	Class Hr	Lab Hr
3	3	0

The main objective of this course is to deliver the basic mathematics including linear algebra and its applications. Specifically, this course mainly covers matrix theory and vector spaces, accompanying with related examples. Linear algebra is one of the branches of mathematics that investigates systems of linear equations, the properties of matrices, and the properties of vector spaces. These concepts will be actively used in other courses in the department of industrial engineering, such as applied statistics, linear programming, management science and operations research 1 and 2, and data mining. Along with mathematical derivations, students will be provided with opportunities to use MATLAB and also have chances to see applications of these concepts to engineering economics, optimization, and data analysis with interesting examples.

Frequency of Course Offering: Every Spring
Prerequisite: Calculus, Algebra

Classification : Extended Major

Management Strategy and Database

Course Code:		INE2016
Credits	Class Hr	Lab Hr
3	3	0

Management Information System has been recognized and developed as a key infrastructure for business corporates as well as non-commercial organizations. According to the changes in business environment and business models, it is absolutely necessary to make a successful development and continuous evolution of management information system. Also, more flexible and robust system for handling a lot of managerial data is one of essential and basic cores for successful management system. In this class, students study the types of evolution of management information systems as well as the future projections of those systems which must be flexible and need strategic adaptation to dynamically changing business environment. In addition, by sharing and discussing several interesting business cases from the top-tier business corporations, it is expected that the level of understanding the overall structure and business significance for management information system could be deepened and strengthened.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Human Factors Engineering

Course Code:		INE3039
Credits	Class Hr	Lab Hr
3	3	0

This introductory course is primarily concerned with various applications of human psychological, physical, and physiological information to the design of tools, machines, systems, tasks, jobs, and environments for safe, comfortable, and effective human use. The course covers major fundamental theories and principles of human factors engineering as it relates to manned systems design problems, from systems engineering and behavioral science standpoints. Representative subjects to be handled in this course include: discussion of effects of poor HF design; classification of human-machine systems; anthropometry (measurement of human sizes); workplace design and product design; biomechanical analysis; material handling issues in the workplace; visual sense and environment; design of visual display devices; auditory sense and environment; design of auditory display devices; and design of control devices. Students are expected to gain knowledge concerning how human perceptual, sensory, and physiological functioning impacts such design through several homework assignments and team design projects.

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Applied Human Factors Methodology

Course Code:		INE3041
Credits	Class Hr	Lab Hr
3	3	0

Based on general theories and principles discussed in the Human Factors Engineering course (offered in the spring semester), this course covers practical methods and approaches of human factors engineering to apply in the workplaces (fields and offices, etc). Some practical ergonomic evaluation tools for occupational musculoskeletal problems (such as RULA, OWAS, and REBA, etc.) and recent trends of pertinent research will also be discussed. Some representative subjects to be handled in this course include: effects of poor HF design on efficiency of the organization; biomechanical application analysis of products; anthropometry and work physiology; workplace design and product design; design of visual and auditory display devices; design of control devices; and human performance evaluation. Students are expected to present and discuss real-life cases of human factors design problems and also are required to perform a semester (team) application project to enhance in-field human factors problems.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Extended Major

Network and Inventory Strategy

Course Code:		INE3082
Credits	Class Hr	Lab Hr
3	3	0

It has been widely known that it is essential to understand the changes in business market and be responsive to the dynamic requirements of customers to be more competitive business corporate. In other words, the traditional limited and restricted core component for business competitiveness is no more valid under the highly volatile business environment. Naturally, the understanding the structure of business logistics for suppliers as well as customers should be further developed to be more competitive business organization. In this class, students study the basic structure of business logistics strategy and the structured quantitative models and techniques to analyze, design and implement a successful business logistics. Basic topics in this class would be how to integrate both network design and inventory decision to make the business logistics more competitive. Also, a lot of business concerns on the supply chain channels would be studied to acquire basic knowledge about the managerial issues.

Frequency of Course Offering: Every Spring
Prerequisite: Linear and Non-linear Programming, Statistics

Classification : Core Major

Experimental Design

Course Code:		INE4004
Credits	Class Hr	Lab Hr
3	3	0

This course covers the principles of design and experiments, their application, and the analysis of experimental data. The course focuses on how scientific experiments should be designed and analyzed, allowing students to approach real experimental problems statistically and practically. This course deals with the types of experiments that are frequently conducted in industrial settings. The main objective is to learn how to plan, design, and conduct experiments efficiently and effectively, and to analyze the data and draw objective conclusions. This course will emphasize practical examples along with adequate understanding on the related theories and principles. The topics of this course are analysis of variance, analysis of covariance, randomized blocks, factorial Designs, blocking, confounding, fractional factorial Designs, nested design, response surface methods, three-level designs, nested designs, and so forth.

