Master of Science in Environmental Sciences
[JOINT DEGREE PROGRAM]
Program code: 200035

INTRODUCTION

The Colleges of Science, Engineering, Law and Life Sciences offer a joint Master's degree program in **Environmental Science**. The program combines various specializations so that those who are interested in environment can gain knowledge about its biological, physical, chemical, civil, and legal aspects. Research requirements include either thesis or non-thesis options.

According to the University Council decision dated 4/2/2007, Thesis students admitted with effect from September 2007 are exempted from the comprehensive examination.

PROGRAM REQUIREMENTS

39 (39) TOTAL COURSE CREDITS (non-thesis option in parenthesis)

15 (18) COMPULSORY COURSES (3 credits each)

2040-500 Foundations of Environmental Sciences
2040-502 The Legal System of the Environment
2040-503 Environment and Sustained Developments
2040-504 Environmental Impact Assessment (EIA)
OR 0620-525 Environmental Management and Impact Assessment
2040-505 Environmental Research Methods and Statistical Analysis
2040-593 Project (Non-thesis option only)

9 (12) CORE COURSES (3 credits each)

Thesis option: The student selects three courses from the following groups but at least two of those courses should be from his/her specialty group.

Non-Thesis option: The student selects four courses from the following groups but at least three of those courses should be from his/her specialty group.

Law Group

2040-510 International Environmental Law
2040-511 Judiciary Protection of the Environment
2040-512 Administrative Responsibility of Public Authorities for Environmental Damages
2040-513 Environmental cases and the Problem of Financial Development
2040-514 Criminal Protection for the Environment

Engineering Group

2040-520 Energy Conservation
2040-521 Pollution Prevention
2040-522 Air Pollution Control
2040-523 Environmental Technology (for non-engineer students)
2040-524 Hazardous Materials Management (for students in all fields specialization)
2040-525 Municipal, industrial Waste and Hazardous Waste Management.
2040-526 Environmental Engineering Processes
OR 0620-521 Unit Operations & Processes of Environmental Engineering I
2040-527 Environmental Hydraulics

Science Group

2040-531 Conservation of Biodiversity and Natural Habitats
2040-532 Coastal Zone Management
2040-533 Remote Sensing and GIS Application in Environmental Science
2040-534 The Geology of Pollution
2040-535 Air Pollution and Climate Change

6 (9) CONCENTRATION COURSES (3 credits each)

The student is allowed to take a maximum of one concentration course (3 credits) from outside his/her specialty group.

Law Group

2040-550 Civil Liability for Damage to the Environment
2040-551 The Environmental Protection during Armed Conflicts
2040-552 Corporate Environmental Responsibility
2040-553 International Environmental Problems Resulted from Petroleum Operations
2040-554 International Law Rules for the Protection of the Marine Environment
2040-555 International Efforts Facing Desertification
2040-556 Public Tranquility Protection
2040-557 Comparative Environmental Law
2040-558 Special Topics in Environmental Law

Engineering Group

2040-559 Life Cycle Assessment
2040-560 Waste Minimization
2040-561 Industrial Water Treatment
2040-562 Environmental Auditing
2040-563 Environmental Standards and Measurements

2040-564 Refinery Waste Water Treatment
2040-565 Environmental Problem Solving with Computers
2040-566 Environmental Quality Modeling
2040-567 Noise Pollution and Control.
2040-568 Environmental Issues in Electrical Power Delivery Systems
2040-569 Special Topics in Environmental Engineering

Science Group

2040-570 Environmental Biotechnology.
2040-571 Management of Living Resources.
2040-572 Atmosphere and Climate
2040-573 Environmental Optics
2040-574 Radiation and Radioactivity
2040-575 Non-Ionizing Radiation
2040-576 Radiation Biophysics
2040-577 Topics in Radiological Health
2040-578 Radiation Detection and Measurement
2040-579 Introduction to Environmental Analysis
2040-580 The Chemistry of Pollution
2040-581 Environmental Chemistry of Organic and Inorganic Wastes
2040-582 Geo-environments, Natural Resources and Human Impact
2040-583 Introduction to Geographic Information Systems (GIS)
2040-584 Instrumental Methods in Environmental Earth Science
2040-585 Earth System Science and the Environment
2040-586 Environmental Geochemistry
2040-587 Environmental Geo-physics
2040-588 Ground water Geology
2040-589 Environmental Coastal Geology
2040-590 Desertification and Land Degradation
2040-591 Introduction to Atmospheric Science
2040-592 Topics in Environmental Sciences

9 COMPULSORY COURSES

2040-597 Thesis (0)
2040-598 Thesis (0)
2000-599 Thesis (9)

COURSE DESCRIPTION

2040-500: FOUNDATIONS OF ENVIRONMENTAL SCIENCE
CR: 3

Introduction to fundamental and theoretical concepts in Environmental Science. It provides a foundation for integrating geology, chemistry, physics, and biology concepts.

