교과목 개요(환경에너지공학 학제전공)

BS462 Environmental Biotechnology **3:0:3**

The course deals with the role of microorganisms in the maintaining of balanced ecosystems in the biosphere. Students will then be encouraged to discuss how to use microorganisms to re-organize an ecosystem destroyed by pollution. Because microorganisms act mainly in water, methods for effectively taking care of polluted water will be the focus of this course. The students will learn to measure the amount of pollution of water; to calculate various parameters for designing effective mechanisms to eliminate polluted water; to use the obtained parameters to create systems of activated sludge treatment, effluent treatment, lagoons, water filtration, and anaerobic fertilization.

BS532 Applied and Environmental Microbiology **3:0:3(1)**

This course deals with the roles of microorganisms in the environment and industry: the characteristics of microorganisms in applications are discussed.

BS536 Environmental Toxicology **3:0:3(2)**

This course covers the absorption, distribution, metabolism and excretion of toxic substances. Topics include: Target organ toxicity and toxic mechanisms of drugs, Pesticides, Food additives and air pollutants. Regulation and risk assessment.

BS760 Selected Topics in Environmental Biotechnology **3:0:3**

The purpose of this course is to give graduate students the most up-to-date formation about environmental biotechnology.

CE572 Environmental Microbiology and Biotechnology

This course will offer lecture series on environmental microbiology and its application in environmental biotechnology. The main topics dealt in the class will include microbial physiology and ecology and their application in biotechnical practices including bioremediation and bioenergy production. This course will also provide an introduction to state-of-art techniques used in microbiology research, including qPCR, next-generation sequencing, metagenomics, and single-cell technology.

CE582 Environmental Electrochemistry

The goal of this class is to present electrochemistry as an important field of environmental engineering that can be applied to dealing with serious environmental problems. This course will start with basic fundamentals of electrochemistry, and then cover key analysis techniques, understanding of electrochemical device and finally important topics in the area of environmental electrochemistry

CBE503 Numerical Methods for Chemical Engineers **3:0:3(4)**

The goals of CBE503 are two fold. First, computational methods are presented for solving many of the differential equations that model physical phenomena arising in chemical engineering. Second, the presentations of these techniques will be organized in a way so that the common strands of numerical analysis are exposed and so that they form the foundations necessary for the more advanced studies required to solve problems arising at the forefront of research.

CBE511 Design of Reaction Sysems **3:0:3(3)**

Design and analysis of reaction systems related to chemical and biomolecular engineering will be introduced. The lecture covers the chemical reaction kinetics, experimental planning, multiple reaction, introduction of ideal reactors, interaction of heat and mass transfer with chemical reaction, residence time distribution, design of nonideal reactors, and stability analysis of reaction systems.

CBE512 ntroduction to Catalysis Engineering **3:0:3(4)**

The Basic concept of heterogeneous catalysis including the catalytic activity and selective adsorption, kinetic models, catalyst preparation and experimental evaluation will be explained. Typical catalytic systems of industrial importance will be discussed ; metal supported catalysts, acid and zeolites, catalytic oxidation, and energy and environmental catalysis.

CBE532 Mass Transfer **3:0:3(4)**

Fundamentals and mechanisms of mass transfer at steady and transient state are explained with diffusion theory and

mass transfer coefficients. Also, the convective mass transfers in laminar and turbulent flow are studied. This course covers the application for the separation process, where mass transfer phenomena is crucial, such as interface contactor and membrane separation.

CBE571 Energy Engineering **3:0:3(4)**

To study on the general energy engineering principles, the current status of alternative energy development and the overall coal energy utilization (pyrolysis, combustion, gasification, liquefaction) processes in this course.

CBE632 Colloids and Surface Chemistry **3:0:3(3)**

The aim of this course is to establish the fundamental concepts on the colloid and biocolloid for industrial and pharmaceutical applications. Following introduction to interfacial engineering, this course is designed to understand in depth and art-of-state knowledge of electrical phenomena, surface modification and adhesion, stabilization of emulsion, foam, and particle dispersion , microcapsules and their industrial applications. Special attentions are paid to pharmaceutical and biomedical applications throughout the topics including sophisticated drug delivery systems.

CBE672 Air Pollution Control **3:0:3(3)**

Chemical reactions in atmosphere, origin, measurement techniques of air pollutants, fluid dynamics of particles and designing of air pollution control equipments will be covered in this course.

CBE673 Water Pollution Control **3:0:3(3)**

Wastewater treatment by physico-chemical and biological methods are discussed. Also taught in the lecture are technologies involved in degradation of recalcitrants, removal of nitrogen and phosphorous, small packaged system for treatment of sewage and wastewater treatment, and sludge treatment and disposal. Students are expected to present a term paper on the recent development on different technologies.

