環境工程與科學系

Environmental Engineering and Science

一、必修科目Required Courses

319001 論文習作與研究方法 2 必 張國慶 上、下

對博士班研究生而言，具有英文論文寫作的能力與充分瞭解研究方法為完成學業與未來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的期刊論文來精鍊技術論文的寫作技巧與熟練研究方法。

319001 Thesis Writing and Research 2 R K.C. Chang F、S

 Methodology

The capability of technical writing and the understanding of research methodology are essential to a graduate student. This course will teach graduate students the logic, sufficient and necessary conditions, and key points of technical writing and research methodology first. And then via reviews of a variety of different excellent environmental-protection related papers from technical and scientific journals to further master the ability of technical writing and familiarize the methodology underlying research and development.

319002專題討論 4 必 薩支高 上、下

本課程旨在訓練研究生對資料蒐集,整理，及表達的能力。學生選擇與環境科學環境工程、或論文有關的題目，蒐集文獻、閱讀、整理成摘要,然後提出報告、討論,並由參與教師評分。

319002 Seminar 4 R W. S. Li F、S

This course is designed to train graduate students the ability in searching literature, organization of material and presentation. Students are required to select a topic in the field of environmental science, environmental engineering or that related to their thesis, search and review literature and drew up a brief. The presentation is scheduled for every student once a semester. Their performance is evaluated by the faculty member.

319003博士論文 12 必 指導教授 上、下

利用完整執行之試驗﹑觀察或實務操作，使學生能徹底了解並應用修課之知識﹑練習口頭報告﹑與科學論文之寫作。老師則藉由討論，提供改進之意見。

319003 Dissertation 4 R Advisor F、S

After a well-designed project being properly conducted by students, he/she will be asked to give a oral presentation and summit the thesis before a deadline. Knowledge acquired during the study should be made use of sufficiently in the preparation of the thesis. Frequent and intensive discussions among teachers and students will be arranged to improve the quality of his/her research.

319004 環工專業英文寫作 3 必 林耀堅 下

專業英文寫作能力於學術研究上所扮演的角色日益重要，本課程之主要目的為提升環工系研究生之環工專業英文寫作能力。課程規劃主軸包括 （1）以修正同學容易產生之造句錯誤著手，增加短句之寫作練習。（2） 經由英文期刊論文之分析與導讀，使其學習環工專業英文寫作之技巧。（3） 學習如何正確撰寫其研究論文之英文摘要。（4） 以逐步學習專業英文短文之寫作，建立撰寫環工專業英文論文之基本能力。

319004 Professional English Writing 3 R Y. J. Lin S

 in Environmental Science and Engineering

In the field of scientific research, professional English writing is getting more and more important. The goal of this course is to enhance the skills of professional English writing for the graduate students in the Department of Environmental Science and Engineering. The course designs include the followings; （1） to extend the writing practice for students and how to avoid common mistakes, （2） to learn the skills of professional English writing through the analytical guiding of international journal papers, （3） to study how to compose the abstract of thesis or dissertation correctly, （4） to be confident about writing professional papers through the extensive experience in writing short paragraphs.

二、選修科目Elective Courses

319005氣膠學特論 3 選 陳瑞仁 上

氣膠學特論是專門研究懸浮於氣相中之空氣毒性物質之微粒行為特性與相關特徵之科學。本課程之主體主要涵蓋下述範圍：氣膠粒徑統計分佈專論、粒子動力學及擴散特性專論、乾沈降模式專論、粒子光學特性專論、粒子成長機制專論、環境中氣膠污染案例檢討。此外，有關最新之氣膠發展亦列為教材講授。

319005 Special Topics in Aerosol Science 3 S S.J.Chen F

Special Topics in Aerosol Science is about the properties and behavior of air toxics particles suspended in a gaseous medium. In the 3-credit course of Special Topics in Aerosol Science, several topics will be covered, including special topic in aerosol size distribution, special topic in particles kinetics and diffusion characteristics, special topic in dry deposition modeling, special topic in optical properties, particle growth mechanisms, and the discussion on special cases. Moreover, new development and application in aerosol science will be discussed.

