

工程數學 Engineering Mathematics (3-0-3) Obligatory

The Engineering mathematics is to introduce the general and fundamental methods to solve the ordinary derivative equation and partial derivative equation.

化學技術實習 Chemical Technology Lab. (Two semesters , 0-3-1 each)
Obligatory

This course is to teach analytical methods for polymers including molecular weights, mechanical and thermal and electrical properties.

反應工程 Chemical Reaction Engineering (3-0-3) Obligatory

The contents are: chemical reaction kinetics, reaction mechanism, isothermal reactor design, catalytic reactor design, and studies of nonideal reactor behaviors.

輸送現象(I) Transport Phenomena(I) (3-0-3) Obligatory

This required core course for chemical engineering undergraduates emphasizes on an understanding of momentum transport phenomena and operation in chemical engineering processes. The course is divided into five phases: fluid properties, equation of motion, momentum transport in laminar flow, momentum transport in turbulent flow, and flow applications in chemical engineering processes.

輸送現象(II) Transport Phenomena(II) (3-0-3) Obligatory

Transport phenomena are the fundamental of chemical unit operation, which introduce the principles of hydrodynamic, heat transfer and mass transfer.

單元操作與輸送現象 (二) Unit Operation and Transport Phenomena (2) (3-0-3)
Obligatory

This course deals with the transfer of energy. Gross quantities of heat added to or rejected from a system may be evaluated by applying the control-volume expression for the first law of thermodynamics. Certainly in designing a plant in which heat must be exchanged with the surroundings, the size of heat-transfer equipment, the materials of which it is to be constructed, and the auxiliary equipment required for its utilization are all important considerations for the chemical engineer. Considerations of an engineering nature such as these require both a familiarity with the basic mechanisms of energy transfer and an ability to evaluate quantitatively these rates as well as the important associated quantities. Our immediate goal is to examine the basic mechanisms of energy transfer and to consider the fundamental equations for evaluating the rate of energy transfer. There are three modes of energy transfer: conduction, convection, and radiation. All heat-transfer processes involve one or more of these modes. This course will be devoted to an introductory description and discussion of these types of transfer.

單元操作與輸送現象 (三) Unit Operation and Transport Phenomena (3) (3-0-3)**Obligatory**

The previous courses (i.e., part 1 and 2) dealing with the transport phenomena of momentum and heat transfer have dealt with one-component phases which possessed a natural tendency to reach equilibrium conditions. When a system contains two or more components whose concentrations vary from point to point, there is a natural tendency for mass to be transferred, minimizing the concentration differences within the system. The transport of one constituent from a region of higher concentration to that of a lower concentration is called mass transfer. A lump of sugar added to a cup of black coffee eventually dissolves and then diffuses uniformly throughout the coffee. Water evaporates from ponds to increase the humidity of the passing air stream. Chemical processes include the chemical vapor deposition (CVD) of silane (SiH_4) onto a silicon wafer, the doping of a silicon wafer to form a semiconducting thin film and the purification of ores and isotopes. Mass transfer underlies the various chemical separation processes where one or more components migrate from one phase to the interface between two phases in contact. For example, in adsorption or crystallization processes, the components remain at the interface, whereas in gas absorption and liquid-liquid extraction processes, the components penetrate the interface and then transfer into the bulk of the second phase. The mechanism of mass transfer, as we have also observed in heat transfer, depends upon the dynamics of the system in which it occurs. Mass can be transferred by random molecular motion in quiescent fluids, or it can be transferred from a surface into a moving fluid, aided by the dynamic characteristics of the flow. These two distinct modes of transport, molecular mass transfer and convective mass transfer, are analogous to conduction heat transfer and convective heat transfer. Each of these modes of mass transfer will be described and analyzed.

單元操作實習 Unit Operations Lab. (兩學期, 各0-3-1) Obligatory

It aims to train student in experimental techniques. The practical training about momentum, heat and mass transfers can enforce the basic skills of themselves.

程序設計 Process Design (3-0-3) Obligatory

This course is to teach how to design a chemical production process on the basis of unit operations, thermodynamics, kinetics, etc.

化工熱力學 Chemical Engineering Thermodynamics (3-0-3) Obligatory

In the subject of chemical engineering thermodynamics is order to derive the first to third laws in the thermodynamics heat engine, vapor-equilibrium and their applications in the chemical engineering region.

化工熱力學 Chemical Engineering Thermodynamics (3-0-3) Obligatory

The first law of Thermodynamics, equations of state, heat effects, the second law of thermodynamics, Solution thermodynamics, phase equilibrium.

