

## Course Description

### **Advanced Environmental Chemistry**

In this course students will use the fundamental principles of chemistry to gain an understanding of the source, fate, and reactivity of compounds in pollution control systems. Environmental issues that will be discussed include pollution and treatment of water, air and soil environment.

### **Design of Solid Waste Landfill**

In this course it will be dealt with the fundamental principles and key technologies that are used to landfill municipal and industrial solid wastes. The major components of sanitary land including barriers systems, leachate discharge and treatment, gas recovery and treatment for recycle will be provided in view points of design and maintenance.

### **Advanced Sludge Treatment**

The purpose of this course is to provide fundamental knowledge regarding the analysis, design and operations of the sludge treatment processes. In addition, the state of the arts of current sludge treatment processes will be provided to help the development of new technology for sludge treatment.

### **Bioenergy Engineering**

The course will present technology and economics issues involved in developing biomass energy as a renewable energy source. Lectures will cover from topics on feedstock selection, feedstock conversion to metabolic engineering, from energy policy, economic, environment to issues of scale up for industry production. Through series of lectures, students will learn how to design, analyze, and sale up various bioconversion scenarios for bioenergy production.

### **Design of Incineration and Pyrolysis**

This course will provide student the thremo-chemical principles applied to waste incineration systems treating municipal solid wastes. And the concepts of new design and operation for various thermal treatment processes will be presented. The additional knowledge in the field of emissions and solid residues from waste incineration systems will be discussed.

### **Advanced Treatment of Hazardous Wastes**

This course is concerned with the management of hazardous materials and wastes in depth. We will deal with the physico-chemical processes for treatment hazardous materials and wastes including precipitation, flocculation, thermal treatment, solidification and advanced oxidation process. Special emphases will be placed on the design and operation of the these processes.

### **Advanced Environmental Microbiology**

This course is lectures on the various functions of microorganisms being utilized in the environment and

related industries are mainly covered by microbial classification and cell structure, metabolism and growth, genetic and evolutionary, bio-reactive engineering, water and soil microbes, element circulation, and pollutant processing processes.

### **Advanced Water Treatment**

Removal mechanism of nutrients, Nutrients removal process, Interpretation and design of treatment process, unit process for ultra pure water production, sedimentation and filtration, gas transfer and mixing, economic water and wastewater treatment system.

### **Biological Treatment**

Cell structure, microbial growth, Fermentation and respiration of microorganism, Microbiology metabolism, Microorganism growth dynamics, Biological treatment process, Aerobic treatment process, Anaerobic treatment process.

### **Physico-chemical Treatment**

Flowrate measurement, Equalization tank, Screen facility, Mixing, Flocculation, Sedimentation, Flotation, Granular filtration, Gas transfer, Chemical precipitation, Adsorption, Disinfection, Other types of chemical treatment

### **Membrane Technology**

Theory and application of reverse osmosis, Microfiltration and Ultrafiltration, Nanofiltration, Application of membrane technology, Wastewater reuse using membrane technology.

### **Clean Technology**

Wastewater reuse, Recycle of solid waste, Source and properties of wastewater sludge, Sludge treatment mechanism, Stabilization, Digestion of aerobic and anaerobic sludges, Composting process, Disinfection, Dewatering, Heat transfer, Heat compression.

### **Industrial Wastewater Treatment and Reuse**

Wastewater reuse, Recycle of municipal solid waste, Source and property of sludge, Sludge treatment system, Stabilization, Aerobic and anaerobic sludge digestion, Composting, Dewatering, Wastewater properties at various industries, Sampling and data analysis, Physico-chemical process, Optimization, Zero emission, Waste reuse, Pollutants properties based on different sources.

### **Appropriate Technology**

Introduction of creative design. Economical water treatment process for developing countries, Design and operation of appropriate water treatment technology, Rainwater harvesting, Development of drinking water, Water cultivation.

### **Advanced Wastewater Treatment**

Treatment mechanism of nutrients, Nutrients removal, Interpretation and design of treatment process, Interpretation and design of advanced oxidation process, Operation of unit process, Composition of economic wastewater treatment system.

### **Aquatic Cycles of Pollutants**

Learn important matters carbon cycle in the Earth environment, especially behavior of organic matter cycling divided into biological and non-biological which is central to the water environment

### **Lake Eutrophication**

Learn Biogeochemical basic theory of the lake, and study expertise such as eutrophication and reduction technology

### **Management of River Environment**

Analyze problems for the main river management of flood control systems and learn urban and rural areas of the river management skills considering environment

### **Advanced Environmental Ecology**

Deals with the relationships between the biological and abiotic environment, organisms and organisms. By studying the basic principles of the ecosystem, learn about the application knowledge for understanding the environment change autumn impact on the ecosystem.

### **Introduction to air pollution**

A study of air pollution. Emphasis is given to principles underlying our understanding of ambient air pollution, its sources, its effects, and mechanisms for its management.

### **Aerosol Engineering**

An aerosol is an assembly of particles suspended in a gaseous medium. They are omnipresent in our workplaces and outdoor environments. They include a wide range of phenomena such as dust, fume, smoke, mist, fog, haze, clouds, and smog. Certain aerosols pose significant health threats, while others improve the quality of our lives. It is necessary to understand how airborne particles behave to control against their undesirable effects and to harness their beneficial potential. This course will explore the mechanics of aerosol behavior, including their generation, transformation, and fate in occupational and environmental settings.