319006無機廢棄物再生技術 3 選 黃武章 上

本課程主要延續廢棄物處理中之再生技術作一討論。目地在於解說再生方法的原理，操作與流程設計。一些新發展中的無機廢棄物再生技術也將一併討論。

319006 Regeneration Techniques of 3 S W.-J. Huang F

 Inorganic Waste

The purpose of this course is to extend the discussion of the “regeneration technique” issue on the hazardous waste treatment. We will introduce the principle, operation parameter and process design of those regeneration methods. Several new developing techniques on inorganic regeneration are also discussed.

319007多孔介質傳輸現象 3 選 黃益助 上

本課程將針對各類多孔介質（土壤、薄膜等）之傳輸現象及相關應用進行探討。課程內容包括：多孔物質之特性，多孔介質中之流體性質，質量、動量及能量平衡方程式，非互溶流體之特性，多孔介質中之顆粒傳輸現象，多孔介質中之基本化學及生物反應等主題。

319007 Transport Phenomena in 3 S Y.C.Huang F

 Porous Media

This course is designed to study the transport phenomena in porous media with special emphasis on fundamentals and applications to various geo-environmental and membrane problems. This course includes 1）properties of porous media, 2）introduction to the physics of flow through porous media, 3）macroscopic balance equations for mass, momentum and energy, 4）flow of immiscible, and 5）fundamentals of chemical and biological reactions in porous media, etc.

319008土壤礦物學 3 選 許正一 下

本課程之目的，在使學生了解土壤礦物的來源、種類、反應與應用等，並能利用儀器分析進一步做礦物鑑定，包括x-ray 繞射儀、紅外光譜儀、表面積法、電子顯微鏡等。主要探討課題為土壤礦物分類與特性、土壤礦物之表面化學、礦物間的平衡、常見土壤礦物之來源、結晶性、穩定性、鑑定方法等，並進一步討論土壤中主要的粘土礦物種類，包括層狀矽酸鹽、金屬氧化物、碳酸鹽類、磷酸鹽類與硫化物等。

319008 Soil Mineralogy 3 S Z. Y. Hseu S

The purpose of this course is to study the source, kind, reaction and application of soil minerals. Mineral identification is conducted by x-ray diffraction, IR, surface area method and electron microscopy. The main issues include mineral classification and characteristics, surface chemistry of soil mineral, mineral equilibria in the soil system, the source, crystallography, stability and identification. Special topics focus on principle clay minerals including layer silicate, metal oxide, carbonate, phosphate and sulfide.

319009環境風險分析 3 選 薩支高 下

本課程內容包括：簡介風險分析及環境健康安全風險的意義；危害確認；因果分析；暴露評估；可靠度分析；不確定性敏感度分析及風險管理等。

319009 Environmental Risk Analysis 3 S J.G.Sah S

This course includes several sections as follow: 1, Introduction to risk analysis and the meaning of environmental health and safety risk; 2, Hazard identification; 3, Reliability analysis; 4, Exposure assessment; 5, Consequence assessment; 6, Uncertainty, variability and sensitivity analysis; 7, Risk management.

319010環境流體力學 3 選 黃益助 下

本課程是專為具有初等流體力學基礎之研究所學生，修讀環工相關領域進階流體力學所設計。課程內容包括：因次分析、相似度分析、控制體積分析、流體向量微分分析、壓縮流體、粘滯流體、邊界流體等。

319010 Environmental Fluid Mechanics 3 S Y.C.Huang S

This course is designed for the graduate students, who have taken the fundamental aspects of fluid mechanics, to learn the advanced knowledge of fluid phenomena related to the field of environmental engineering. This course includes 1） dimensional analysis, similitude, and modeling; 2） finite control volume analysis; 3） differential analysis of fluid flow; 4） compressible flow; 5） viscous flow; and 6） boundary-layer flow.