CBE680 Membrane Technology **3:0:3(3)**

Membrane technology starts with introducing the competitiveness of membrane separation with other separation processes. Membrane materials, processing and characterization; transport in membranes, concept of concentration polarization and fouling, modules are covered. Special topics include desalination by reverse osmosis, ethanol purification using pervaporation, microfiltration in wastewater treatment, fuel cell and electrodialysis.

CBE761 Bioprocess Analysis and Control **3:0:3(3)**

Topics relating to bioprocess monitoring and control are to be dealt with. Biosensor systems for the on-line monitoring of bioreactors will be introduced. Various techniques for the indirect estimation of nonmeasurable quantities will be also discussed. Algorithms for the optimization of batch and fed-batch cultures will be introduced. Stability analysis and control of continuous bioreactors will be discussed. (Prerequisite course : CBE564)

CE474 U-Eco Policy and Management Engineering **3:1:3(8)**

This course is to provide a set of operational contributions to environmental policy analysis and to discuss about multidimensional approach to environmental and resource management problems. Also, emphasis is given to an integration of different fields which normally play a role in environmental policy analysis: economics, physics, regional science, ecology and social and political science.

CE504 Advanced Environmental Chemistry **3:1:3(12)**

The goal of this course is to understand the concept of advanced chemistry and develop the ability of application for the identification of chemical phenomena occurred in natural and engineered environments. The course will provide basic knowledge to properly conduct important environmental researches and to fully understand environmental problems in hazardous waste treatment, wastewater treatment, and contaminated soil and groundwater remediation.

CE571 Environmental Engineering Laboratory **1:6:3(10)**

This course deals with theories and experiments related to the manufacture of physical, chemical and biological reactors, operational and experimental plans, scale-up problems, and analysis / application of environmental data.

CE573 Advanced Membrane-based Water Treatment **3:1:3(6)**

This course will offer the advanced knowledge on the fabrication, separation theory, and state-of-art applications of membranes related on water and wastewater treatment processes.

CE579 Hazardous and Industrial Waste Treatment **3:1:3(8)**

This course consists of clean technologies, reduction technologies, intermediate and final waste disposal technologies

in hazardous and industrial waste management. It also includes purification technologies for contaminated soil and groundwater. Term projects are required for all students.

ENV501 Introduction to Clean Technology **3:0:3(4)**
This course deals with clean technologies to solve environmental problems fundamentally through pollution prevention. It examines pollutant reduction processes, clean production processes, and zero-discharge / pollutant free processes.

ENV521 Environmental microbiology experiment **0:9:3**
This course consists of a series of basic microbial experiments including pure isolation, culture, etc. Students are expected to investigate microbial distribution in environmental systems.

ENV651 Soil and Groundwater Pollution Management Engineering **3:0:3(3)**
This course introduces remediation technologies for polluted soil and groundwater. It includes examination of soil properties, treatment methods, and shielding.

ENV661 Toxics Management Engineering **3:0:3(3)**
This course deals with basic technologies for hazardous waste from sources to final disposal. Term projects are required for all students.

ENV731 Advanced Water Quality Management Engineering **3:0:3(3)**
This course examines management of water quality and water resources. It deals with pollutants to reach various natural systems (surface water, groundwater, estuaries, and coasts) and systematic management of those pollutants. It further discusses management models for long-term improvement in water quality.

ENV741 Advanced Air Pollution Control Technology **3:0:3(3)**
This course introduces recent technologies for various air pollution sources. It further designs air pollution control equipments based on literature survey.

ENV791 Special Topics in Environmental Engineering **3:0:3(3)**
This course deals with emerging issues, technologies or policies related to environmental engineering.

ME452 Noise Control Engineering **3:0:3(6)**
Generation and control of sound/noise will be covered in the course. Fundamental principles that govern sound generation and control are designed to be understood, not by theoretical approach but mainly physical, conceptual means. Class competition and experiment are expected.

ME513 Advanced Combustion **3:0:3(6)**
This course deals with the calculation of thermochemical equilibrium, chemical kinetics, governing equations for reacting flow, premixed flame, diffusion flame and heterogeneous combustion.

ME654 Noise Control **3:0:3(6)**
Various environmental pollutions are being concerned very much along with the fast development of industry and living standard. Among various pollution topics, 'noise', in particular from various mechanical systems, becomes a big concerning item to generals and manufacturers because the machine noise is usually directly related with the ordinary life of human beings. Quietness of machines becomes one of quality and market value evaluation points of a machine and the customers and regulations demand a lot of noise-related functions to the machine manufacturers. In this course, for the high value design of machines and the quietness of everyday life and environment, source characteristics, human perception characteristics, identification of noise sources and transfer paths, product sound quality, and countermeasure plans are studied, which should be in mind for a noise and vibration engineer.