2040-502: THE LEGAL SYSTEM OF THE ENVIRONMENT
CR: 3

The definition of the environment, along with the importance of the environmental protection on the constitutional and legislative levels. It will focus on the powers of the administrative law, and the rules of the precautionary protection through the administrative enforcement in the Environmental field (air, water, food, Ionization and noise). The course will also address the national bodies responsible for environmental protection, the rules of administrative responsibility for environmental damage. The course will follow the comparative method among the administrative legal systems in Kuwait, the GCC members and other Arab States.

2040-503: ENVIRONMENT & SUSTAINED DEVELOPMENTS
CR: 3

Explore elements of sustainable development and how it affects our natural world. Discuss what constitutes social progress, and the character of development in the present and into the future. Discuss challenges involved in the implementation of sustainable development. Examine relations of sustainable developments and different socio-political and economic factors. Provide illustrations of sustainable developments on global, regional, and local levels. Discuss challenges facing high consumption societies, economies in transition and third world countries in their efforts to achieve sustainable development.

2040-504: ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
CR: 3

The impact of human activity on the environment. Topics like, the principles of EIA will be examined. The Emphasis will be on synthesizing the four basic resources areas of plants, animals, soil and water, with economic and social assessments under the heading of EIA.

2040-505: ENVIRONMENTAL RESEARCH METHODS AND STATISTICAL ANALYSIS
CR: 3

This course provides an introduction to a wide range of methods for conducting research in the environmental field. The course takes a multidisciplinary approach and it includes methods from the physical, biological, and social science arenas. They include methods of random and non-random sampling, methods of data collection (primary and secondary data) and approaches to data analysis. Discuss the reliability and validity of various measuring techniques.

2040-510: INTERNATIONAL ENVIRONMENTAL LAW
CR: 3

The first appearance of the environmental problems and the international efforts to face it, which created the field of international and environmental law. By examining the international and national sources of law, the international environmental law rules will be analyzed through the different époques. Moreover, the course will address the characters of the international environmental law. The protection offered to the air, water and land resources will also be examined. Finally, the course will focus on the international responsibility for environmental damage, and the method of settling environmental disputes.

2040-511: JUDICIARY PROTECTION OF THE ENVIRONMENT
CR: 3

The general principles of the judiciary protection, with special focus on the environmental protection. It will high light the legal problems of judicial environmental protection: the legal obstacles to the acceptance of the environmental protection lawsuits, the need for reform of the concept of 'interest in action' in environmental protection cases, and suggested changes in the law. It analyzes the class action as a measure for environmental protection. On the other hand it will search new

mechanisms for the implementation of environmental protection judgments (the exemplary fines and its applicability to the States). Finally, it will address the legal problems of enforcement of court actions concerning the environment.

2040-512: ADMINISTRATIVE RESPONSIBILITY OF PUBLIC AUTHORITIES FOR ENVIRONMENTAL DAMAGES
CR: 3

Administrative principles about organizing the preservative protection of environment by means of administrative police regulations. It demonstrates specific authorities, rules, sanctions which govern the matter by way of comparison among the different legal experiences in some other G.C.C. and Arab countries.

2040-513: ENVIRONMENTAL CASES AND PROBLEM OF FINANCIAL DEVELOPMENT
CR: 3

Environmental lessons and cases, which has financial effects on the balance of the state and its financial plans, including the negative effect on nature and natural resources. The course addresses the effect of the development on the water, air and land. Finally, it examines the directions and plans which have financial effect on the environmental cases and development.

2040-514: CRIMINAL PROTECTION FOR THE ENVIRONMENT
CR: 3

The legal basics for criminalizing acts that harm the natural environment. Basically, the course will focus on the traditional protection of the environment, the role of criminal legislation, the developing of he rules of criminal law to protect the environment. The course will address the indirect environmental protection that provided through number of specialized laws. The course will provide detailed vision to international and uninternational crimes committed against the environment, along with the criminal responsibility of individuals for environmental crimes.