### **Atmospheric Chemistry**

An understanding of the structure and chemistry of the Earth's atmosphere. how it evolved, and the importance of the interplay between the atmosphere and other parts of the biosphere; an overview of the physical chemistry underpinning both natural and pollution based aspects of the atmosphere; an understanding of key environmental issues such as stratospheric ozone depletion, acid rain, tropospheric smog, and global warming; and an appreciation of the links and feedback between these issues.

### **Sources and Control of Air Pollution**

As a comprehensive course, it introduces the effects of air pollutants on human beings and environment, the sources of air pollution, and the physical and chemical behavior of pollutants in the atmosphere. Also, it covers legislation and regulation; control technologies and future trends toward preventing air pollution.

### **Techniques and Instrumentation in Air Pollution Monitoring**

Introduction to sampling techniques and analytical methods to measure environmental contamination in air, water, soils, and food. Emphasis on instrument selection and quality control, including documentation, calibration, and sample management.

### **Aerosol Measurements**

Subjects to be discussed include: aerosol mass concentration measurements (including source sampling, ambient PM sampling techniques such as TSP, PM10, PM2.5 and samplers for work place); particle size distribution (PSD) measurements (including cascade impactor, electrical sensing zone, laser diffraction, microscopy, etc.); aerosol speciation (including organic and inorganic composition analysis)

### **Dispersion Models**

The objective of this course is to provide students with knowledge and skills for air quality modeling, including air pollution dispersion modeling, meteorological modeling, emission modeling, 3-D photo-chemical modeling and their applications.

### **Receptor Models**

A forensic approach to identifying sources of air pollution based on actual observations called receptor modeling. The basics of receptor-oriented modeling for air pollution source apportionment will be given with current examples.

### **Advanced Environmental Soil Chemistry**

It is designed to provide an understanding of fundamental principles of environmental soil chemistry.

### **Special Topics Seminar in Environmental Engineering(1)**

It is designed to discuss emerging environmental issues including water/wastewater problems and soil/groundwater contamination.

### **Special Topics Seminar in Environmental Engineering(2)**

It is designed to discuss emerging environmental technologies including water/wastewater treatment and soil/groundwater remediation.

### **Ecological Engineering Design**

The pollution management technologies necessary to total water pollution load management constructed such as forests, agriculture, environmental facilities, urban distinguish to watershed management system suitable for field, and design process is learn through the establishment plan that ecological engineering skills are fit with regional characteristics.

### **Design of Constructed Wetland**

Learn various techniques of natural water purification engineering, and raise the capacity to apply the method to combine a variety of techniques the wetlands in accordance with the design purpose such as Geology, hydraulics, water quality, ecosystem. also lectures in conjunction post- monitoring technology.

### **Nano Technology(1)**

The intended course covers the whole spectrum of nanomaterials ranging from overview, synthesis, properties, and characterization of nanophase materials to application including some new developments in various aspects.

### **Nano Technology(2)**

The intended course covers the whole spectrum of nanomaterials ranging from overview, synthesis, properties, and characterization of nanophase materials to application including some new developments in various aspects.

### **Advanced Water Chemistry**

Study principal theories including General Chemistry, Physicochemical Chemistry, Organic Chemistry and others to apply in water pollution prevention and water treatment.

### **Filtration Technology**

Study solid-liquid separation technologies including slow sand filtration, rapid filtration, and membrane filtration.

### **Disinfection and Oxidation Technology**

Study disinfection and oxidation technologies involving chlorine, chloramines, chlorine dioxide, ozone, hydrogen peroxide, ultraviolet, and others.

### **Unit Operations for Water Treatment**

Study mass transfer and unit operations for processes in water treatment.

### **Special Topics in Water Supply**

Study best available technologies and best management practices for water treatment and distribution systems.

### **Special Topics in Water Reuse**

Study treatment, supply and social issues in water reclamation and reuse.

### **Special Topics in Wastewater Engineering**

Study issues and alternatives in sewage collection, conventional treatment and advanced treatment for wastewater.

### **Environmental Statistics**

Research in the field of environmental engineering will learn how to collect, analyze, and answer information through statistical methods for a given problem.

### **Advanced Oxidation Processes**

It is designed to provide an understanding of fundamental principles of advanced oxidation processes including photocatalysis, sonolysis, ozonolysis, and Fenton's oxidation.

### **Advanced Soil and Groundwater Contamination**

It is designed to provide an understanding of fundamental principles of soil and groundwater contamination and remediation.

### **Advanced Design and Operation of Environmental Engineering Systems**

It is designed to provide an understanding of fundamental principles of environmental engineering systems design and operation.

### **Advanced Environmental Modeling**

It is designed to provide an understanding of fundamental principles of environmental modeling.

### **Advanced Environmental Organic Chemistry**

It is designed to provide an understanding of fundamental principles of environmental organic chemistry.

### **Advanced Soil and Groundwater Remediation**

It is designed to provide an understanding of fundamental principles of soil and groundwater contamination and remediation.

### **Advanced Environmental Engineering**

It is designed to provide an understanding of fundamental principles of environmental engineering systems.