319011傳輸理論與現象 3 選 林傑 上

本課程藉由介紹傳輸理論與現象探討可能引起環境衝擊之負面有害化學物質於不同環境介質中之擴散、濃縮、稀釋等效應對生態及人體健康風險之影響，課程內容包含了解污染物質於環境中之平衡、轉移及殘餘態，採用傳統質量、動量、能量傳輸流程應用於環境污染問題之解析，提供部份案例說明可能導致污染之化學物質於環境中之傳輸途徑與宿命，併以工程觀點討論其最佳之控制技術可行性。藉由熱力平衡基理與化學動力模式分析環境污染調查之客觀性與評估有害物質於處理製程中之破壞效率將是本課程之教學目標。

319011 Transport Modeling and 3 S C.Lin F

 Phenomena for Environmental

 Media

This course will discuss an anthropogenic chemical that has been released from a production, isolation, or treatment process to one of the environmental phases（air, water, or soil）.There is then an immediate need to know how it affects humans and the ecosystem; how we can isolate it from the ecosystem and minimize the risk resulting from it. The primary content is to introduce the transport modeling, and the fate of the hazardous chemical. The core of this environmental engineering discipline is to confront with the final equilibrium state of the compound in the natural environment; i.e., which of the environmental phases is the most favorable and how much resides in each at equilibrium? How fast does the compound move from one phase to another; what is the residence time in each phase; and how fast does it degrade or change its original state? The answer requires the applications of concepts from chemical kinetics and transport phenomena. This course will adopt an approach similar to the integrated heat-, mass-, and momentum-transport course of chemical and mechanical engineering curricula and provide examples of transport processes relevant to the three main environmental media-air, water, and soil. The principles introduced here clarify the basis of new and improved models and designs in environmental engineering.

319012厭氧生物技術 3 選 郭文健 上

從基本厭氧處理原理，微生物特性，進到厭氧處理時之環境、條件、參數控制，最終應用於不同之產業，給學生對厭氧生物技術有一完整之觀念，並能據以實施及應用。

319012 Anaerobic Biotechnology 3 S W.C.Kuo F

From fundamental anaerobic theory, microbial characterics, to environment, conditions, and controlling parameters, eventually to the application of different industries, this course aims to give the students a complete concept of anaerobic treatment so the students can practically put the anaerobic techniques in their applications.

319013奈米科技在環境科學上 2 選 黃益助 上

 之應用

國內、外奈米科學與技術不斷創新及發展，本課程目的將奈米科技應用於環境科學上，課程內容包括：增進奈米材料理論及物化特性、提升奈米科學與技術之理論與應用、整合說明奈米技術在環境科學上的技術與應用、培植環境與奈米科技相關人才。

319013 Nanotechnology in 2 S Y.C. Huang F

 Environmental Application

Nano science and technology is dynamically innovating and developing. The purpose of this course is to apply the nano science and technology to the environmental science. The contents include improvement of the theory and physical-chemical characteristics of nano materials, promotion of the theory and application of the nano science and technology, integral illustration of the nano technology and application on environmental science, cultivation of the researchers working on the field of environment and nano technology.

319014專題研究（1） 3 選 輪授 上

本課程將針對環境相關領域，進行專題研究及相關主題探討，專題研究主題將由授課教師安排及訂定。

319014 Special Topics （1） 3 S Alternative Teaching F

This course is designed to study the selected topics and related problems in an identified area of environmental engineering. The Topics will be arranged by the lecturer.

319015高等空氣污染防治設計 3 選 李嘉塗 上

這門課程提供控制設計理念和程序，開始簡單討論空氣污染問題和簡易的設計。理論和設計提供進一步了解整個課程。整個課程章節包括顆粒介紹和不同種類顆粒控制設計、顆粒控制整個計畫、VOC控制計畫。簡易明瞭例題，使課程容易學習。

319015 Advance Design for Air 3 S J.T.Lee F

 Pollution Control

The course describes the philosophy and procedures for the design of control systems. This course begins with a general discussion of air pollution and design approach. Theory and practice are well balanced to provide a firm understanding of the course. The subject include particulates and the process design of different kinds of particulate control equipment, design – project chapter for particulate control, a comprehensive V.O.C control design project. Numerous examples emphasize key points and design techniques.

