環境工程與科學系

Department of Environmental Science and Engineering

一、必修科目Required Courses

312001 環境工程概論 3 必 陳瑞仁 上

環境工程概論是門介紹以技術及科學知識來改善及淨化我們的生活環境之課程。本課程內容包括：水汙染、非點源汙染、水質測定、給水工程、淨水工程、廢水收集、廢水處理、汙泥處理與處置、固體廢棄物與處理、資源回收、有害廢棄物與處理、放射性廢料、空氣污染、氣象學與空氣品質、空氣噪音測定、空氣污染控制、噪音污染、噪音之測定與控制、環境影響評估與經濟衝擊評估、及環境倫理。

312001 Introduction to Environmental 3 R S. J. Chen S

Engineering

The introduction to Environmental Engineering is the course for utilizing technical and scientific information to improve and clean up the living environment. The contents of this course include: water pollution, nonpoint source water pollution, water quality measurement, water supply, water treatment, collection of wastewater, wastewater treatment, sludge treatment and disposal, solid waste management, resource recovery, hazardous waste management, radioactive waste management, air pollution, meterology and air quality, air quality measurement, air pollution control, noise pollution, noise measurement and control, environmental impact and economic assessment, and the environmental ethic.

312002 環境微生物學 3 必 邱瑞宇、趙浩然 下

本課程內容特別針對環境領域應用微生物學而設計，主要以建立學生的基本概念與知識，內容包含:微生物學基本知識、微生物控制、微生物的生化反應、微生物的遺傳、分子生物的技術、分子生物技術在環境上的應用以及微生物控制與污染物控制的關係。

312002 Environmental Microbiology 3 R R. Y. Chiou、H. R. Chao S

This course is specially designed for the basic concept and knowledge of applied microbiology in the environmental field. This course is covered as the followings: the basic knowledge of microbiology, microbial control, biochemical reactions in microbes, genetics in microbes, molecular biological tools, the applications of molecular biology in environmental science, applications of associations between microbial control and pollutant control.

312003 環境科學概論 2 必 薩支高 下

本課程目的在使環工系學生進入環工專業領域前能瞭解環境議題的科學面，課程內容包括:地球科學原理、氣象學原理、自然資源管理與維護、環境污染預防、生態學概念與應用、社會與人文環境管理、環境政策與規劃、及永續發展等觀念之建立。

312003 Introduction to Environmental 2 R J.G. Sah S

Science

The purpose of this course is teaching the scientific knowledge of environmental to those undergraduate students of the environmental science and engineering department before they start their special topics of environmental engineering studies. This course will contains: principle of earth science, meteorology, management and reservation of natural resources, pollution prevention, concept and application of ecology, social environmental management, environmental policy and planning, and sustainable environmental development.

312004 工程數學（1） 2 必 謝連德、張國慶 下

1.常微分方程式：可分離方程式、恰當方程式、積分因子。2.線性微分方程式：一階、二階及任意階微分方程式、尤拉-柯西方程式、非齊次方程式。3.系統微分方程式：特徵值、特徵向量。4.微分方程式之級數解：雷德方程式與多項式、白塞爾方程式與函數、史特姆-劉維勒問題、正交性。5.拉卜拉式轉換：拉式轉換與反轉換之性質、疊積。6.線性幾何：向量、矩陣與行列式之基本運算。

312004 Engineering Mathematics（1） 2 R L. T. Hsieh、K. C. Chang S

Ordinary differential equations : separable equations, exact differential equation, integrating factors. 2.Ordinary linear differential equations: first-order, second-order, and higher order equations, Euler-Cauchy equations, homogeneous equations. 3.Systems of differential equations: eigenvalues, eigenvectrors. 4.Power series solutions of differential equations: Legendre’s equations and polynomainal, Bessel equations and function, Strum-Liouville problems, orthogonality. 5.Laplace transform: Laplace transform, inverse transform, properties of Laplace transform, convrlution. 6.Linear algebra: introduction to vectors, matrices and determinants.

312005 工程數學（2） 2必 張國慶 上

本課程主要內容包含下列各章及要節：向量微積分：純量場與向量場、梯度、散度、強度、線積分、雙重積分與三重積分、格林定理；符立葉分析：符立葉級數，積分與換；偏微分方程式：分離變數法、波方程式、熱方程式、拉卜氏方程式之解；複變數分析：複變數、複變可析函數、複變數積、柯西積分公式及餘數定理。

312005 Engineering Mathematics（2） 2 R K. C. Chang F

The main contents of this course include the following chapters and important sections:Vector differential calculus: scalar field and vector fields, gradient, divergence, curl, line integral, double and triple integrals, Green’s theorem; Fourier analysis: Fourier series, integrals and transform; Partial differential equations: separation of variables, wave equation, heat equation, and solutions of Laplace equation, Cauchy’s integral formula, residue theorem.

312006 流體力學 3 必 陳庭堅 上

流體力學係研究流體在靜止和運動時的性質、其研究方法是使用解析和數學理論而非經由經驗而來。流體力學探討流體力學基本原理、將提供許多工程領域中所遇到有關流體性質問題的解答。本課程內容包括向量計算、垂直作標系統、流體性質的說明、流體的分類、靜止與運動流場的壓力變化、流體運動學、傳輸方程式的觀念以及推導、理想流體方程式與應用以及渠流的計算。

312006 Fluid Mechanics 3 S T. C. Chen F

Fluid mechanics is the study of fluids under all conditions of rest and motion. Its approach is analytical and mathematical rather than empirical; it is concerned with basic principles that provide the solution to numerous and diverse problems encountered in many fields of engineering, regardless of the physical properties of the fluid involved. The content of Fluid Mechanics include vector calculation, fluid properties, regimes of flow, pressure variations in fluids at rest and in motion, fluid kinematics, concept and derivation of transport equation, ideal flow equation and application, and open channel flow.

312007 環境土壤學 3 必 許正一 上

本課程旨在介紹土壤基本之物理、化學及生物性質，其教授之內容包括土壤之重要性、土壤之來源、土壤無機礦物、土壤有機質、土壤水份、土壤空氣、土壤粒子表面性質、土壤酸鹼性、及土壤肥力（氮、磷、鉀、鈣、鎂、硫）等，使學生奠定土壤之基本知識，俾能進一步探討土壤污染之相關課題。

312007 Environmental Soil Science 3 R Z. Y. Hseu F

This course in troduces students the physical, chemical, and biological properties of soils. The subjects include the importance of soils, the origin of soils, mineral particles, organic materials, water in soils, air in soils, particle surfaces, soil acidity and alkalinity, soil fertility（N,P,K,Ca,Mg,S） etc. The students may be familiar with basic properties of soils as a tool for further study of soil pollution.

312008 環境土壤學實驗 1 必 許正一、余伍洲 上

本課程在培養學生正確之土壤採樣技術及土樣調製方法，同時，訓練學生分析土壤物理與化學性質之能力，其主要項目包括：容重、土粒密度、質地、酸鹼度、可溶性鹽、有機質、陽離子交換容量、全氮、磷、鉀、鈣、鎂、鈉及重金屬之含量等，以奠定學生研習土壤污染與防治之基礎。

312008 Environmental Soil Science Lab. 1 R C. R. Liao F

The objectives of this course are to train students the techniques of collecting and preparing soil samples, and the ability of examining soil physical and chemical properties. The properties includes bulkdensity, partical density, texture, pH values, soluble salts, organicmatter, cation exchange capacity, total N, P, K, Ca, Mg, Na.and heavy metals. The training will make students available in studying soil pollution and remedia tion.

312009 環境統計學 3 必 李嘉塗 上

本課程之主要目的在於提供學生一個基本的統計概念，以便於學生進行有關環境採樣分析、數據整理與計算、實驗結果比較與推論時，能運用相關統計工具，在敘明之統計條件下做出適當之結論。課程內容安排包括前言、敘述統計、機率、機率分佈、估計、假設檢定、迴歸分析等。

312009 Environmental Statistics 3 R C. R. Liao F

The objectives of this course are to provide the students a basic understanding in applications of statistics in the area of environmental engineering. With these fundamentals, students can have a correct decision making and conclusion in topics such as environmental sampling and analysis, data management, experimental data analysis and results comparison, etc. Topics discussed in this class include descriptive statistics, probability, discrete and continuous probability distributions, estimation, hypothesis testing, regression and correlation methods, etc.