ME810 Special Topics in Thermal & Fluid Engineering **3:0:3(6)**
This lecture is designed to deal with the selected theory and application in thermal and fluid engineering part. The specific topics will be announced before the semester begins.

MGT537 Environmental and Resource Economics **3:0:3(5)**
This course is about the inhibition factors, for efficient control of resource / environment, such as moral hazard, informational rent and free-rider effect. It also suggests the role of government and industries for the solution and deals with game theory for setting the conflicts between economists.

NQE401 System Engineering of Nuclear Power Plants Experiments **3:3:4(6)**

Unified treatment of the design concept and overall description of components and system control in nuclear power plants. Discussion of engineering and operational principles of components such as steam generators, pressurizer, pumps, turbines, condensers, valves, BOP, CVCS. Emphasis on the basic concepts of thermodynamics associated with nuclear power plants. Performance of experiments of each component and simulation of the system through a micro-simulator.

NQE441 Environmental Engineering of Nuclear Power **3:0:3(4)**

Environmental effects of nuclear power and radiations are covered broadly. Radiological assessment methods and characterizing the various radiation sources are deals directly with analysis. Liquid effluent management and dispersion of gaseous radioactive nuclides and transport or migration of radiactivity through surface water, underground water and biosphere are described. Finally, environmental pathway modeling is examined and compared.

NQE512 Nuclear Reactor Analysis and Design **3:0:3(4)**

This course is designed to cover the nuclear reactor analysis and design, introduction of neutron transport equation, approximation of diffusion theory, solution of few-group and multi-group neutron diffusion equation, calculation of energy distribution of fast and thermal neutrons, and homogenization to heterogeneous reactors. It also include recent methods (ex. nodal method) to predict the spatial and temporal distribution of neutrons, This course includes several projects running design computer code systems under realistic reactor design situation

NQE513 Neutron/Radiation Transport Theory and Computation **3:0:3(4)**

This course is designed to cover the neutron/radiation transport theory and its computation. It includes nuclear data evaluation and processing, computational methods, and numerical algorithms for continuous, one-group, multi-group neutron and radiation transport computational formulations, that can be applied to the design of various nuclear reactors, radiation shielding facilities, analysis of radiation distribution in systems such as nuclear fusion reactor, accelerator, nuclear bio-medical equipment, and nuclear imaging problems in nuclear prospecting, nuclear assay, and computed tomography.

NQE522 Nuclear Power Plant Design Project **3:0:3(4)**

The objective of this course is to accumulate the composite design experiences of the core and other equipments using the principles of nuclear engineering. Unique design of reactor core satisfying the parameters of the particular reactor type, the output of power and the limit temperature, etc., the size of core and the size, the number, the interval and the operating temperature, etc. of fuel rods must be determined by computational codes. It also includes an estimate of the cost price for a reactor system containing heat exchangers, steam generators, condensers, turbines, etc.

NQE523 Nuclear Reactor Safety **3:0:3(4)**

The course provides safety goals, characteristics, analysis methods and diagnosis techniques. Both deterministic and probabilistic analyses related with transients, design basis accidents and PSA level 2 and 3 are emphasized. The course covers actual plant accidents. Also, students deduct and discuss safety issues in case-studies.

NQE541 Radioactive Waste Management **3:0:3(4)**

This course is designed to provide the students about the technology of the general management of the radioactive waste generated during the operation of nuclear power plant and nuclear fuel cycle facility including the treatment and disposal of the wastes. Background information on the sources of the gaseous, liquid and solid radioactive waste, and process and treatment facilities, solidification and volume reduction technology, packaging and transportation, storage methods of the wastes and spent nuclear fuel, design, safety and construction of the waste repositories, migration of the radionuclide at the subsurface, environmental monitoring and protection, repository safety assesment, decontamination and decommissioning, and the management of spent nuclear fuel will be covered.

NQE575 Nuclear Energy Policy **3:0:3(4)**

Historical development and utilization of Nuclear Energy are reviewed from the dawn of atomic age. This important alternative energy technology is evaluated comparatively in terms of technoeconomic, sociolpolitical and environmental aspects of nuclear energy uses. The nuclear energy utilization programs of major countries, regional or global basis are assessed for the characterization of different nuclear energy policy. In view of the established international nonproliferation regime and International Atomic Energy Agency(IAEA), the prospect of Nuclear Energy Policy Alternatives should be analysed in conformity with changing policy issues.

ENV960 Thesis (Master Sudent)

ENV966 Seminar (Master Student) **1:0:1**

ENV980 Thesis (Ph.D. Student)

ENV986 Seminar (Ph.D. Student) **1:0:1**