Course Description

Creative Introduction to Engineering Design
This is the introductory course for the materials project design course. This course covers concepts of engineering design, team work including investigation, discussion, presentation and research to solve the engineering problems.
Materials Science and Engineering 1
The chemical, physical, and engineering properties of materials depend on the microscopic and macroscopic structures of the materials. This course deals with fundamental theories based on the understanding the relationships between the properties and the structures of metallic, ceramic, and organic materials.
Materiallography Design and Lab
The microstructure of the material is changed during the manufacturing processes. And the microstructure can affect the final properties of materials, ie, physical, chemical and mechanical properties. This course examine the microstructure using the optical microscopy including specimen collection and handling (grinding, polishing, etching etc.). Learning how to discuss the experimental results. In addition, microscopic analysis of the challenges given by team addressed through the design elements that are included.
Materials Mechanical Characteristics Design and Lab.
This lecture provides the basics for students studying materials science and engineering. This course aims to understand the mechanical properties of materials and their applications performing various experiment and study, which constitutes the hardness, tensile, bending, and impact tests.
Computer Aided Design in Materials Science and Engineering
It is taught basic computer aided drawing and design command and practice of die set and equipment for materials process and manufacturing. This subject leads to computer aided manufacturing in materials science and engineering.
Materials Science and Engineering 2
The objective of this lecture is to present the scientific theories and knowledge which are necessary to develop the advanced materials for next generation semiconductor, energy storage, display, aerospace and biomaterials. This lecture covers mechanical properties, alloying, corrosion and electromagnetism.
Materials Chemical Characteristics Design and Lab.
The objective of this course is to provide basic knowledge and information on experimentations through selective experimental works to learn chemical properties of materials including diffusion, phase transformation, erosion/deterioration and also chemical processing for composite materials. The class offers a design element to students by performing team projects to solve problems by materials chemical characteristics.

Materials Electrical and Electronics Design and Lab.
This subject gives the knowledge of fundamental concepts of basic electrical and electronics engineering and aims at providing the students with basic understanding of electrical fundamentals, A.C circuits, batteries, analog devices and digital electronics for effective functioning in the field of electronic service industry. Team project must be designed and implemented by the end of the semester. Students use their engineering design concepts and analytical and measurement tools, in conjunction with their own ingenuity, to create a new solution to a specified engineering design problem.
Electric and Electronic Engineering
The purpose of this class is to provide understanding of electrical/electronic measurement principal of materials. The course contents cover basic concepts of electrical circuits, electrical/electronic phenomena of R, L, C and the operation principles of semiconductors, diodes and transistors.
Microstructure of Materials
Phase diagrams are graphical representations of relationship of composition and phase in metal and ceramic materials. By understanding the principle and application of the binary and ternary phase diagrams will be able to understand and predict many aspects of the properties of materials, especially the effect of microstructure on properties of materials. In this lecture, the emphasis has been placed on binary and ternary phase diagrams, microstructure development with addition of another elements and mechanical and physical properties.
Thermodynamics of Materials1
Thermodynamics is built on the study of energy transfers that can be strictly resolved into heat and work in field of metals/ceramics/energy and electronic materials. Its contents are composed of thermodynamic basic concepts/laws, phase transform and diagrams, phase equilibrium of gas/solution/solid, and electrochemistry for materials engineer.
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Design for Materials and Manufacturing Process
Design for Materials and manufacturing has addressed by selecting the material and manufacturing process (powder-, bulk-, thin-film process ets.) and solving the special projects for making a prototype material (module, parts, semi-finished materials) or end-products. This course will provide introductory information concerning several manufacturing processes, and carry out the experimental work by student group with term project by coaching the professor. The objective of this course is to achieve a knowledge and understanding of a wide