312010 環境有機化學（1） 2 必 林耀堅 上

本課程主要目的為使同學瞭解有機污染物質的分類、官能基、與基本性質，藉由其反應原理及衍生物，探討有機污染物質在自然環境與人為條件中可能進行的降解、轉變、轉移與傳輸過程，以增進同學於調查、分析或處理環境有機污染物質時的認識。其中內容將介紹環境中有機污染物質之（1）分類與相關特性、（2）基本反應原理、以及（3）環境宿命。

312010 Environmental Organic 2 R Y. J. Lin F

Chemistry （1）

The major purpose of this course is to familiar students with the types, functional groups, and basic properties of organic pollutants. Based on the reaction mechanisms and their derivatives, the degradation, transformation, translocation, and transportation processes of organic pollutants in natural environment and particular conditions will be discussed. It is expected that students will recognize the related processes of organic pollutants during future research, analysis and treatment of environmental organic pollutants. The contents include （1） classifications and related characteristics, （2） basic reaction principles, （3） environmental fates of organic pollutants.

312011 環境有機化學實驗（1） 1 必 林耀堅 上

本課程為配合環工系修讀環境有機化學之學生而開設，期促使學生熟悉一般實驗技術，並從實驗中增加對教材之了解，除有機化合物中之物理化學之基本測定外，並依各官能基之不同化合物逐一實驗：烷、烯、炔、苯、有機鹵化物、醇、醚、醛、酸、酸衍生物及胺等，此實驗的重點是在於有機化學（有機物）與環工之關聯性以及其於環境中之產生、傳輸、分佈、降解與宿命。

312011 Environmental Organic 1 R Y. J. Lin F

Chemistry Lab（1）

This course is designed in conjunction with the lectures for the students who take environmental organic chemistry course. It intends to provide students a profound understanding of the subjects from laboratory practices and to familiar with basic laboratory techniques. In addition to the measurements of physical and chemical characteristics of organic compounds, the course is carried out according to the functional groups which are alkanes, alkenes, alkynes, benzenes, organic halides, alcohols, ethers, aldehydes, ketones, carboxylic acids, the derivatives of carboxylic acids, and amines. The experimental designs emphasize on the connection between organic chemistry （organic compounds） and environmental science including their origins, transportation, distribution, degradation and fate.

312012 給水工程 3 必 黃益助 下

本課程乃著重於討論一般給水工程領域所需的知識與技術，主要目的在於介紹公共給水的工程技術，其內容包括：給水工程概論、給水工程計劃、給水水質、水文循環、地下水之給水、地面水之給水、取水工程、導（ 送 ）水工程、抽水機及抽水站、配水工程、管線腐蝕、給水水質測定、給水處理、沉澱池與其附屬設備、混凝、膠凝、過濾、水之消毒、硬水軟化，及特殊處理方法。

312012 Water Supply Engineering 3 R Y. C. Huang S

The purpose of this course lays special on the discussion of both technical and general knowledge required in water supply engineering. The scope has been principally confined to introduce the necessary technique of engineering in public water supplies. The contents of this course include introduction of water supply engineering, proposal of water supply engineering, water quality, hydrologic cycle, groundwater supplies, surface water supplies, intake work, water transmission, pump and pumping station, water distribution, corrosion of pipes, measurement of water quality, water supply and treatment, sedimentation tank and its appurtenances, coagulation, flocculation, filtration, disinfection, water softening, and miscellaneous methods of water treatment.

312013 儀器分析 2 必 葉桂君 下

以在環境科學領域內常用之儀器分析為主要對象，講解各種儀器原理、儀器構造、儀器之使用操作方法及儀器之保養方法。課程內容包括可視光之吸收分析、紫外光之吸收分析、螢光分析、紅外線吸收分析、焰光分析、原子吸光分析、pH值測定及電位分析、氣相色層分析與液相色層分析。

312013 Instrumental Analysis 2 R K. J. Yeh S

The major subject of instrumental analysis is used in the area of environmental science frequently. The lecture includes the theory, structure, practice, operation and maintenance of analytical instrumentation. The contents of course include visible absorption method, ultraviolet absorption method, fluorometry, infrared spectrometry, flame emission spectroscopy, atomic absorption spectroscopy, potentiometric method, pH measurement, gas chromatography, and liquid chromatography.

312014 儀器分析實驗 1 必 葉桂君 下

本課程的目的為驗證在講授中討論之儀器分析原理，提供各類實驗，進而使學生對各種儀器分析方法充分瞭解。課程內容包括：標準序列法、可視光吸收法、紫外光吸收法、螢光光度計法、原子吸光法、焰光光度計法、氣相色層分析法、液相色層分析法及pH計法。

312014 Instrumental Analysis Lab. 1 R K. J. Yeh S

The purpose of this course is to provide experiments that demonstrate the principles discussed in the lecture of instrumental analysis, and it is added to insure that the students gains sufficient understanding of the methods of every kind of instrument. The contents of this course include standard series method, visible Absorption methods, Ultraviolet Absorption methods, Fluorometry, Atomic Absorption Spectrometry, Flame Photometry, Gas Chromatography, Liquid Chromatography and pH meter methods.

312015 環工單元操作 3 必 輪授 上

本課程內容將包含以下環境工程上重要之單元操作程序: 1.活性污泥程序2.沉澱3.厭氣消化反應動力學4.混凝5.活性碳吸附6.空氣除塵（袋式集塵器）7.空氣除酸（填充滌氣塔）8.煙道氣體量測。課程設計為課堂單元操作原理講授每週兩小時與實驗操作每週三小時。

312015 Unit Operations of 3 R Alternative Teaching F

Environmental Engineering

This course covers the important and most often used unit operations or processes in environmental engineering. The following unit operations will be studied: 1.activated sludge process; 2.sedimentation or settling;3.anaerobic digestion chemical reaction kinetics; 4.flocculation and coagulation; 5.activated carbon adsorption; 6.particulate removal （baghouse）; 7.acid gas scrubbing （packed tower scrubber）; flue gas measurement. The course is divided into two parts: a two-hour lecture which introduces the principles of unit operations and a three-hour experiment every week.

312016 噪音與振動 3 必 葉桂君 上

噪音通常係指人們所不想要的聲音，我們關心噪音主要有1.因連續的曝露而造成聽力的損傷；2.說話的干擾或通話的中斷；3.干擾睡眠、休閑及其他活動。本課程內容包括：聲音的物理特性、噪音對人們的影響、職業傷害、噪音的來源、危害現況分析、噪音曝露分析、噪音測定儀器、聲音測定、噪音控制的基本原理、噪音管制策略。

312016 Noise and Vibration 3 R K. J. Yeh F

Noise is generally defined as "unwanted sound". Major concerns are1.hearing damage resulting from exposure to excessive noise; 2.interference of speech or interruption of communication by noise; and 3.noise to interference of sleep, leisure and other activities. The contents of this course include: physical properties of sound, effects of noise on people, occupational damage, sources of noise, analysis of its damage, analysis of noise exposure, noise measuring instruments, sound surveys, elemental theories of noise control, noise control program.

312017 污水工程 3 必 葉桂君 上

本課程包括廢水處理程序的原理與技術，從下水道工程之規劃、設計、施工、維護談起，再介紹各種污水質特性指標和承受水體之自淨能力與污染防治，接下來再介紹各污水處理單元（物理、化學、生物）之原理與應用，最後介紹污泥的處理與處置，以使學生在污水處理工程領域中獲得良好的知識與訓練。

312017 Wastewater Engineering 3 R K. J. Yeh F

This course covers the treatment principles and technology of wastewater engineering. It includes the following sections: （1）planning, design, construction, and maintenance of sanitary engineering; （2）wastewater quality index; （3）pollution prevention; （4）principles and application of various wastewater treatment process including physical, chemical, and biological; （5）disposal and handling of activated sludge. This course intends to offer the proper training and information to the students.