程序控制 Process Control (3-0-3) Obligatory

The subject of process control aims to introduce the advantage of automatic control system for industrial manufacture, and the basic principle of control system analysis and design.

物理化學實習(I) Physical Chemistry Lab (I) (0-3-1) Obligatory

This lab. Course will enable students who have finished the course of physical chemistry (I) have the opportunity to experience some measuring experiments using physical principals and techniques to measure the difference of various chemical processes. Experimental subjects include: thermodynamics, kinetics, gases, solid solutions, chemical equilibrium, physical equilibrium, electrochemistry, surface chemistry, etc.

物理化學實習(II) Physical Chemistry Lab (II) (0-3-1) Obligatory

This course will enable students who have finished the course of physical chemistry (I) and (II) have the opportunity to experience some measuring experiments using physical principals and techniques to explore the consequences of various chemical processes. Experimental subjects include: thermodynamics, kinetics, gases, solid solutions, chemical equilibrium, physical equilibrium, electro-chemistry, surface chemistry, etc.

質能均衡 Mass and Energy Balances (3-0-3) Obligatory

This required core course for chemical engineering undergraduates emphasizes on the practice of principles and computation of mass and energy flows in chemical engineering processes. The course is divided into four phases: unit conversion, conservation of mass, conservation of energy, and computer-aided computation skill.

物理化學(一) Physical Chemistry (3-0-3) Obligatory

This course introduces how to synthesize the knowledge students have learned from mathematics, physics, and chemistry courses into a coherent pattern of knowledge. It should be regarded as a prerequisite course to take the professional courses for chemical engineering students. The content includes thermodynamics, gas behaviors, chemical equilibrium, phase rule, etc.

物理化學(二) Physical Chemistry (3-0-3) Obligatory

This course introduces students how to synthesize the knowledge they have learned from mathematics, physics, and chemistry courses into a coherent pattern of knowledge. It should be regarded as a prerequisite course to take the professional courses for chemical engineering students. The content includes kinetics, electro-chemistry, photo-chemistry, surface chemistry, colloids, macromolecules, etc.

計算機概論 Calculator Introduction (2-0-2) Obligatory

To introduce the purpose of computer and its development, and also recognizes a few computer programming in chemical engineering.

化學工程概論 Introduction of Chemical Engineering (1-0-1) Obligatory

This course is arranged for the fresh man of the department of chemical engineering. The purpose of this course is to introduce the chemical engineering to the students and tell them what courses they will learn in the future four years and how importance is it for their future development in industry field. The contents of this course include “what is the chemical engineering?” “the importance and contribution of chemical engineering on advanced material”, “the importance and contribution on biotechnology”, “the importance and contribution on energy resource technology”, “the importance and contribution on environment protection and process safety”. In addition, the basic concept of material and energy balance will be introduced to the students.

化工安全衛生 Introduction to Safety and Hygiene of Chemical Industries (3-0-3) Elective

The objective of this course is to enable the student to understand the concepts of industrial hygiene and safety. The course content includes laws and regulations, boiler and pressurized vessel, fire and explosion, chemical waste treatment, chemicals storage and transportation, safety assessment.

電化學 Electrochemistry (3-0-3) Elective

Electrochemistry is a knowledge that investigates the chemical phenomena related to electricity. It probes the relationship between the electrolyte and electric charge during chemical reaction; it discusses the reactions occurred on various electrodes and its potential variation; it discusses reactions occurred in various kind of cells and its electromotive force. This course will firstly introduce the fundamental principle, then its practical applications such as electrolysis, plating, electrowinning, electrorefining, electrolytic polishing, corrosion resistance, and its applications in analysis such as potentiometric titration, conductometric titration, polarographic method and other technologies such as anodic treatment, cell and battery (primary cell, secondary cell, fuel cell, and solar cell), electrochemical synthesis method, and waste water treatment. In addition, this course will also introduce the related electrochemical technologies and principles applied to the electronic and semiconductor fields. It is expected that the students can understand how to utilize the electrochemistry to produce the electronic products.

化學工業程序 Chemical Process Industries (3-0-3) Elective

This course is intended to guide students through chemical manufacturing processes and to

introduce the current developments of global chemical industries.

應用分析化學 Applied Analytical Chemistry (3-0-3) Elective

This course is made for the introduction of today's analytical chemistry, including application of basic theories and analytical instruments, optical methods and separation technology.

生物化學 Biochemistry (3-0-3) Elective

The contents are: cell structure, functions of biomolecules, cell metabolism, bioenergetics, and transfer of genetic information.