variety of manufacturing processes involving materials.
Energy Materials Design Project
This course deals with the properties of energy materials for environmental cleanup and energy conversion devices including fuel cells and solar cells by performing a design project for development of new technologies of energy materials based on students' own creative idea.
Phase Transformations in Materials
This field study is aiming to create new high strength materials, high corrosion resistance material and high temperature materials. In particular, we are introducing in the mechanism of advanced metallic and ceramic materials through thinking of theory and phenomena of thermodynamics, diffusion, interface, nucleation and phase transit phenomena etc. The coupling of structural inspiration with nano-scale design can lead to enhanced materials properties for demanding applications. We are demonstrating that the themodynamic and nano -scaled inspired materials are suitable for applications such as high strengthened materials, high magnetic materials and advanced functional metallic and ceramic materials for next generation.
Electronics Materials 1
This course deals with the electron theory in the aspect of quantum-mechanics and the principles, concepts, and applications of electrons to electronic materials, which can be applied, for examples, to devices of semiconductors, information displays, dielectrics, and optoelectronics.
Introduction to Crystallography
This course covers crystal structure and symmetry theory of materials. This provides concepts of lattice and point group and space groups, the indexing of planes and directions, and relationships between crystal structures and properties of materials.
Ferrous Metallic Materials
This lecture presents phase diagram, alloy design, microstructure control, the change of mechanical properties and application of the iron and steels which are the most widely used materials in the industrial fields.
Carbon Materials
This course provides basic concepts of various raw carbon materials, processes, structures and characteristics. Contents are composed of carbon based composite materials including nano composites, thin film composites and structural composites.
Electrochemistry for Materials Science

Electrochemistry concerns interfacial reactions which take place in a solution at the interface of an electron conductor and an ionic conductor and which involve electron transfer between the electrode and the electrolyte. Its contents are composed of electrochemical theory, equilibrium, interface phenomena, reaction kinetics, and electrochemical application for materials engineer.
Ceramic Processing
Covers basic principles of fine ceramics processing. Emphasis on uses of different kinds of processing examples in the fields. Fine ceramics processing and its application are covered from the point of materials science and engineering
Introduction to Organic Materials
This class deals with the structure and basic knowledge of organic materials including polymers. This class covers the chemical reaction, nomenclature and molding technique of organic materials.
Practice in Structural Materials Engineering 1
Ability for reliability evaluation of the product, quality management of materials and related skills is required, in order to increase the competitiveness in the industry, such as steel-, metal-, automobile-, shipbuilding-, semiconductor-industry, and heavy chemical industry. In this course provides a practical expert knowledge for the "Industrial Engineer Metal Material, Industrial Engineer Metallography, Industrial Engineer Radiation Nondestructive Testing, Industrial Engineer Magnetic Nondestructive Testing, Industrial Engineer Ultrasonic Nondestructive Testing, Industrial Engineer Penetrate Nondestructive Testing" (national technical qualification certificate).
Practical materials safety
Practical materials safety studies scientific and technological means to prevent industrial disasters caused from inappropriate usage of materials. That is, this course focuses on the scientific identification of accidents that emerge from the production process, the hazards and risks in the context of materials-related mishaps, systems safety engineering approach to manage risks associated with materials-related mishaps.
Materials Project Design1
This course is a graduation project by using all knowledge of student. The design project is carried out the co-working of student team under supervising of professor.
Materials Analysis and Characterization Design
This course covers team projects and designs, the experimental analysis work and presentations for the basic understanding of improvement of creativity as a material scientist. This course carry out the experimental analysis work by student group with term project in consultation with a faculty member. Experimental techniques and analysis of materials through a materials analysis and characterization techniques; crystallography, X-ray diffraction, electron microscopy, XRF, FT-IR, ICP, Raman, DSC, TG-DTA etc. The objective of this course is to