312018 空氣污染學 3 必 李嘉塗 上

空氣污染為一非常複雜的議題，欲充分瞭解且尋求改善之道需要有各種不同知識領域的訓練。因此，本課程僅為一有關空氣污染的入門課程，內容包括空氣污染物的來源（自然與人造）與影響、空氣污染防制法規、空氣污染氣象學、大氣擴散、粒狀污染物防治、氣狀污染物防治、光化學反應及其污染防治、移動性污染的防治、惡臭的控制防止、有害空氣污染物的防治、通風與排氣的設計、以及空氣污染防制的管理與策略。

312018 Air Pollution 3 R J. T. Lee F

This course is intended to be a introductory course to air pollution which is a complex subject and involve a variety of technical disciplines. The course provides the following topics: emission sources of air pollutants （natural and man-made） and their effects，air pollution related statutes, meteorology of air pollution, atmospheric air pollutants dispersion or diffusion, formation of particulate matters and their prevention and control, formation of gaseous pollutants and their prevention and control, photochemical reactions and their pollution control, mobile air pollution prevention and control, air toxics prevention and control, design of ventilation system, and management and strategy of air pollution control.

312019 環境化學 3 必 余伍洲 上

本課程旨在介紹在環境介質中與污染有關化學物質、基本反應原理以及簡易分析方法。其授課內容包括自然水之性質與組成、水中氧化還原平衡、水中錯合作用、水中微生物之催化作用、液–固–氣之相互作用、水污染與處理、簡易環境化學分析、地層與土壤環境化學、大氣性質與組成、氣態無機污染物及氧化物、顆粒物質、光化學煙霧、大氣監測、有機污染物、自然資源與能量、環境生化學與毒物化學、以及有害廢棄物之性質、來源與其環境化學。

312019 Environmental Chemistry 3 R W. C. Yu F

This course is designed to introduce the properties, basic reaction principles and fundamental approach of analysis of the pollution-related chemical substance occured in he environmental medium. The content includes: The propertes and composition of natural waters, redox equilibria in natural waters, complexation in natural waters, the catalysis of aquatic chemical reactions, liquid-sold-gas interactions in aquatic chemistry, water pollution & reatment, environmental chemical analysis, environmental chemistry of the geosphere and soil, the nature and composition of the atomosphere, gaseous inorganic pollutants. Oxide and particulate matter in the atmosphere, photochemical smog, organic pollutants in the atmosphere, atmosphere monitoring, natural resources and energy, environmental biochemistry and chemical toxicology, and the naturesource and chemistry of hazardous wastes.

312020 環境化學實驗 1 必 余伍洲 上

本課程旨在使學生熟悉環境介質中一般化學物質分析的知識與技術。內容包括：分溶與萃取，共同離子效應，濁度、色度與硬度，導電度、pH、酸度與鹼度，總固體與懸浮固體，總有機碳，溶氧，化學需氧量，生物需氧量，氯度與鹽度，重金屬離子，陽離子交換容量，二氧化硫與農藥等之檢測與分析。

312020 Environmental Chemistry Lab. 1 R W. C. Yu F

This course if designed to let students familiar with the analytical knowledge and technigues of Chemical substance in the environmental media. It’s content includes measurement test and analysis of the following items partition and extraction, commonion effect, turbidity color and hardness, p H acidity and alkalimity, total organic carbon, total solid and suspension solid, chlorinity and salinity, heavy metal ions, cation exchange capauty, sulfur dioide, as wellas pesticide.

312021 文獻選讀與寫作 1 必 黃國林 下

對工學院學生而言，具有科技論文（中英文）研讀與寫作的能力以及充分瞭解研究方法與結果分析探討為完成學業、未來工作、與繼續從事研究的基本要件。本課程將先講授論文寫作與研究方法的論理學、必要守則、及重要關鍵，再透過研讀環境保護中各種不同知識領域（空氣污染、廢水、廢棄物、毒物、及土壤污染等）的期刊論文來精鍊技術論文的寫作技巧與熟練研究方法。

312021 Literature Reading and Writing 1 R K. L. Huang S

The capability of technical reading and writing and the understanding of research methodology are essential to an engineering student and will definitely affect his future career. This course will teach students the logic, sufficient and necessary conditions, and key points of technical reading and writing and research methodology first. And then via reviews of a variety of different excellent environmental-protection related papers （air pollution, wastewater, waste treatment and management, toxicants, soil pollution, and etc.） from technical and scientific journals to further master the ability of technical reading and writing and familiarize the methodology underlying research and development.

312022 廢棄物處理與設計 3 必 黃武章 下

本課程著重於固體廢棄物處理所應用之技術，它包含：1.簡介與定義2.垃圾之來源、組成、物化性質與採樣分析3.垃圾之貯存、收集、清運4.垃圾之前處理與資源回收5.燃燒原理與垃圾焚化6.垃圾衛生掩埋7.垃圾堆肥處理8.垃圾焦解、固化及其它處理 9.結論。

312022 Waster Treatment and Design 3 R W. J. Huang S

This course focuses on the technology for managing urban solid waste. It encompasses the entire spectrum: 1.Introdution 2.Soure, composition, physical-chemical property of solid waste 3.Storage, collection and transport 4. Processing and resource recovery 5.Combustiou principles and mass burn design 6.Sanitary landfill 7.Composting 8.Pyrolysis, solidification and other treatment technology 9.Conclusion.

312023 環境規劃與管理 3 必 陳冠中 下

本課程之目的在於教導大學生如何管理因人為或天然環境變化產生之影響。主要內容包括：（1）環境政策；（2）環境法規介紹；（3）規劃原理及方法；（4）環境質量管理；（5）環境經濟學；（6）殘餘物管理；（7）環境影響評估；（8）土地利用與國土規劃；（9）區域環境管理；（10）都市環境管理；（11）環境風險管理；（12）公共參與決策；及（13）永續發展之環境管理。

312023 Environmental Planning and 3 R K. C. Chen S

Management

The purposes of this course are to introduce undergraduate student how to manage the impact from man-made or nature environmental changes. It contains following subjects:

（1）Environmental policy;（2）Environmental Acts; （3）Principle and method of planning;

（4）Environmental mass management;（5）Environmental economy;（6）Residual management;

（7）Environmental impact assessment;（8）Land use planning and management;（9）Regional management;（10）Urban management;（11）Environmental risk management; （12）Public participation;（13）Sustainable development.

312024 生物化學 3 必 薩支高 下

本課程介紹碳水化合物、蛋白質、脂肪、核酸之結構，生物能量之代謝及生化反應之催化及控制，以為環工系學生修習生物復育及代謝相關課程的基礎。

312024 Biochemistry 3 R J. G. Sah S

The objective of this course is introducing the basic knowledge on bioremediation to the students who are major in environmental science and engineering. The contents include: （1）, the structure of carbohydrates, proteins, lipids and nucleic acids, （2）, the metabolism of energy, and （3）, the control and catalysis of biochemical reaction.

312025 校外實習 9 必 許正一 下

本課程旨在提升學生實做能力，使大學部學生在畢業時能根據所學知理論基礎而立即進入職場崗位，為企業所用。學生可依自己興趣選擇與本系相關之產業，如環境檢測公司、工程顧問公司、污水處理廠、資源回收公司與環境影響評估公司等，進行4.5個月的職場實習，並在實習結束後提出心得報告，以取得學分。

312025 Off-compus practice 9 R Z. Y. Hseu S

The purposes of this course are to increase the ability of operation skill in technology and to be immediatelly employed after graduation for bachelors in accordance with the study fundamentals in the compus. The learners may enter any industry depending on their interests for a 4.5 month practice. However, the industry should be related to the teaching contents of the department, which includes environmental analysis company, engineering cousultant institute, wastewater treatment plant, resource recycle company, environmental impact aessessment agency, etc. The study scores will be obtained after finishing the report in the end of practice.