2040-520: ENERGY CONSERVATION
CR: 3

Thermodynamics and energy conservation, energy and separation processes, optimization of heat exchanger systems, thermally coupled distillation systems, heat pumps, hybrid desalination systems, economic analysis of technical solution to energy conservation problems, term paper.

2040-521: POLLUTION PREVENTION
CR: 3

Strategies for pollution prevention. Principals of waste minimization. Wastes and emissions in Kuwait. Waste Audits Emission inventories. Pollution prevention for unit operations. Flow-sheet analysis for pollution prevention. Mass Exchange Networks graphical mass-pinch analysis. Path diagram for tracking pollutants. Synthesis of environmentally acceptable reactions. Practical Example: Prevention of NOx emissions from process heaters. Gas-oil- water separations. Reducing VOC emissions. Total site integration for reducing emissions.

2040-522: AIR POLLUTION CONTROL
CR: 3

Description models of pollutants in the atmosphere. Particulate matter and design of control equipment. Gaseous pollutant and design of control equipment. Atmospheric photochemical reactions. Instrumentation, measurement and emission testing equipment. Air pollution packages. Applications.

2040-523: ENVIRONMENTAL TECHNOLOGY
CR: 3

Overview of environmental laws and regulations, toxicology, ecology, air pollution, water pollution, water treatment, hazardous materials, solid and hazardous waste, waste site investigation and remediation, and occupational safety and health.

2040-524: HAZARDOUS MATERIALS MANAGEMENT
CR: 3

An overview of the management practices for hazardous materials and hazardous waste. This includes principles of science and technology, occupational health and safety concerns and regulatory compliance.

2040-525: MUNICIPAL, INDUSTRIAL WASTE AND HAZADOUS WASTE MANAGEMENT
CR: 3

Evaluation of processes used for treatment of wastes requiring special handling and disposal: toxic organic chemicals, heavy metals, acidic, and caustic waste material. Techniques for destruction, immobilization, and resource recovery, assessment of environmental impact of treatment process and products.

2040-526: ENVIRONMENTAL ENGINEERING PROCESSES
CR: 3

Quantitative study of physical, chemical and biological environmental processes. Analysis of pollution transport, treatment, containment, remediation. Process engineering approach to containment removal methods, including use of appropriate computer software. Materials balance approach to process analysis including use of non-steady-state behavior, process kinetics and reactor effects. Integration of individual processes into and overall treatment system. Case Studies.

2040-527: ENVIRONMENTAL HYDRAULICS
CR: 3

The technological advances of recent years include the emergence of new remote sensing and geographic information systems that are invaluable for the study of wetlands, agricultural land, and land use change. This course gives a comprehensive hydrogeologic overview that supplements information on hydrologic processes with data on these new information technology tools. Environmental hydraulics provide a qualitative understanding of hydrologic processes and cover new methods for quantifying hydrologic parameters and processes. Discusses the components of the hydrologic cycle, precipitation, stream processes, and human impacts. Illustrate use of new analytical tools and measurement methodologies in the field.

2040-531: CONSERVATION OF BIODIVERSITY AND NATURAL HABITATS
CR: 3

The importance of protecting natural ecosystems in general and biodiversity in particular. Protection of biodiversity and natural resources as international objective will be emphasized.

2040-532: COASTAL ZONE MANAGEMENT
CR: 3

An introduction to coastal zone management (CZM) designed for concentrator in marine environmental science. The course examines the many issues covering the wise control of coast. Topics include the physical setting; ecological characteristics; the utilization of coastal resources and economics, the various legal regimes responsible for management. The state CZM programs, and regional and international coastal zone management. Incorporation of these various separate disciplines into practical real-world integrated coastal management plans and analysis of local, regional and international coastal zone policies.

2040-533: REMOTE SENSING AND GIS APPLICATION IN ENVIRONMETAL SCIENCE
CR: 3

Principles of remote sensing, remote sensing platforms, radiation characteristics, analysis and interpretation of aerial and satellite images, application to global environment, applications to hazards and disasters.

2040-534: THE GEOLOGY OF POLLUTION
CR: 3

The geologic aspects of pollution. Natural and unnatural (authropogenic) sources of pollution; how do natural events such as volcanic eruptions forest fires, and dust storms pollution large portions of the world? How much of the pollution found in the world's oceans and ice sheets are natural in origin? How much of the global warming and acid rain problem is natural in origin?; chemical contamination by pollution out of the lithosphere and into the atmosphere, hydrosphere and biosphere; asbestos; radon radioactive gas; landfills; hazardous (radioactive) waste storage; deep ocean disposal sites; salt dome storage.