achieve a knowledge and understanding of a wide variety of analysis and characterization involving materials.
X-Ray Diffraction and Design
This course provide an introduction to materials characterization with x-ray diffraction and its importance. Deal with the topic of crystal structure and how structures can be determined using diffraction methods. And describe the properties and behavior of x-rays and their use in materials characterization, such as stress analysis, phase diagram, chemical analysis, preferred orientation (texture), and nano-size grain analysis. In addition, x-ray diffraction analysis of the challenges given by team addressed through the design elements that are included.
Electronic Materials 2
This course deals with the optical properties of optoelectronic devices such as LED, laser, etc. and the magnetics properties of materials such as permanent magnets, magnetic head, magnetic tape, etc. and the thermal properties of materials such as coefficient of thermal expansion, heat capacity, etc. This helps attendees understand the operating principles of electronic devices and apply to the development of devices.
Strengthening Mechanism of Materials
This lecture covers the physical meaning and the calculation of stress and strain in elastic and plastic deformation of materials. It also presents the understandings of dislocations, and the strengthening and failure mechanisms of materials.
Nonferrous Metallic Materials
This course covers the characteristics of nonferrous metallic materials such as Al, Cu, Ti, Ni, Mg alloys and rare earth metals etc. The effects of alloying elements, phase diagram, mechanical and chemical properties, heat treatment processes of nonferrous metallic materials are taught to develop the ability for design and application of metallic alloys.
Computer Simulation in Materials Engineering
It is taught that the basic finite element method and prediction of stress and strain relationship during and after the deformation of materials in this subject.
Metallurgical Engineering
The course concerns the principles of metallurgical engineering, thermodynamic/kinetic analysis of metallurgical reactions, analysis of conventional metallurgical processes. It also treats keyword of metallurgical technologies for the development of next-generation.
Green Energy Engineering
The purpose of this course is to provide an introduction to environmental crisis, energy depletion and alternative energy sources which are the most serious problems of entire human being. International issues about climate

change, the related domestic political/economical movement, hydrogen technology as an alternative energy and other environment-friendly technologies will be discussed.
Organic Materials Property
This class deals with the structure, characteristics, physical/chemical properties, electrical/electronic properties and applications of functional polymers used for information/electronic materials.
Semiconductor Devices
Studies of basic theory and operational principles of semicondctor devices such as Microwave Diodes, Quantum-Effect Devices, MESFET, MOSFET Devices, Bipolar Transistor, and related semiconducting materials.
Materials Project Design2
This course is a graduation project by using all knowledge of student. The design project is carried out the co-working of student team under supervising of professor.
Plasticity in Materials
It is taught that the relationship between stress and strain in elastic and plastic deformation of materials. Based on the elasticity and plasticity theory, metals forging, rolling, extrusion, wire drawing, sheet forming, micro forming and special forming method will be taught in this subject.
Ceramic Structural Materials
Ceramic structural materials demonstrate enhanced properties under special demanding conditions; erosive, corrosive, or high-temperature environments. The basic theories for understanding of materials, application and some example of ceramic structural materials are treated.
Energy Storage Materials
This lecture provides the basics for students studying energy storage materials. This course aims to understand the basics of the energy storage materials, such as operating principles, various kinds, constitutions, and overall systems. In this lecture, the energy storage systems contain Li-ion batteries, Mg batteries, and super-capacitors.
Information Display Engineering and Design
This course deals with the operating principles, structures, and fabrication process of information displays such as CRT, LCD, PDP, OLED, FED, e-paper, etc. This helps attendees easily adapt to display industries after study.
Semiconductor Processing
In this course the basic goals, principles and techniques of semiconductor materials processing are discussed. The emphasis is on physical explanations of how devices and processes work rather than on elaborate

mathematical models. After taking this course, you will be able to understand the capabilities and the limitations of the various techniques that are used to fabricate semiconductor devices and integrated circuits (ICs), including semiconductor junction, lithography, thermal oxidation, diffusion, etching, and metalization. Statistical process control and design of experiments are included. The course will have a significant process modeling component.
Thin Film Engineering
This subject gives the knowledge of fundamental concepts of thin film technology in electronic industry. For the application, evaporation, sputtering, chemical vapor deposition and sol-del process such as spray, spinning, and screen printing are introduced with basic understanding of its theory and fabrication process.
Practice in Structural Materials Engineering 2
Ability for reliability evaluation of the product, quality management of materials and related skills is required, in order to increase the competitiveness in the industry, such as steel-, metal-, automobile-, shipbuilding-, semiconductor-industry, and heavy chemical industry. In this course provides a practical expert knowledge for the "Engineer Metal Material, Engineer Radiation Nondestructive Testing, Engineer Magnetic Nondestructive Testing, Engineer Ultrasonic Nondestructive Testing, Engineer Penetrate Nondestructive Testing, Engineer Eddy Current Nondestructive Testing" (national technical qualification certificate).
Practice in Nondestructive Testing
Practice in nondestructive testing concerns analysis techniques used in science and industry to evaluate the properties of a material, component or system without causing damage. Its contents are composed of ultrasonic, magnetic-particle, liquid penetrant, radiographic, remote visual inspection (RVI) and eddy-current testing under the basis of materials science and engineering knowledge.
Electron Microscopy and Design
This lecture presents observation of inner microstructure of thin foil sample and surface microstructure, and the analysis of elements and crystallography on micro-area using the TEM (transmission electron microscope) and SEM (scanning electron microscope). Also the methods of sample preparation, operation of electron microscope and the data analysis are given through the design program.
Functional Metals
This course covers super plastic materials, shape memory alloys, anti-vibrating metals, hydrogen storage materials, superconducting materials and materials for very low temperature. This provides concept of functional materials, processes and industrial application which are based on phase diagrams, alloy design, microstructures and mechanical properties.
Surface Treatment Engineering