二、選修科目Elective Courses

312026 程式語言與實習 2 選 李嘉塗 上

本課程之主要目的在於提供學生 學習最重要的程式設計概念.內容包括資料型態與運算式、條件判斷與迴圈、陣列應用技巧、副程式與函式、基本控制項編輯技巧。

312026 Computer Programming 2 S J. T. Lee F

Language and Practice

The objectives of this course are to provide the students an important program design idea. The detail include data type and operation、condition and loop、subroutine and function、basic command and editor technique.

312027 微積分（2） 3 選 下

本課程希望在一學期中，能使學生對積分有充分的瞭解、培養邏輯推理、啟發思考創造、強化計算演繹並注重應用與作圖，以建立同學未來學習工程數學及相關專業課程之數學基礎，充分達到學以致用的目的。課程內容包括：1.不定積分與定積分，2.積分法則，3.瑕積分，4.定積分的應用，5.級數，6.偏導數，7.空間幾何與向量微積分。

312027 Calculus （2） 3 S S

This course aims at developing comprehension of integral, activating capabilities of logic inference and induction, enlightening confidence and independence, strengthening calculating abilities with an emphasis on its application and diagram, furnishing a sound basis for future specialty. The content includes: 1.Indefinite and Definite Integral, 2.Techniques of Integration, 3.Improper Integral, 4.Application of Integration, 5.Infinitr Series, 6.Partial Derivative, 7.Basic Vector Analysis.

312028 普通化學（2） 3 必 邱春惠、謝季吟 下

本課程的目的在使學生對量子理論有相當的認識並對化學鍵結有較深入的了解，加強水溶液的反應性質及化學平衡觀念，並熟悉相關的理論與計量方法，以奠定修習及研究相關科目的穩固基礎，其內容如下：1.量子理論、2.元素的週期表關係、3.化學鍵結（基本概念及分子的立體結構）、4.液體及固體的分子間作用力、5.溶液的物理特性、6.化學平衡、7.酸和鹼、6.酸鹼平衡。

312028 General Chemistry（2） 3 R C. H. Chiou、C. Y. Hsieh S

This course focuses on quantum theory, chemical bonding, the chemical reaction of aqueous and chemical equilibrium principles, and mathematical methods of chemistry. The outlines are offered as below: 1.Quantum theory, 2.Periodic relationships among the elements 3.Chemical bonding（basic concepts and molecular geometry）, 4.Intermolecular forces and liquids and solids, 5.Physical properties of solutions, 6.Chemical equilibrium, 7.Acids and bases, 8.Acid-base equilibrium.

312029 普通化學實驗（2） 1 必 邱春惠、謝季吟 下

本課程主要瞭解內容包括各項實驗操作技術介紹以及針對實驗原理及反應機制進行探討.授課者會提出問題來測試學生相關知識及應用程度. 學生在課程結束會具有操作儀器、學習觀察及正確整合實驗結果之能力。

312029 General Chemistry Lab.（2） 1 R C. H. Chiou、C. Y. Hsieh S

**This course emphasis on laboratory techniques essential for the related topics. The laboratory provides not only the principle but also the reaction mechanisms involved in the experiments.The questions at the end of the experiment will be selected by the instructor to test the student’s knowledge of the experimental theory and the applications. With the training, the students can develop the ability to handle the equipment, make observations and correctly interpret the results.**

312030 環境微生物學實驗 1 選 邱瑞宇 下

本實驗課程在使學生熟練微生物學的基礎技術，認識環境微生物的特性與環境因子對微生物得影響及微生物在環境污染控制上的角色。實驗內容包括1.顯微鏡鏡檢2.微生物分離與培養3.微生物染色4.格蘭式染色5.微生物生長測定6.溫度對微生物的影響7.水中藻類8.污泥中微生物9.水質指標微生物定性分析10. 水質指標微生物定量分析11.影響優氧化的環境因子12.纖維分解菌分離。

312030 Environmental Microbiology Lab. 1 S R. Y. Chiou S

The object of this exercise is to acquaint the student with the basic techniques of microorganisms, and recognize the fundamental characteristics of environmental microorganisms and the effects of environmental factors on microbes, and the demonstrate the role of microorganisms in environmental pollution control. This exercise includes: 1. Microscopic examination 2. Isolation and culture of microbes 3. Simple stain 4.Gram’s stain 5.Growth measurement of microbes 6.Temperature on microbial growth 7.Algae 8.Microbes in sludge 9.Qualty analysis of water indicated microorganism 10.Quantity analysis of water indicated microorganisms 11.Environmentl factors on eutriphication 11.Isolation of cellulomonas.

312031 生態學（農學院開授） 2 選 下

本課程講授生態學的基本概念，內容包含緒論、生態系統、生物與環境、族群生態、群落生態以及應用生態等項目。

312031 Ecology 2 S S

The purpose of this course is to study the basic concepts of ecology. Course contents include topics of ecosystems, organisms and environments, population ecology, community ecology, as well as applied ecology.

312032 水質分析與實驗 2 選 郭文健 上

本實驗之目的為 （1）使同學熟練各種水質的分析技術，以及分析結果的解釋，（2）學習水樣採集的品保與品管。實驗的項目包括：嗅度、溫度、濁度、導電度、硬度、酸鹼度、生化需氧量、化學需氧量、總有機碳、溶氧、銨態氮、全氮、磷酸鹽、硫酸鹽、氯化物、重金屬、農藥、懸浮固體、溶解固體。

312032 Water Quality Analysis and 2 S W. C. Kuo F

Lab.

The objectives of this course are （1） to acquaint the student with the analytical techniques of water quality and the interpretation of result, （2） to learn the quality control and quality assurance of environmental water sampling. The subjects of this course include the followings; smell, temperature, turbidity, conductivity, hardness, pH, acidity, alkalinity, BOD, TOC, COD, DO, NH4-N, total nitrogen, phosphate, sulfate, chloride, heavy metals, pesticides, suspended solid, and dissolved solid.

312033 環境污染調查與監測 3 選 謝季吟 上

本課程之主要目的在於教導學生認識環境污染，包括空氣污染、水質污染、固態廢棄物污染、土壤污染、噪音污染....等，之調查與監測方法，其主要內容包括：各種環境污染之特色，污染物之性質與測定原理，污染物之檢測指標與方法，環境中污染物之標準量與調查方法，環境污染之監測原理與方法，藉此學習，使學生具備監控與判斷環境污染之基本知識與能力。

312033 Environmental Pollution 3 S C. R. Liao/C.Y.Hsieh F

Investigation and Supervision

The objective of this course is to make students understand the survey and monitor methods of environmental pollution, including air pollution, water pollution, soil-waste pollution, soil pollution, and noise pollution, etc. The course mainly introduce students the characteristics of various environmental pollution, the properties and measuring principles of pollutants, the indexes and methods of measurement, the standard data and survey methods of pollutants, and the principles and methods of monitering pollutants. Through the learning, students may have the ability to monitor and evaluate environmental pollution.

312034 資源回收 2 選 黃國林 上

資源回收除能紓解日益嚴重的廢棄物污染問題外還可以回收物質與能源。其最終目的在減少廢棄物的生產與排放，並透過資源回收的再利用以維持地球的永續經營。課程內容包括1.資源回收的背景與意義2.廢棄物的種類與特性3.廢棄物的減量與再利用4.廢棄物的厭氣性處理5.廢棄物的好氣性處理6.廢水之處理與再生利用7.廢紙回收與再利用8.生物科技在資源回收上的應用。

312034 Resource Recovery 2 S K. L. Huang F

Resource recovery can do not only for alleviating the wastes pollution but also for producing energy and materials. The main purpose are to reduce the production and release of wastes, also maintain a sustainable management of the earth. Courses contain 1.Background and means of resource recovery.2.The varieties and characteristics of wastes. 3.Reduction and reuse of Wastes. 4.Anaerobic treatment of wastes. 5.Aerobic treatment of wastes. 6.Treatment and reuse of wastewater. 7.Recovery of waste paper and it’s reuse. 8.Application of biotechnology on resources recovery.