數值方法 Numerical Methods (3-0-3) Elective

To introduce numerical analysis techniques including methods for solving simultaneous linear equations, interpolation and the differential equations, etc. The MATLAB is a main programming tool.

高等工程數學 Advanced Engineering Mathematics (3-0-3) Elective

The Engineering mathematics is to introduce the general and fundamental methods to solve the ordinary derivative equation and partial derivative equation

生物科技概論 Introduction to Biotechnology (3-0-3) Elective

This course is intended to introduce some characteristics of biotechnology, the principles and applications of both traditional and current new biological processes.

生化工學 Biochemical Engineering (3-0-3) Elective

This course is concerned with applying chemical engineering principles to design and development of biological process, including basic biological concept, selection and operation of bio reactor, as well as application of non-traditional bio systems.

高分子化學 Polymer Chemistry (3-0-3) Elective

This course is to teach polymer synthetic methods including condensation, free-radical, ionic, emulsion, ring-opening polymerizations.

生化分離技術 Bioseparation Technology (3-0-3) Elective

The purpose of this course is to introduce the downstream separation techniques of biochemical processes. The main topics covered in the course are: removal of insolubles (filtration and micro-filtration, centrifugation, cell disruption); isolation (extraction, adsorption); purification (elution chromatography, precipitation); polishing (crystallization, drying).

儀器分析 Instrumental Analysis (3-0-3) Elective

This course is to teach analytical methods using instruments including FTIR, UV/VIS, GC, LC DSC, NMR, ETC, etc.

複合材料 Composite Materials (3-0-3) Elective

This course introduces the basic principal of composite materials, applications of composite materials, manufacture and processing methods, pre-impregnated materials, reinforcements, fracture behaviors and mechanical properties, interfaces of composite materials. The prerequisite courses should be polymer chemistry, polymer physics, or polymer science

高分子物性 Polymer Physical Property (3-0-3) Elective

This course covers introduction of basic chemical synthesis, including oxidation reduction reaction, alkylation, aldol condensation Environmental reaction, Dials-Alder reaction and C-C double bond formation reaction.

實驗設計法 Experimental Design and Analysis (3-0-3) Elective

The purpose of this course is to introduce the process optimization by experimental design and analysis. The main topics covered in the course are: analysis of variance; factorial designs; fractional factorial designs; regression analysis; response surface methodology; case studies of process optimization.

工業觸媒 Industrial Catalysts (3-0-3) Elective

This undergraduate course introduces students about catalyst materials, catalysis principles, and applications in industry. Five phases of the course include basic concepts of catalysis, preparation and characterization of catalyst materials, catalytic reaction kinetics, catalytic reaction processes, and catalytic reactor design. Students are assigned to present practical topics of applied catalysis in industry.

半導體材料 Semiconductor Materials (3-0-3) Elective

This course will mainly introduce the processes and related materials of the semiconductor industry. They include the wafer manufacture, formation of semiconductor film, growth of oxide layer, growth of dielectric layer, growth of metal film, synthesis and exposure of photo resistant, growth of passivation layer and so on. In addition, it also introduce the formation mechanism and the related tools, such as chemical vapor deposition, physical vapor deposition, plasma, electrodeposition, spin coating, and chemical mechanical polishing. It is expected that the students can realize the relationship between the chemical engineering and semiconductor industry.

酵素工程學 Enzyme Engineering (3-0-3) Elective

The contents are: Industrial production of enzymes, technology of enzyme technology, enzyme reaction kinetics, enzyme reactor design, and industrial applications of enzymes.

薄膜技術 Thin film Technologies

(3-0-3) Elective

This course addresses the major advances in the thin film technology, as related to device fabrication, electronic packaging of microcircuits, and optical applications. The topics discussed include the various important classes of thin film deposition techniques with an emphasis on the principles and practices of film deposition, thin film material synthesis and characterization, design guidelines, and applications. Chapter 1 is an introduction to thin film deposition techniques including chemical and physical methods used in various forms to create thin films. Chapter 2 provides an in-depth study of photolithographic techniques used to fabricate thin films with intricate patterns. Chapter 3 presents an overview of thin film materials and their various properties and attributes. Chapter 4 analyzes the nature of semiconductor thin films that form the backbone of modern microelectronics. Chapter 5 outlines design considerations and guidelines for the use of thin film materials, particularly for use in microelectronic assemblies. Chapter 6 is a compendium of characterization techniques used to evaluate and measure the properties of thin films, devices, and structures. The emphasis of this chapter is on semiconductor films; however, these techniques are generally applicable to any thin film material. The rapidly growing arena of electronic packaging is the special focus of Chapters 7 provides a detailed look at thin film multichip modules. The final chapter (Chapter 8) is a detailed look at testing and reliability of electronic assemblies, in particular thin film modules, which play an increasingly important role in microelectronics.