2040-535: AIR POLLUTION AND CLIMATE CHANGE
CR: 3

Introduction to atmospheric composition and climate Sulfur dioxide, Nitrogen oxide, Ammonium sulfates, acid rain formation and

deposition of acidity, ozone and photochemical smog, ozone depletion, effect at air pollutant (global and local).

2040-550: CIVIL LIABILITY FOR DAMAGE TO THE ENVIRONMENT
CR: 3

The term "Environment" and the risks threatening it with appraising the specific nature of the environmental damage. The course addresses both the traditional and new rules of environmental liability. It analyzes the civil procedures and other related laws that assure the right to seek compensation for environmental damage. Legal obstacles that reflect on the possibility for obtaining compensation for environmental damages will be examined during the course. In counterpart number of solutions and proposals will be set forth to eliminate such obstacle.

2040-551: ENVIRONMENAL PROTECTION DURING ARMED CONFLICTS
CR: 3

The international instruments that deal with the environmental protection. It will focus on the international humanitarian law, environmental law instruments and the instruments of disarmament. The course will survey some national laws that deal with military activities and its damage to the environment whether in peace time or times of armed conflicts, the responsibility for environmental harm during armed conflict, and propose new mechanism to avoid future environmental destruction.

2040-552: CORPORATE ENVIRONMENTAL RESPONSIBLITY
CR: 3

Focus on a particular area in the environmental law relating to the regulations that govern the role of companies towards the preservation of the environment. The purpose is to examine how the regulations impose a duty upon companies not to cause damage to the environment while conducting their activities. In addition, this course aims to explain the nature of the company by which responsibility can be established in the event of environmental damage. This course includes a case study on corporate environmental responsibility.

2040-553: INTERNATIONAL ENVIRONMENTAL PROBLEMS RESULTED FROM PETROLEUM OPERATIONS
CR: 3

The environmental damage caused by all the petroleum operations from discovering the oil wells until the consuming of the petroleum products. The Course will define each petroleum operation, exploration, digging, production, transportation, and consuming. The course will address national jurisdiction and international instruments that regulate petroleum operations, to explore their environmental positions toward such problems. The course will discuss some practical and hypothetical cases to explore the ideas of environmental protection in this field.

2040-554: INTERNATIONAL LAW RULES FOR THE PROTECTION OF THE MARINE ENVIRONEMNT
CR: 3

The Kuwait Regional Convention for the Protection of the Marine Environment form pollution and its protocols. Moreover, the United Nations Convention of the Law of the Seas will be analyzes thoroughly. Finally, the responsibility for polluting the marine environment will be addressed during the course in consideration with some international law principles such as "Polluter Pays"

2040-555: INTERNATIONAL EFFORTS FACING DESERTIFICATION
CR: 3

the problem of desertification, its causes and legal solutions. It will highlight the scientific and legal definitions of desertification. It focuses on both the internal and international law's efforts in fighting desertification by analyzing treaties, declarations, laws and regulations. Finally, the course examines the ideas and methods of enforcing the fight against desertification.

2040-556: PUBLIC TRANQUILITY PROTECTION
CR: 3

Environmental problems that legislature has dealt with and the judiciary has surrounded it with scrutiny. It is the problem of acoustic pollution. The conception of Public Tranquility and analyzes its legal and judiciary protection, the protection

provided by Islamic Law “Sharia’a” in order to confront this problem.

2040-557: COMPARATIVE ENVIRONMENAL LAW
CR: 3

The protection of the environment in Kuwaiti laws, in comparison with the protection offered by other legal systems. The comparison will be based on the environmental elements , water , soil and air protection. The course will also analyze the protection offered by the different legal systems to nature and natural resources. Finally, the course will address the role of governmental and non-governmental authorities in providing environmental protection and methods of enforcement.

2040-558: SPECIAL TOPICS IN ENVIRONMENTAL LAW
CR: 3

The course content is selected by the instructor and is designed to address special areas of the environmental law, which are not covered by other courses in the curriculum. The course content vary from year to year and it may include study of specific elements of the environmental law as well as detailed analysis and evaluation of legal aspects of actual field cases.

2040-559: LIFE CYCLE ASSESSMENT
CR: 3

The objective of this course is to provide a comprehensive understanding of life Cycle Assessment (LCA) system modelling and analyses. Through studying the environmental aspects and potential impacts throughout a (product) life (i.e.,cradle-to-grave) from raw material acquisition through production, use and disposal through formulating and applying the following steps and in accordance to ISO standards that apply: goal and scope definition, Inventory analysis, Impact Assessment, Interpretation in the broader sense of sustainability.