312035 工程經濟（土木系開授） 3 選 林金炳 上

本課程介紹基本經濟分析原理及方法以應用於工程計劃方案之評估。授課內容共分為五階段。第一階段介紹基本計算方法，第二階段介紹三種廣泛適用之評估方法，第三階段討論此三種評估方法之應用，第四階段介通貨膨脹理論、公司稅法及其經櫅分析之應用，第五階段討論一些高等經濟分析方法及其應用。

312035 Engineering Economics 3 S J. B. Lin F

This course presents the basic principles of economic analysis for the application in the decision-making process among various engineering alternatives. The principles covered in this course are divided into five levels. Level one introduces the computational skills for economic analysis. Level two covers three most widely used evaluation techniques for comparison analysis. Level three discusses the applications of these techniques in Engineering Economy. Level four discusses depreciation and corporation taxation and their applications in economic analysis. Finally, level five covers the supplementary and advanced analysis procedures for advanced analysis.

312036 分析化學 3 選 黃國林 下

分析化學主要含蓋定性與定量的分析方法以及離析的分析方法，本課程的主要目的為使學生瞭解組成樣品物質中各成份相對含量的離析、驗證與確認等工作。所討論的主題包括（1）分析化學的化學原理（2）實驗數據準確度與精密度的評定（3）介紹當前分析化學的各種技術。

312036 Analytical Chemistry 3 S K. L. Huang S

The course of analytical chemistry is principally covered with qualitative and quantitative methods of analysis and methods of analytical separation. The major objective of this course is to familiar the student with separating, identifying, and determining the relative amounts of the components making up a sample of matter. The discussion topics will include the followings; （1） the chemical principle to analytical chemistry, （2） judging the accuracy and precision of experimental data, （3） introducing to a wide range of techniques of modern analytical chemistry.

312037 分析化學實驗 1 選 黃武章 下

本分析化學實驗課程為學生設計各種化學分析的操作，並提供各種化學分析實驗操作的詳細過程，使學生得以充分練習其中操作要領。實驗操作的項目包括重量分析、中和滴定、沉澱滴定、利用EDTA進行錯合物滴定、過錳酸鉀滴定、碘滴定、硫代硫酸鈉滴定、溴酸鉀滴定、電位分析法、電重量法、放射吸附法、原子光譜儀、以及利用離子交換分離陽離子。

312037 Analytical Chemistry Lab. 1 S W. J. Huang S

The course of analytical chemistry laboratory is designed for the student to practice a variety of chemical analyses. The objective of this course is to provide the students the opportunity to learn the operating practices with the detailed directions for the various chemical analytical experiments. The laboratory session include gravimetric methods of analysis, neutralization titrations, precipitation titrations, complex-formation titrations with EDTA, titrations with potassium permanganate, titrations with iodine, titrations with sodium thiosulfate, titrations with potassium bromate, potentiometric methods, electrogravimetric methods, methods based on the absorption of radiation, atomic spectroscopy, and the separation of cations by ion exchange.

312038 國際標準認證 2 選 陳冠中 下

本課程之目的在於教導大學生環境管理的趨勢及環境管理國際標準（ISO14000系列）。課程主要內容包括：（1）環境管理的國際趨勢；（2）國內環境管理現況；（3）ISO14000環境管理系統；（4）ISO14004環境管理系統指導綱要；（5）ISO14010環境稽核指導綱要；（6）ISO14011環境稽核指導綱要-稽核程序；（7）ISO14012環境稽核指導綱要-稽核員資格；（8）ISO14020環保標章；（9）ISO14040生命週期評估；（10）Guide64產品標準含環靜考量面之指引。

312038 Introduction to International 2 S K. C. Chen S

Standards Organization

The purposes of this course are to introduce undergraduate student the trend of environmental management and the contents of the standardized international environmental management （ISO14000 series）. It contains the following subjects:（1）The international trend of environmental management;（2）Domestic condition of the environmental management;（3）ISO14001, nvironmental management system; （4）ISO14004, Environmental management systems-general guidelines on principles, systems and supporting techniques;（5）ISO14010, Guideline on environmental auditing-general principles;（6）ISO14011, Guideline on environmental auditing-audit procedures;（7）ISO14012, Guideline on environmental auditing-qualification criteria for environmental auditors;（8）ISO14020, Environmental labeling;（9）ISO14040, Life cycle assessment; （10）Guide 64, Environmental aspects in product standards.

312039 給水工程設計 3 選 郭文健 上

本課程乃著重於討論一般給水工程領域所需的知識與技術，主要目的在於介紹公共給水的工程技術，其內容包括：給水工程概論、給水工程計劃、給水水質、水文循環、地下水之給水、地面水之給水、取水工程、導（ 送 ）水工程、抽水機及抽水站、配水工程、管線腐蝕、給水水質測定、給水處理、沉澱池與其附屬設備、混凝、膠凝、過濾、水之消毒、硬水軟化，及特殊處理方法。

312039 Water Supply Engineering 3 S W. C. Kuo F

Design

The purpose of this course lays special on the discussion of both technical and general knowledge required in water supply engineering. The scope has been principally confined to introduce the necessary technique of engineering in public water supplies. The contents of this course include introduction of water supply engineering, proposal of water supply engineering, water quality, hydrologic cycle, groundwater supplies, surface water supplies, intake work, water transmission, pump and pumping station, water distribution, corrosion of pipes, measurement of water quality, water supply and treatment, sedimentation tank and its appurtenances, coagulation, flocculation, filtration, disinfection, water softening, and miscellaneous methods of water treatment.

312040 環境有機化學（2） 2 選 林耀堅 上

環境有機化學主要目的為使同學瞭解有機污染物質的分類、官能基、與基本性質，藉由其反應原理及衍生物，探討有機污染物質在自然環境與人為條件中可能進行的降解、轉變、轉移與傳輸過程，以增進同學於調查、分析或處理環境有機污染物質時的認識。本課程將著重於介紹環境中有機污染物質之（1）分類與相關特性、（2）基本反應原理、（3）環境宿命。其中（1）分類與相關特性: 包括有機物質的分類、物理化學性質、蒸氣壓、水中溶解度與活性係數、分配係數（空氣與水之間、有機溶劑與水之間）、生物累積、擴散、吸附與脫附作用。（2）基本反應原理:水解作用（水解動力、水解反應機制、親核取代、催化作用）、還原作用（還原性轉換反應、還原動力）、環境氧化作用（氧分子、過氧化氫、表面氧化反應、熱氧化）、與清潔劑之作用、光化學反應（直接光解、間接光解）、生物性轉換反應。（3）環境宿命:碳循環、有機物質轉移、液氣固相對有機物質之影響。

312040 Environmental Organic 2 S Y. J. Lin F

Chemistry （2）

The major purpose of Environmental Organic Chemistry is to familiar students with the types, functional groups, and basic properties of organic pollutants. Based on the reaction mechanisms and their derivatives, the degradation, transformation, translocation, and transportation processes of organic pollutants in natural environment and particular conditions will be discussed. It is expected that students will recognize the related processes of organic pollutants during future research, analysis and treatment of environmental organic pollutants. The contents of this course will focus on （1） classifications and related characteristics, （2） basic reaction principles, （3） environmental fates of organic pollutants. （1） Classifications and related characteristics: include organics classification, physical and chemical properties, vapor pressure, water solubility and activity coefficient, air-water partitioning, organic solvent-water partitioning, bioconcentration, diffusion, sorption and desorption, （2） Basic reaction principles: hydrolysis （hydrolysis kinetics, hydrolysis reaction mechanisms, nucleophilic substitution reactions, catalysis）, reduction （reductive transformation pathways, reductive kinetics）, environmental oxidation （molecular oxygen, hydrogen peroxide, surface reaction, thermal oxidations）, reactions with disinfectants, photochemical reactions （direct and indirect photodegradation）, biotransformation, （3） Environmental fates of organic pollutants: the carbon cycle, organic translocation, organic transformation, effects of L-G-S phases on organics.