319016土壤物理化學 3 選 許正一 上

本課程之目的，在使學生了解土壤膠體電雙層理論、離子吸附模式、土壤溶液熱力學、粘土礦物表面化學反應與動力學、沉澱與溶解機制、土壤有機物化學性質與氧化還原過程等課題，以期對學生從事土壤環境污染研究有所幫助。

319016 Soil Physical Chemistry 3 S Z. Y. Hseu F

The purpose of this course is to study electrochemistry of the double layer, chemical modeling of ion adsorption in soils, thermodynamics of soil solution, kinetics and mechanism of chemical reactions at the surface of clay mineral, precipitation/dissolution reactions in soils, chemistry of soil organic matter, and soil redox process for help in the research of soil environment pollution

319017空氣毒物處理特論 3 選 謝連德 下

本課程:首先概述空氣毒性物質之種類及其在環境中之傳播，並對特殊空氣毒性物質之特性作深入探討。其次亦介紹空氣毒性物質反應動力學，包括氯化有機物燃燒之過程、質量平衡及熱平衡、醫療廢棄物燃燒過程產生之毒性物質探討，更對一般大氣中毒性物質與燃燒產物之關係作深入討論。最後對於空氣毒性物質之處理技術，則主要介紹電漿技術之應用、電漿反應器之基本設計、電漿處理之案例說明、電漿處理之模式模擬。

319017 Special Topics in Air Toxics 3 S L.T.Hsieh S

 Treatment

This course covers the introduction to the species of air toxics and their distributions in our environment. Some important transportation of air toxics is also included. Reaction dynamics of air toxics, including chlorinated air toxics, are discussed. The new technology of plasma is also introduced. Basic plasma technology, design of plasma reactor, treatment cases by applied plasma reactors, basic plasma modeling and simulations are discussed.

319018地下水污染傳輸 3 選 葉桂君 下

污染物在地下水層之傳輸牽涉到複雜的物理、化學與生物作用。因此，進行地下水整治需先了解污染物在地下水層傳輸之機制與動力。 本課程內容包含：（1）地下水層中，水力、物理、化學與生物因素對污染物傳輸之影響；（2）地下水污染整治時，污染物在氣相、液相與固相間之轉換與分解；與（3）污染物在地下水層傳輸與整治之預測模式。

319018 Pollutant Transfer in 3 S C.K.Yeh S

 Groundwater

Pollutants in the aquifer are subject to complex physical, chemical and biological transformations during their movement through the subsurface. Thus, the remediation of groundwater pollution requires an understanding of the dynamics and processes controlling the transport of contaminants. This class provides a detailed review of the partitioning of pollutants as affected by hydraulic, physical, chemical and biological constituents in aquifers. The basic theory and latest finding in the transportation and transformation of pollutants among the aqueous, solid and gaseous phases during ground remediation are discussed. The discussion topic also includes models used to predict the behavior of pollutants in aquifers as well as the efficiency of remediation.

319019綠色工程與化學 3 選 張國慶 下

本課程內容以永續發展的核心價值為思考重心，將綠色工程與綠色化學的科技發展及其基本理論突破加以探討研習，並且引入相關新科技領域如奈米科技、電漿化學、超臨界化學、光電與半導體、超導體、燃料電池、及生物科技等最新進展對污染預防可能的衝擊與應用。

319019 Green Engineering 3 S K.C.Chang S

 and Green Chemistry

Sustainable development as core value will be the hub of this course. The recent technology progresses, basic theory breakthrough, and ongoing research of green engineering and green chemistry will be introduced and studied. The impacts of related newly developing high techs such as Nanotechnology, Plasma Chemistry, Supercritical Chemistry, Photoelectronic and transistors, Superconductor, Fuel cell, Biotechnology, and etc. on Pollution Prenvention and their applicabilities will also be persued.

319020專題研究（2） 3 選 輪授 下

本課程將針對環境相關領域，進行專題研究及相關主題探討。專題研究主題將由授課教師安排及訂定。

319020 Special Topics （2） 3 S Alternative Teaching S

This course is designed to study the selected topics and related problems in an identified area of environmental engineering. The topics will be arranged by the lecturer.

**319021 環境化學動態學 3選 黃國林 上**

本課程旨在介紹污染物環境系統中的傳輸及平衡現象。授課內容包括污染物傳輸概論、環境介面平衡、污染物傳輸法則、空氣與水相之間的物質交換、水與土壤之間的物質交換、空氣與土壤之間的物質交換及環境數學模式概論。

**319021 Chemodynamics 3 S K.L.Huang F**

This course is designed to introduce the transport and balance phenomenon of contaminants in environmental media (air, water, and soil). the contents of this course consist of introduction to contaminant transport, equilibrium at environmental interfaces, transport fundamentals, air-water interface transfers, water-soil interface transfers, soil-air interface transfers, mathematical modeling the transport of contaminant in the environment, and mathematical models/solutions.