化工分離程序 Chemical Engineering Separation Processes (3-0-3) Elective

This elective course for chemical engineering undergraduates emphasizes on an understanding of mass transfer phenomena and operations in chemical engineering processes. The course is divided into three phases: molecular diffusion and mass transfer, phase-equilibrium separation processes, and rate-controlled separation processes.

工業觸媒 Industrial Catalysts (3-0-3) Elective

This undergraduate course introduces students about catalyst materials, catalysis principles, and applications in industry. Five phases of the course include basic concepts of catalysis, preparation and characterization of catalyst materials, catalytic reaction kinetics, catalytic reaction processes, and catalytic reactor design. Students are assigned to present practical topics of applied catalysis in industry.

奈米材料化學 Nanostructured Materials Chemistry (3-0-3) Elective

This graduate course emphasizes on developing an advanced understanding of the correlated chemical nature of the atomic, molecular and bonding characteristics of the nanoscale materials with structure, function and property. The course is composed of four phases: quantum chemistry, solid-state chemistry, characterization techniques, and synthesis chemistry. Students are assigned to present research-oriented topics in nanostructured materials, nanoscience, or nanotechnology.

膠體化學 Colloid Chemistry (3-0-3) Elective

The emphasis of this undergraduate course is on developing an understanding of colloidal system based on physical chemistry principles, properties, surface phenomena and applications. The course is divided into four phases: colloidal state, interfacial phenomena of colloidal solution, kinetic and optical properties, and colloid stability. Students are assigned to present topics of colloidal chemistry in chemical engineering applications.

化工安全衛生 Safety and Hygiene of Chemical Industries (3-0-3) Elective

The objective of this course is to enable the student to understand the concepts of industrial hygiene and safety. The course content includes laws and regulations, boiler and pressurized vessel, fire and explosion, chemical waste treatment, chemicals storage and transportation, safety assessment.

化工製程安全設計 Safety Design of Chemical Process (3-0-3) Elective

This course is designed to teach and applied the fundamentals of chemical process safety. The course content includes laws and regulations, toxicology, industrial hygiene, designs to prevent fires and explosion, toxic release and dispersion models, relief sizing.

危害物跨質傳輸 Multimedia Transport of Hazardous Waste (3-0-3) Elective

This course will provide an overview of the mechanisms and rates of movement of chemicals across interfaces. It also will introduce how to assess the movement of substances from the site of entry into the environment to the various geospheres by quantitative tools.

危害物洩漏預防 Prevention Leaks and Spills of Hazardous Waste (3-0-3) Elective

This course will teach students how to prevent leaks and spills of hazards from facilities that produce hazards, store them, or transfer them to and from transportation Terminals. It also will introduce regulations / codes and consider current local prevention practices for major hazards.

高分子分析技術 Polymer characterization (3-0-3) Elective

This course is to teach analytical methods for polymers including molecular weights, mechanical and thermal and electrical properties.

計算機程式語言 Computer Programming (3-0-3) Elective

The contents are: introduction and basic operations of VB6.0, form design, data and operators, arrays, uses of objects, and edit of VB programs.

材料科學 Material science (3-0-3) Elective

The material science is to introduce the material kinds, material design, material function, and introduce advance materials, including of nanocomposites biomaterials and conductive materials, etc.

醫工實驗 Medical Engineering Experiment (0-2-1) Elective

The class is an experimental class. In the subject, the biomaterials are synthesized in the

experiment, and to research the factors, such as surface polarity, surface tension, surface roughness, which influence the blood compatibility and bio compatibility.

不均相觸媒 Heterogeneous Catalysts (3-0-3) Elective

Heterogeneous catalysts are very important for chemical industries, because it plays a very important role in petroleum chemical industries, energy source development and environment protection and so on. Accordingly, this course will focus mainly on the catalytic behaviors between the solid and gas phase and on the synthesis and characterization of the related catalysts. The contents will include basic concepts such as catalytic activity, catalyst selectivity, active sites, and thermodynamics and energetics. It also includes the concepts of physical and chemical adsorption; the concepts of reaction rate, reaction mechanism, and kinetics models evaluation; the methods of catalyst preparation and manufacture; the physical characterization and surface analysis techniques. Especially, this course will introduce the topic of supported metal catalysts and discuss the physic-chemical interaction between the metal particles and oxides, which its principle will also be able to apply extensively to the field of electronic materials.