312041 環境衛生學 2 選 邱春惠 上

本課程乃授與學生環境衛生與安全之基本概念與知識，授課內容包括環境與健康、病媒控制、空氣資源管理、水及土壤污染、食品衛生、給水與廢水、固態廢棄物、放射性物質、學校環境衛生、社區噪音、環境管理、工業安全、工業公害及意外災害控制與預防等。

312041 Environmental Sanitation 2 S C. H. Chiou F

This course is designed to present basic concept and knowledge to the environmental sanitation and safety. Topics covered will emphasize on environment and health, disease vectors, air resources management, food sanitation, water supply and wastewater, solid waste, radioactive material, institute sanitation, community noise, environmental management, industrial hygiene, accident control and prevention.

312042 厭氧生物技術 3 選 郭文健 上

本課程的目的在於提供學生一些厭氧生物技術之基本概念，包括從微生物、生化、分子生物、生物定量化學、反應動力學，以及實際厭氧生物技術之工程應用進行探討，使學生具備相關厭氧處理之工程規劃與設計能力，同時解決污染與能源問題。

312042 Anaerobic biotechnology 3 S Wen-Chien Kuo F

This course aims at providing the students a fundamental understanding of the anaerobic biotechnology, from the aspects of microbiology, biochemistry, molecular biology, biological stoichiometry and kinetics, and real world anaerobic biotechnology applications.  It is hoped that, after this course students will have the capability in dealing with planning and design of anaerobic technology, and solving the pollution and energy problems at the same time.

312043 水文學（土木系開授） 3 選 鄒禕 上

本課程主要授課內容包括：1.氣象因子概述2.降水成因及降兩量資料分析3.蒸發散量之估計4.入滲因子、入滲分析5.河川水流6.逕流歷線、單位歷線洪水演算8.暴雨、洪水頻率分析。

312043 Hydrology 3 S I.Tsou F

This course contents the following subjects:1.Climatological factor introduction. 2.Types of precipitation and analysis Rain. 3.Estimating evaporation. 4.Infiltration and methods of determining infiltration. 5.Stream flow. 6.Runoff and unit hydrographic. 7.Flood routing. 8.Flood frequency probability and stochastic methods.

312044 作業環境測定 3 選 趙浩然 上

作業環境測定是職業安全衛生的課程之一，其主要的焦點集中在瞭解環境毒物在工作場所衍生出的衛生問題，以及對工人的健康所形成不良健康效應。基於這個目的，作業環境測定建立許多採樣的方法學以及採用直讀式的量測與分析儀器來評估職業暴露的化學與物理性的危害。

312044 Work Environment Measurement 3 S H. R. Chao F

Work Environment Measurement is one of Occupational Safety Health lessons to be focused on the process or procedures of determining the hygiene of environmental hazards in the working place and their adverse effects on works’ health. For these purposes, Work Environment Measurement is conducted through several sampling methodologies and/or direct measurement utilizing direct reading and analytical instruments to evaluate the chemical and physical hazards for the occupational exposure.

312045 土壤污染與防治 2 選 余伍洲 下

本課程在使學生瞭解本省土壤受污染之情形及各種可能之污染物與污染源，各種污染物之特質及其在土壤中之累積、分解與移動情形，土壤遭受污染後對其物理、化學及生物性質之影響及污染土壤在利用上所產生之問題。此外，並介紹學生各種污染土壤之改善方法，使學生得以瞭解土壤污染所衍生之問題及可行之對策。

312045 Soil Pollution and Reclamation 2 S W. C. Yu S

This course will give students the knowledge of soil pollution, including the properties of different pollutants, the sources of each pollutant, the accumulation, the decomposition, and the movement of pollutants in soils, the changes of soil properties caused by pollution, and the problems caused by utilization of polluted soils. In addition, the reclamation methods of polluted soil will also be introduced.

312046 土壤污染與防治實驗 1 選 余伍洲 下

本課程旨在訓練學生分析土壤中各種不同污染物含量之技術，瞭解土壤對不同污染物之吸附與脫附現象、污染物在土壤中之移動情形、以及受污染土壤之處理方法。使學生有能力檢定土壤受污染之程度，並針對不同污染物與污染量進行適當之處理，以達到改善污染土壤之目的。

312046 Soil Pollution and Reclamation 1 S W. C. Yu S

Lab.

The students will learn from this course the techniques of determining the kinds and the amounts of soil pollutants, the adsorption, the desorption, and the movement of pollutants in soils, and the reclamation methods of polluted soils. Through the learning, they may have the ability to judge the extent of soil pollution and to develop the appropriate methods of reclamation.

312047 污水工程設計 3 選 葉桂君 下

處理廠單元設計；包括：水利分析、欄污柵、質量平衡、曝氣池、終沉池之設計。

312047 Wastewater Engineering Design 3 S K. J. Yeh S

Introduction and design of wastewater treatment plants including bar sueening, primary settling tank mass balance, aeration tank, Secondary settling tank and hydraulic analysis for treatment units.

312048 工業與環境毒物 3 選 邱春惠 下

本課程主要闡述與環境直接有關的毒物。首先就毒物的定義、分類及其毒性影響因子作說明並介紹 一般中毒之急救措施及解毒原理，以作為自我保護及緊急應變之需要；再就空氣、水及土壤環境中，易發生的各種毒物特性作介紹，其中包括毒物的來源、理化性質、毒性大小、毒性作用、重要事例的介紹及適當的解毒方式；並特別對毒性化學物質、食品污染與殘留及工業毒物作介紹，增加此類毒物的認識，以避免急性中毒的發生並降低慢性中毒的暴露。

312048 Industrial and Environmental 3 S C. H. Chiu S

Toxicology

The purpose of this course is to describe the toxicity in connection with the environment. First of all, it introduces the definition and classification of toxicants, the factor of toxicity, the procedures of first aids, and principles of antidote. These are the bases of self-protection and emergence solutions. Secondly, the course also introduces the characteristics of toxicants available everywhere in the air, water, and soil. The contents are resources of toxicants, characteristics of both physical and chemical, toxicity, important poison events and proper application of antidotes. In addition, it also in introduces the important toxicants, pollution of food, and industrial poisons. So the students would further learn about these toxicants to prevent both acute and chronic exposure.

312049 電子計算機在環工上之應用 3 選 李嘉塗 下

本課程乃針對環境工程有關連的各種問題為對象熟練各種數值計算之程式設計，以便擺脫單調數學的數學計算領域直接解析環境工程上的問題。內容包括電腦數學、線性系統、非線性代數方程式、參數的推斷、常微分方程式、偏微分方程式。

312049 Application of Computer in 3 S J. T. Lee S

Environmental Engineering

The objects of this course point at involving each questions of environmental engineering, practicing each kind of programs designing about numerical mathematics, solving the problem of environmental engineering. It includes computer mathematics, linear system, nonlinear equations, parameter concluding, ordirary differential equations, and partial differential equations.

312050 環境系統分析 3選 余伍洲 下

1.數學複習與預備-微積分、泰勒級數、線數及非線性代數方程式。 2.系統分析基本原理-動態系統、相關圖、其他系統分析 3.模式理論與方法-生物現象、化學現象、土壤環境現象、作物生長模式。 4.電腦模擬-歐拉方向場及歐拉法、郎吉–庫達法、微分方程式組、電腦程式。 5.系統分析問題-數學及電腦誤差、測試校正及驗證系統分析的發展。

312050 Environmental System Analysis 3 S W. C. Yu S

1.Mathematical Review and Preparation-Calculus, Taylor Series. Linear and nonlinear Algebraic Equations. 2.Elements of a System Analysis-Dynamics of a System, Relational Diagram. Distributed System Models. 3.Modeling Theory and Technique-Biological Phenomena, Chemical Phenomena, Soil Environmental Phenomena, Crop models. 4.Computer Simulation methods-Euler Field and Eular Method Runge-Kutta method, System of Ordinary Differential Equations, Computer programing. 5.Problems on System Analysis-Mathematics and Computer Errors. Verification, Calibration, and Validation Phylosophy and Logic of System Analysis.