This subject covers corrosion and protection of materials based on corrosion engineering and corrosion science. Also the basic principle of electro-plating, physical and chemical vapor deposition method will be taught in this subject.
Photovoltaic Materials
This field study is aiming to create new high efficient photovoltaic materials by the hybridization of organic and inorganic materials. In particular, we are introducing in the development of advanced Photovoltaic materials through converging of thermoelectric device and thin film technology etc. The coupling of semiconductor inspiration with nano-scale design can lead to enhanced performance and materials properties for demanding applications. We are demonstrating that the thermo-electric and semiconduct-inspired materials are very suitable for applications such as high efficient photovoltaic device, self-cooling photovoltaic device and high-throughput photovoltaic system.
Electronic Ceramic Materials
Studies of types, properties, and applications of ceramics based on basic knowledge of atomic and electronic structures of advanced electronic ceramics such as semiconductors, dielectrics, ferroelectrics, piezoelectrics, and pyroelectrics.
Application of Nano Electronic Materials
The course reviews the trends in low dimensional semiconductors which use quantum phenomena to realize new functions or devices and new basic building blocks. These aim at electronic, optoelectronic and new bio applications. New approaches to nanoelectronic systems will also be overviewed.
Properties of Ceramic Materials 1
This class covers fundamentals of structural properties of ceramics and their dependence on various physical parameters. The diversity in their properties stems from their bonding and crystal structures. Ceramic bonds are mixed, ionic and covalent and crystal structures are divided with its structural nature of chemical spices. We study fundamental science on thermal and mechanical properties of ceramics and understand the effect of structural characteristics on physical properties of ceramics for various ceramic applications.
Properties of Ceramic Materials 2
This class covers fundamentals of electronic/electrical properties of ceramics. We study modern physics and crystallographic defect theory to understand electronic properties of ceramics. Based on the fundamentals, electrical, dielectric, magnetic and optical characteristics of ceramics are addressed.
Materials Engineering Stoichiometry
Materials Engineering Stoichiometry In this subject, we will understand first the concept of unit that is of importance in the engineering calculation, followed by those of temperature and pressure. Material balance and Energy balance for a given materials engineering process is then studied together with the properties of

gas, liquid, and solid. The mutual conversion between the SI unit and the F.P.S. unit is also treated to enhance the ability of engineering calculation in the industrial plants.
Functional Glasses
This class addresses fundamentals of structure, classification, fabrication of glass ceramics and their chemical, thermal, mechanical and optical properties. Further, we study various functional glasses for practical applications such as display, optical and information devices.
Materials Analysis
Studies of basic operation principles of instruments to measure structure and composition of unknown materials for understanding physical, chemical, and electronic properties of bulks, thin films, and nano-structured materials; including analysis ability of measured data.
Application of Organic Materials
Organic materials based on carbon and hydrogen are widely used in real life due to various applications. In this course, we will learn what distinguishes organic materials, especially organic semiconductor materials, from inorganic materials. In addition, we will study nanoscale processing methods for organic materials and the operation principles of various organic electronic devices including organic transistor, organic light emitting devices, organic solar cells, and liquid crystal displays.