生物學 Biology (3-0-3) Elective

This course is concerned with the essence of life, the basic concept of biology and the relationship between organisms and their related society.

生物整治 Bioremediation (3-0-3) Elective

This course will teach students how to evaluate contaminant transport in porous media using numerical codes. It also will introduce environmental microbiology, bioremediation technologies, and on-site remediation technologies. The class design project will consider current local problems with soil and groundwater contamination.

危害物熱處理 Thermal Processing Of Hazardous Waste (3-0-3) Elective

This course will provide an overview of the disposal of hazardous wastes using thermal means. It will introduce appropriate fundamentals of thermodynamics and kinetics and will introduce hardware and permitting.

環境化學 Environmental Chemistry (3-0-3) Elective

This course is concerned with application of chemical principles to the maintenance and enhancement of environmental quality. The chemistry of present atmosphere and natural water as well as interactions between water and either the atmosphere or the underlying rock are examined.

高等化工熱力學 Advanced Chemical Engineering Thermodynamics (3-0-3) Elective

This course is one of the required core courses for chemical engineering graduates. The advanced practice of thermodynamics, viewed from the standpoint of chemical engineering, is

concentrated on principles, applications, and computer-aided computation methodology. Students after taking this course are capable of solving problems of energy flow and equilibrium. The course is divided into four phases: three laws of thermodynamics, equation of state, phase equilibrium, and chemical reaction equilibrium.

吸附分離特論 Special Topics of Adsorptive Separations (3-0-3) Elective

The purpose of this course is to introduce the fundamental principles and industrial practice of adsorptive and chromatographic separations. The main topics covered in the course are: porous adsorbents; adsorption equilibrium; kinetics of adsorption in batch systems; dynamics of adsorption columns; isolation by solid-phase extraction; product purification by column chromatography; their applications.

高等高分子化學 Advanced Polymer Chemistry (3-0-3) Elective

The advanced polymer chemistry is to introduce the synthesis methods of polymers, synthesis kinetics and the advanced technology of especial function polymers.

高等高分子物理 Advanced polymer property (3-0-3) Elective

This course is to teach advanced polymer physical properties including chain conformation, rubber elastic state, polymer solutions, amorphous state, molten state, crystalline state, etc.

高等輸送現象 Advanced Transport Phenomena (3-0-3) Elective

The aim of this course is to teach student about theories on fluid flow and energy transfer. The main topics include viscous flow, potential flow, boundary layer theory, and convective heat flow.

食品化學特論 Special Topics On Food Chemistry (3-0-3) Elective

This course is concerned with chemical properties of food ingredients, products, The composition and properties of food product are also examined.

生化工程特論 Special Topics On Biochemical Engineering (3-0-3) Elective

This course is concerned with application of biotechnology such as recombinant DNA technology, protein technology, and aeration and agitation Theories to fermentation processes

高等數值分析 Advanced numerical Analysis (3-0-3) Elective

To introduce numerical analysis techniques, including methods of the differential equations and partial differential equations. The MATLAB is a main programming tool.

高等程序控制 Advanced Process Control (3-0-3) Elective

To introduce the many of conventional or advanced control designs in chemical processes.

化工製程安全設計特論 Special Topics on Safety Design of Chemical Process (3-0-3) Elective

This course is designed to discuss special topics on chemical process safety design. The main

topics include design to prevent fires and explosions, relief system, hazards analysis and risk assessment.

複合材料特論 Special Topics on Composite Materials (3-0-3) Elective

Modern structural composites, frequently referred to as advanced composites, are blends of two or more materials, one of which is composed of stiff, long fibers and, for polymeric composites, a resinous binder or matrix that holds the fibers in place, Special topics of composite materials cover general introduction, fibers and matrices, composite modeling, analysis and design, PMC properties, repair of composite structures, Nondestructive evaluation, testing, and inspection .

高等輸送現象 Advanced Transport Phenomena (3-0-3) Elective

The aim of this course is to teach student about theories on fluid flow and energy transfer. The main topics include viscous flow, potential flow, boundary layer theory, and convective heat flow.

製程危害性評估 Hazard Evaluation For Chemical Process Industries (3-0-3) Elective

Toxicology, Source models, Toxic Release and Dispersion Models, hazards Identification, Risk Assessment, Discussion of Hazard Evaluation Examples.