312051 綠色能源 3 選 黃國林 下

從產業生產活動至個人每日生活，不可避免皆需使用而消耗能源與資源，然而目前能源主要依賴化石燃料，其燃燒不僅造成空氣污染，亦帶來溫室效應，因此，環境問題與能源之使用息息相關，本課程以此為主軸，介紹以下單元：

綜論、能源耗竭與環保、化石燃料、綠色再生能源、熱引擎介紹、太陽光電系統、風能發電系統、生質能發電系統、其他再生能源、核能、節能設施與策略、能源與運輸、能源與空氣污染、溫室效應與氣候變遷。

312051 Green Powers 3 S K. L. Huang S

Fossil fuels are the major world energy sources that drive our daily activities; however, the combustion of fossil fuels emits considerable amounts of air pollutants and CO2, a critical greenhouse gas associated with global warming. Therefore, the use of fuels is highly related to the environmental problems. Accordingly, this course focuses on the energy and the environment: an introduction to green power sources including the units of overview, the environment and depletion of fuel resources, fossil fuels, green/renewable energies, photovoltaic power systems, wind power systems, biomass power systems, other green power systems, nuclear energy, energy conservation, energy and transportation, energy and air pollution, and global effects.

312052 焚化系統設計 3 選 林傑 上

此課程涵蓋焚化相關法規介紹、特性分析、焚化基本概念、熱化學質能平衡、焚化計算、焚化爐體技術、空氣污染防治設備設計、焚化程序設計、焚化績效及危險評估、焚化系統操作管理以及實例介紹與說明。除一般焚化系統（都市垃圾混燒式、旋轉窯、流體化床、液態廢棄物焚化、固定床式等）外，亦包含觸媒焚化、富氧焚化、其他熱裂解方法（電漿、紅外線、熔鹽式等）。

312052 Incineration System Design 3 S C. Lin F

The course covers incineration-relate regulations, characterization of waste, basic concepts and incineration principles, thermochemistry, material and energy balance, incineration calculation, incinerator technology, air pollution control devices design, incineration process design, performance evaluation, risk analysis, operation and maintenance, management, and case studies. In addition to the traditional incineration systems（mass burn facilities of municipal solid waste, rotary kiln incinerator, fluidized-bed combustor, liquid waste incinerator, and fix-bed incinerator） it also includes catalytic incineration, oxygen-enriched incineration, and other emerging advanced thermal treatments（Plasma, IR, molten salt, and etc..）

312053 減廢理論與實務 3 選 林傑 上

減廢為廢棄物處理、貯存與處置之前的環境技術，故又名污染預防、清淨技術與低廢或無廢技術。其可分為產源減少與回收再利用。產源減少又分產源控制與產品改變，產品改變有產品替代、產品保存與產品組成變更；產源控制則可分為進料變更、技術變更與更佳操作。回收再利用（現場與場區外）則可分為使用在利用與再製，使用再利用包含回到原製程或替代其他製程；再製則含資源回收與副產品製造。

312053 Waste Minimization Theory 3 S C. Lin F

and Practice

Waste minimization means the reduction, to the extent feasible （technology and economic feasible）, of hazardous waste that is generated prior to treatment, storage, or disposal of the waste. Somewhat synonymous terms for waste minimization are waste reduction, clean technologies, pollution prevention, environmental technologies, low and non-waste technologies. Waste minimization techniques focus on source reduction or recycling activities that reduce either the volume or the toxicity of hazardous waste generated. Source reduction consists of product changes and source control. Source control includes input material changes, technology changes, and good operating practices. Recycling （on site and off site） covers use and reuse and reclamation. Waste minimization procedure consists of five phases：planning and organization assessment preparation step, assessment step, feasibility analysis step, and implementation.

312054 工業安全與衛生 3 選 張國慶 上

本課程針對學生未來工作中可能面臨的安全與衛生問題，提供所需要的相關基本原理，尤其在安全管理與安全工程方面特別強調。課程分為四部份：第一部份係安全管理，範圍包含概論、法規、教育訓練、災害預防、損失控制、自動檢查等；第二部份係工業衛生，範圍包含工業衛生概論、毒性物質的危害、作業環境測定、及健康檢查等；第三部份係安全控制，範圍包含危害控制、安全評估、緊急應變與事故處理、機械、電機、壓力、及溫度危害、火災與爆炸防止、以及個人防護具等；第四部份係心理與行為，範圍包含工作倫理與態度、職災傾向、人因工程、零災害理念、預知危險活動、及員工協助方案等。

312054 Industrial Safety and Hygiene 3 S K. C. Chang F

This course is intended to serve the basic needs of students whose future professional work requires a sound knowledge of the fundamental principles of safety, particularly those relative to management and engineering. The course is divided into four parts: Part I: Safety management, including basic principles of accident prevention, management leadership, hazard recognition, safety program management, accident investigation, and occupational safety and health statutes； Part II: Industrial hygiene, including fundamentals of industrial hygiene, industrial toxicology, and medical and health surveillance system； Part III: Hazard and stresses control, including industrial noise, fundamentals of machine and power tool guarding, personal protective equipment, fire and explosion protection and prevention, radiation safety, heat and temperature safety, and pressure safety；Part IV: Psychological and behavioral aspects of safety performance, including attitudes, work ethic, human behavior, acceptance of risk, accident proneness, history and development of the safety movement.

312055 空氣污染控制與設計 3 選 李嘉塗 上

本課程乃針對環境工程有關連的各種問題，進一步處理和設計，內容包括:空氣污染設備設計、經濟效益評估、氣狀物控制、粒狀物控制。

312055 Air Pollution Control and 3 S J. T. Lee F

Design

The governments of many industrialized countries recognize the urgency of this predicamnet and have developed legislation aimed at reducing emissions of air pollutants while maintaining a healthy economy. Such a task us by no means trivial. It requires a professional trained in such disciplines as: material and energy balances: thermodynamics; fluid dynamics; heat-and mass-transfer reaction kinetics; process design and economics; and applied mathemtics. The hemical engineer, with a formal training in all these disciplines, has a distinct advantage.

The objective in writing this course is to provide a means for senior chemical engineering students and practicing engineers to exploit fully their potential for the solution of air pollution control engineering problems.

312056 環保法規 2 選 黃武章 上

本課程著重於討論目前最新之環保法規，包括環境基本法、空氣污染防制法、水污染防治法、噪音管制法、廢棄物清理法、飲用水管理法、毒性化學物質管理法等法規立法過程與精神。務期使學生瞭解各項法令，並配合電子化申報模擬系統學習實場之申報業務。

312056 Laws of Environmental Protection 2 S W. J. Huang F

This course emphasizes the discussion of the latest environmental regulations, including fundamental law of environments, protections, laws for air pollution control, water pollution control, noise pollution control, waste management, drinking water management, poison chemicals management, and emphasized points for regulation process and aspirates. After taking this course, students will be more confidants in understanding all the environmental control laws, and practice the application procedures on a website simulation system.

312057 職業病概論 3 選 趙浩然 上

國內工安事件頻傳，工作場所的安全與衛生日受重視，許多受薪者常暴露於職業病的風險而不自知，職業病的產生乃是由工作所引起的，而且是在工作中所發生的疾病，其發生係暴露於某特定危害因子之工作環境下所可能產生之傷害。 本課程以器官系統為分類，探討職業病的起因、種類、發生過程與預防。課程內容將與毒物學、環境流行病學、作業環境偵測、生物偵測與暴露評估等課程橫串連，系統簡介與職業暴露有關的化學性、物理性、生物性與人體工學引起之危害。

312057 Introduction to Occupational 3 S H. R. Chao F

Medicine

Many critical episodes and events with respect to occupational health affect the contemporary and the following eras substantially.  This course gives an insight of the happenings and the impacts of these events.

312058 高科技產業污染防治 3 選 黃武章 上

本課程著重於介紹半導業之生產與污染來源及半導體之分析。期望透過課程使同學對半導體污染防治技術有基本認知.

312058 Pollution Protection of High 3 S W. J. Huang F

Technical Industries

This course emphasizes the introduction the analysis methods, production and pollution sources in semi-conducting plants. In order to build the basic concept of pollution protection in semi-conducting plants.