Frequency of Course Offering: Every Fall
Prerequisite: Applied Statistics

Classification : Extended Major

Human-Computer Interface Design

Course Code:		INE4038
Credits	Class Hr	Lab Hr
3	3	0

Surveys of theoretical and empirical foundations/principles are applied to design and evaluation of human-computer systems. Major areas to be discussed include ways to determine which form of interaction is best for which user and which task; the design process by which we can develop the right system to fit a specific purpose; methods to evaluate whether systems are usable by the target users; and Web usability. Other selected topics to be handled in this course include: background and impact of HCI and effective User-Interface; introduction of student team project and demonstration of Prototyping; fundamentals for HCI; introduction of System Engineering and its related design process; discussion of representative HCI theories; discussion of major HCI principles; discussion of fundamental HCI guidelines; managing design process; assessments of usability; discussion of major interaction, including direct manipulation & VR; various other types of interaction; numerous interaction devices; web design issues and UCC (User-Centered Design).

Frequency of Course Offering: Every Spring
Prerequisite: None

Classification : Extended Major

Data Mining

Course Code:		INE5008
Credits	Class Hr	Lab Hr
3	3	0

Data mining is one of the modern statistical processes which results in a discovery of new patterns in data sets. This course sets its goal to develop students' understanding on the concepts of several data mining techniques, and to eventually help students perform data mining analysis. The topics of the course will include decision trees based upon regression analysis, cluster analysis, discriminant analysis, factor analysis, naïve Bayesian classifier, neural networks, Logistic/Poisson regression, and support vector machines. Modern statistical software such as MS Excel and R along with other languages, as needed, will be used to demonstrate the techniques. The aim of this course is to enable students to understand various kinds of data mining techniques and apply them to real-life data sets.

Frequency of Course Offering: Every Spring
Prerequisite: Applied Statistics

COLLEGE OF ENGINEERING

DEPARTMENT OF AUTOMOTIVE ENGINEERING

HANYANG UNIVERSITY

Classification : Core Major

Signals and Systems

Course Code:	ECE3008	
Credits	Class Hr	Lab Hr
3	3	0

This course aims to provide students with the ability of analyzing the basic concepts and characteristics of signal, system, and signal processing. In the beginning of the course, the basic theory of continuous and discrete time signal and system, impulse response, characteristics of linear time invariant system and convolution will be dealt. Then, towards the end of the semester, the course will cover topics on the analysis technique in the frequency domain using Fourier series and Fourier transform of continuous and discrete time function signal. In addition, Laplace transform and sampling theory to transform a continuous analog signal into discrete digital signal and system are also discussed in class.

Frequency of Course Offering: Every Spring
Prerequisite: Calculus 1&2, Engineering Mathematics 1&2

Classification : Extended Major

Embedded System

Course Code:	ECL3003	
Credits	Class Hr	Lab Hr
3	2	2

This course provides theoretical background and practical exercises on embedded system design. Students will learn the following basics of embedded system including the software build system and initialization of embedded system, real-time OS concept and kernel, controller area network (CAN) protocol, and standard software architecture for automotive applications (basic concept of AUTOSAR). In addition, as for the practical exercises, students implement embedded SW with designing components based SW architecture and CAN network communication. By doing this, students will be able to put theories into real-life practices. To provide practical experiences for developing real-life application, an essential mission of this course revolves around a team-project that implements an embedded system. In this mission, students will learn the development process of an actual embedded system through projects.

Frequency of Course Offering: Every Spring
Prerequisite: Microprocessor Applications

Classification : Core Major

Digital Logic Design

Course Code:	ECN1001	
Credits	Class Hr	Lab Hr
3	2	2

This course focuses on digital logic circuits design. In order to provide basic knowledge of logical algorithm design, students will study the Boolean algebra and device characteristics. Minimization and combination of the process will optimize the logic circuit by eliminating unnecessary devices. Adder, subtracter, and decoder are the representative logic circuits. Students will also design synchronous logic circuits using complex timing devices, such as flip-flop and latch. The designed logic circuits are then implemented via the lab work equipment. Students will use the logic circuits for various applications as the basic course for microprocessor applications. This will include signal conditioning of I/O interfaces, filtering, and amplifying. During the lab work hours, students will conduct a term project that integrates logic circuits to bread board using the learned logical devices. By conducting both class and term projects, students will obtain skills for designing digital circuits and its applications.