2040-560: WASTE MINIMIZATION
CR: 3

Concept of clean technologies with minimal emissions. Concept of waste minimization and its applications in process design. Waste reduction technologies such as in-plant modifications, recycle. Recovery and re-use and waste exchange. Case studies will include examples from petroleum refining, petrochemical and chemical industries.

2040-561: INDUSTRIAL WATER TREATMENT
CR: 3

Application of chemical engineering principles to selected operations encountered in industrial wastewater treatment. The course will cover the various industrial wastes. Special attention will be given to hazardous waste. Biological and kinetic models will be discussed.

2040-562: ENVRONMENTAL AUDITING
CR: 3

Designing, conducting and documenting an environmental audit. Compliance with the ISO Environmental Management Standard (ISO 14000). ISO 14000 basic features. Principal components of the Standard (Environmental Standard specification; Principles of environmental auditing; Eco-labeling principles and practice; Environmental performance evaluation; Life-cycle assessment). Benefits. Regulatory Compliance Auditing. Problems associated with complying with the increasing burden of environmental legislation. Compliance with occupational health and safety legislations.

2040-563: ENVIRONMENTAL STANDARDS AND MEASUREMNETS
CR: 3

Standards relating to the chemical composition, microbiology, and suspended solids content of wastewater. Standards relating to drinking water. Test methods, Physiology. Monitoring techniques and data analysis for water pollution. Standards relating to gaseous emissions into the atmosphere. Global warming . Point and fugitive emissions. Common gaseous chemical pollution (Sox, Nox, VOCs, etc). particulate emissions. Standard test methods, monitoring techniques and data analysis for air pollution. Standards relating to solid wastes, noise, thermal pollution.

2040-564: REFINARY WASTE WATER TREATMENT
CR: 3

Chemistry of refinery wastewater. Refinery effluents and primary treatment. Secondary and tertiary treatment techniques. Treatment of spent caustic and petrochemical plant effluents. Conditioning of cooling water. Computer

applications to refinery waste water flow sheeting. Case Studies.

2040-565: ENVIRONMENTAL PROBLEM SOLVING WITH COMPUTERS
CR: 3

Solution of general environmental problems using computers. Applications of numerical analysis, statistics, and data handling.

2040-566: ENVIRONMENTAL QUALITY MODELING
CR: 3

Comprehensive overview of transport-and-fate modeling of pollutions in surface water. An introduction to modeling fundamentals (mass balance, kinetics, transport) along with in-depth descriptions of how a variety of pollutants (pathogens, oxygen-demanding organics, nutrients, toxic and heat) move and react within a variety of water bodies.

2040-567: NOISE POLLUTION AND CONTROL
CR: 3

Introduction; Basic acoustics; Analysis of sound waves; Statistical analysis of c. “” noise levels; Measurement and instrumentation; Noise propagation in the environment; Practical noise measurement; Environmental noise regulations; Application of noise regulations.

2040-568: ENVIRONMENTAL ISSUES IN ELECTRICAL POWER DELIVERY SYSTEMS
CR: 3

Sources of power Frequency Fields in the Electric Power System. Modeling and calculating the Transmission Line Electrostatic Field Modeling and Calculating the Transmission Line Magnetic Field. Fields and Human Health Issues. Nature and Measurements of power Frequency Fields. Characterization of fields from Transmission and Distribution Lines. Characterization of Fields from Transmission and Distribution Substations and Transformers. Power Frequency Magnetic Fields at Home. Management of Fields by Shielding. The Science of Epidemiology.

2040-569: SPECIAL TOPICS IN ENVIRONMENTAL ENGINEERING
CR: 3

The Special topics course will provide an opportunity for introducing students to issues of contemporary importance in the field of environmental issues and the engineering approach to solving it.

2040-570: ENVIRONMENTAL BIOTECHNOLOGY
CR: 3

A study of fundamentals of environmental biotechnology focusing on the role of micro-organisms in the remediation of municipal and industrial organic waste, and the management of contaminated sites.

2040-571: MANAGEMENT OF LIVING RESOURCES
CR: 3

Importance of living resources and their sound utilization in order to ensure sustainability.

2040-572: ATMOSPHERIE AND CLIMATE
CR: 3

Atmospheric composition and energy, atmospheric moisture, atmospheric motion, air masses and fronts, small scale climate. Climate change, and global observations.