312059 環境影響評估 3 選 陳冠中 下

本課程之目的在於教導大學生如何評估開發行為對環境產生之衝擊並參與評估計畫。主要內容包括：（1）環境政策；（2）環境影響評估制度與觀念之源起；（3）程序與法規介紹；（4）方法論應用；（5）大氣環境、地表水及地下水、噪音振動、社經、土壤、景觀美質及生態等之預測與評估模式；及（6）公共參與決策。

312059 Environmental Impact 3 S K. C. Chen S

Assessment

The purposes of this course are to introduce undergraduate student how to assess environmental impact and how to participate an assessment plan. It contains following subjects:

1. Environmental policy
2. Concept and source of EIA
3. Process and Acts
4. Methodology
5. Prediction and assessment of impacts on the air environment, surface and ground water environment, noise and vibration environment, cultural environment, socioeconomic environment, soil environment, visual impact and biological environment
6. Public participation in environmental decision making.

312060 地下水污染與防治 3 選 葉桂君 下

對於地下水污染狀況及整治復育技術之介紹，內容包括：地下水水文學之簡介，地下水污染源，污染物在地下水層之傳送、分解，地下水污染之調查，地下水污染之復育技術介紹。

312060 Groundwater Pollution Control 3 S K. J. Yeh S

This course introduces the study of groundwater pollution and its remediation technologies. including the overview of groundwater hydrology, groundwater pollution sources, the transport of pollution in the groundwater and the remediation technologies of groundwater pollution.

312061 有害物質處理與設計 3 選 張國慶 下

有害物質管理與有害廢棄物的處理是和人們息息相關的課題，適宜的有害廢棄物處理策略應包括了解有害物質之生命週期及如何從使用源中達到減量。本課程主要內容涵蓋（1）有害物質處理對環境問題衍生。（2）如何訂定相關法律規範去限制有害物質排放。（3）發展有害廢棄物減量技術。（4）配合國際環境標準化觀念提升有害物質處理技術水準。

312061 Hazardous Materials Treatment 3 S K . C. Chang S

and Design

Hazardous materials and waste management is a topic that touches all lives. Every day people encounter hazardous materials （chemicals） or hazardous waste in their home, school or place of business. In order to properly manage hazardous waste, it is important to consider the entire life cycle, including when the waste was a useful chemical or hazardous material. Waste minimization is built upon this concept. The contents of this topic can be divided into four phases:

1. the realization of environmental problem
2. the regulations designed to limit discharge to the environment
3. the development of waste minimization
4. the environmental standardization

312062 水污染防治 3 選 謝連德 下

本課程主要討論水污染問題與防治方法。內容首先介紹水管理所涉及之法令，技術以及環境考慮因素；次則說明自來水與廢水系統；當然，水污染控制所用之物理化學，生物等方法亦在本課程內討論；最後並介紹水質模式以為水污染防治之整體考量依據。

312062 Water Pollution Control 3 S L. T. Hsieh S

This course deals with water pollution phenomena and control. Overview of water management relevant to institutions, technology, and environmental considerations will be first introduced to the students. Also, Lectures will include water supply and waste water systems in a mordern society. Emphasis of this course is to be placed on water pollution control technologies and water quality models which serve as useful tools for protecting our water resources.

312063品管⁄品保與實驗室認證 3 選 黃益助 下

各種環境保護工作的推展，舉凡政策法令的制度，標準的訂定與執行，不論是積極的改善污染情況提高生活環境品質或是消極的對製造污染者課以處分，均有賴正確的檢驗數據作為環保決策之依據。為了落實數據品質，品質管理與品質保證作業應優先予以重視，本課程之主要內容包括實驗室驗證所需具備之品保⁄品管項目：（1）初始率及率定查證、（2）持續率定查證、（3）預備空白試驗分析、（4）抑制干擾樣品分析、（5）矩陣分析、（6）重複樣品分析、（7）標準加成法、（8）實驗室品質控制樣品分析。

312063 QA ⁄ QC and Lab. Certification 3 S Y . C. Huang S

The object of a QA/QC program to provide a uniform basis for sample collection and handling, instrument and method maintenance, performance evaluation, and analytical data gathering and reporting.

QA/QC program to certify an analytical laboratory for standard methods includes：（1）Initial calibration and calibration verification. （2）Continuing calibration verification （3） Preparation blank analysis （4） Interference check sample analysis. （5）Matrix spike analysis.（6）Duplicate Sample analysis. （7）Method of standard additions （8） Laboratory quality control sample analysis.

312064 預警防災監控系統 3 選 林傑 下

本課程之規劃與設計將著重於環境污染預防及科技系統防災方面之介紹，希望藉此課程之修習讓學生充分了解人與環境之互動關係，於各種環境工程應用設計與規劃階段，皆考慮環境等級之影響因素，對減低災害發生之可能性危害影響因子，增加作業場所之安全性評估考量將有其助益性。課程內容將集中於空氣類別之污染狀況預警，包含（1）空氣品質監測（2）有害空氣污染物採樣及鑑定（3）污染物之分析原理及方式（4）監測數據傳輸及運用（5）災害預警及緊急應變與通報（6）環境管理回饋系統等。

312064 Emergency Response and 3 S C. Lin S

Disaster Prevention System

The focus of this program is on the environmental pollution and disaster prevention system. Special attention is paid to the communication between human being and the environment. Based on the discipline, while an environmental engineer plan and design a project the environment should be consider to feedback and avoid to disrupt the balance of the ecological system. The possible factors to cause the calamity should be evaluated for the safety concerning. The primary application of this course will demonstrate the air pollution alarm system. The scope of this course includes （1） air quality monitoring （2） hazardous air pollutant sampling and identification （3） pollutant analysis theory and methodology （4） monitoring data acquisition and transfer （5） disaster alarm and emergency response （6） the feedback system for the environment management.

312065 風險評估 3 選 謝季吟 下

由於近幾年來新的化學物質及混合物大量被製造並藉由不同途徑流入市面，充斥於我們的生活環境中，然而這些物質可能對人體所造成的有害性及生態毒理特性仍並不十分清楚。過去五十年來原本認為無害或對人體生殖系統並不會造成傷害的物質（如石綿及撒利多邁德胺），甚至已被證實具致癌性，也有越來越多的化學物質在動物試驗中被證實具致突變性及致畸性。為更進一步了解環境及工作場所有害物質的來源及特性，並降低對人體及生態系的長久影響，風險評估已儼然成為一個重要議題。

本課程內容將包括”危害”及”風險”觀念及內涵的釐清；何種物質會對人體造成影響及進入生物體內的途徑及方法；危害物質於環境中的排放與宿命；隨機及非隨機效應評估的差異；風險評估過程不確定性分析及探討；針對暴露評估準則的確立進行了解；生物標記的運用；如何降低風險及運用評估結果來當作風險管理的基準。

312065 Risk Assessment 3 S C. Y. Hsieh S

There has been a dramatic increase in the use of chemicals in recent years, many of them new compounds and mixtures whose toxicological properties have not previously been studied and which prove to be harmful to humans. Over the last fifty years several substances previously thought to be inert or harmless in humans have been found to be carcinogenic （asbestos minerals） or toxic to the reproductive process （thalidomide）. A wide and increasing range of compounds have been shown to be mutagenic or carcinogenic in animal studies. For further understand the main sources and characteristics of hazard materials in the environment and working place in order to minimize the effect for humans and ecosystems. Risk assessment has become an important issue.

The course will offer the knowledges in the following topics including the difference in meaning of the terms “ hazard” and “risk” and the four stages of risk assessment；the commonest routes by which substances are absorbed into the body and be able to differentiate between the acute and chronic、 local and systemic、reversible and irreversible effects；how to extrapolate the results of studies of the harmful effects of substances from animals to humans； the difference between stochastic and deterministic effects；uncertainty analysis in the risk assessment process；the principles of exposure assessment and the use of biomarkers and the approaches to minimizingrisk and how to progress from risk assessment to risk management.