Frequency of Course Offering: Every Fall
Prerequisite: None

Classification : Core Major

Electric Circuit Theory

Course Code:	ELE2058	
Credits	Class Hr	Lab Hr
3	2	2

This course introduces the fundamentals of electrical circuits and related experiments. Major concepts that will be covered in this course include: 1) core components, performances, and variables of circuits, 2) circuits using R, C, and/or L, 3) steady-state and transient analysis, 4) frequency analysis, and 5) power and energy. This course provides circuit analysis methodologies starting from Kirchhoff's circuit laws (Kirchhoff's voltage law and current laws) to more complicated circuit analysis methods (mesh and nodal analysis, superposition, and the Norton and Thevenin theorems). It also covers the analysis of the AC network such as AC power and dynamic responses of AC circuits. Differences and similarities in steady-state, transient, and frequency responses are also discussed. In addition, concepts needed to analyze power and energy of given circuits will be learned.

Frequency of Course Offering: Every Spring
Prerequisite: Physics and Lab I and II

Classification : Extended Major

Power Electronics

Course Code:	ELE4005	
Credits	Class Hr	Lab Hr
3	3	0

This course studies power conversion circuits needed in automotive engineering. The power conversion control, which can control and convert an electrical energy according to the load characteristics, is divided into four types of converters: DC to DC converters, DC to AC inverters, AC to DC rectifiers, and AC to AC cycloconverters. This course focuses on converters (including DC/DC converters, DC/AC inverters, and AC/DC rectifiers) widely used in hybrid and electric vehicles, and provides how power electronics are used in automotive engineering. In addition, the course will discuss major concepts needed to analyze power electronic circuits and their specifications. In addition, the design and analysis of general power conversion control circuits and the composition of control algorithm will be studied. Power semiconductors will be also covered. Because of the uniqueness of this course, to take this course, students must receive an approval from the lecturer that they have satisfied all four prerequisites.

Frequency of Course Offering: Every Fall
Prerequisite: Electrical Circuits and Laboratory, Electronic Circuits and Laboratory, Electromagnetics, Signals and Systems

Classification : Core Major

Microelectronic Circuits

Course Code:	ENE3001	
Credits	Class Hr	Lab Hr
3	2	2

Through this course, students will learn the basic principles of electronic devices, especially active devices, and electronic circuits using such devices. Topics covered in this course starts with very basics of semiconductor physics. Then, physics of diodes, their ideal/non-ideal models, and circuits such as rectifiers will be discussed. The next topic is the physics of and amplifiers using bipolar transistors, focusing on large/small signal models and CE/CB/CC amplifiers. The last topic is the physics of and amplifiers using field effect transistors with their large/small signal models and CS/CG/CD amplifiers. The differences between bipolar and MOSFET circuits will be also covered. This course requires both a classroom lecture and tightly scheduled circuit laboratory. Thus, to take this course, students must receive an approval from the lecturer that they have satisfied all prerequisites, including laboratories.

Frequency of Course Offering: Every Fall
Prerequisite: Physics and Laboratory I and II, Electrical Circuits and Laboratory

Classification : Core Major

Microprocessor Applications

Course Code:		ENE4041
Credits	Class Hr	Lab Hr
3	2	2

This class covers microprocessor structures including the controller, ALU, memory, I/O devices and their operations. Students will study computer programming and assembly languages to handle the basic registers. This program will provide the basic knowledge for microprocessor to design its software and its applications. This course will also cover hardware architecture and the basic functions of the microprocessor, such as a pulse width modulation (PWM), an analog digital converter (ADC), and controller area network (CAN) communication. Using the microprocessor, students will design the control system involving thermal devices, automotive applications, machine tools, etc. During the lab work hours, the designed control system will be implemented to evaluation board as part of a term project. Through this course and its term project, students will understand the operating principles of the microprocessor, and various microprocessor applications' software design.

Frequency of Course Offering: Every Spring
Prerequisite: Digital Logic Design

Classification :

Course Code:		
Credits	Class Hr	Lab Hr