2040-573: ENVIRONMENTAL OPTICS
CR:3

Light sources and detectors, Color Temperature and Brightness, Imaging and optical Instruments Protection from optical Radiation.

2040-574: RADIATION AND RADIOACTIVITY
CR: 3

Atomic theory, Nuclear structure, Nuclear radiation, Radioactivity, Interaction of radioaction with matter, Nuclear reactions and production of radio isotopes, Neutron activation analysis, Nuclear fission, Environmental radioactivity, Biological effects of radiation.

2040-575: NON-IONIZING RADIATION
CR: 3

Basic physical phenomena, Electro- Magnetic radiation in the non-ionizing range, RF, microwave, visible, Interaction and mechanisms, Biological effects and hazards, Instruments, Field measurements, UV radiation, Ozone filter, safety

measures Lasers, sources, application and safety measures. Toxic and non toxic elements in environments and Risk assessment, Radiation exposure from consumer products - Television receivers, Video Display Terminals, Airport x-ray machines, etc.

2040-576: RADIATION BIOPHYSICS
CR: 3

Exposure and dose equivalents, Energy transfer processes, Multiple collision energy transfer, Absorbed dose and Kerma, Neutron interactions in tissues, Neutron dosimetry, Metabolism and biological effects of deposited radionuclides, Radionuclides of biological importance, Therapeutic radiology, Acute response of normal tissues, Acute lethal response in mammals, Acute radiation syndrome in man, Late effects of radiation on normal tissues-stochastic and non-stochastic effects. High linear energy transfer radiation effects and relative biological effectiveness.

2040-577: TOPICS IN RADIOLOGICAL HEALTH
CR: 3

Background radiation levels, Radiation exposure standards, external and internal radiation exposure and protection. Dose measurement, External and internal human dose estimation by computational methods, Sources of background, Active methods of background reduction, The physical basis of radiation protection, Radiation levels, Occupational exposure, Space radiation problems, Environmental radioactivity and natural background, Risk estimates for the Tissue Weighing factor, Dose from inhaled radionuclides, Exposure from Cosmic rays and cosmogenic radionuclides; Exposure from medical applications - Diagnostic X-ray examination, Therapeutic radiology and Nuclear medicine procedures, Exposure from nuclear power operations.

2040-578: RADIATION DETECTION & MEASUREMENT
CR: 3

General properties of radiation detection, Energy resolution, Detector efficiency, Ionization Chambers, Geiger-Muller counters, Scintillation detectors, Phototubes and photodiodes, Semiconductor detectors, Si and Ge detectors, Multichannel, analysis, Background radiation and sheilding, Counting and statistics, Dose estimation, Radiation protection.

2040-579: INTRODUCTION TO ENVIRONMENTAL ANALYSIS
CR: 3

The application of analytical techniques such as gass chromatography, liquid chromatography, infra-red, x-ray fluorescence, for analyzing and measuring water, solid and atmospheric samples and for monitoring environmental pollutants.

2040-580: THE CHEMISTRY OF POLLUTION
CR: 3

An overview of the important aspects of pollution occuring in the atmosphere, water and soil. Commonly known harmful substances (CO, heavy metals, SO2, toxins in foods, radioisotopes).

2040-581: ENVIRONMENTAL CHEMISTRY OF ORGANIC AND INORGANIC WASTES
CR: 3

Treating industrial systems as analogous to natural ecosystems, hazardous wastes from an innovative perspective, the human-made anthrosphere; principles of industrial metabolism; toxicological and biological hazards; and the industrial ecology of waste minimization, treatment, and disposal, exposure to general and organic and inorganic chemistry, overall framework of industrial ecology to cover hazardous wastes from an environmental chemistry perspective.

2040-582: GEOENVIRONMENTS, NATURAL RESOURCES AND HUMAN IMPACT
CR: 3

Study of the dynamic interactions of geologic process and human activities; human modification and nature; the impact of population growth and technological change upon the environment; examples of environmental disruption; oil spills, sea-level rise, greenhouse effect, ozone depletion, radon threat, earthquake, volcanoes, etc. Geologic resources and energy; pollution, soil and groundwater contamination; land use; global warming and geological record of global change.

2040-583: INTRODUCTION TO GEOGRAPHIC INFORMATION SYSTEMS (GIS)
CR: 3

Applied experience in using GIS in natural resource management and pollution monitoring.

2040-584: INSTRUMENTAL METHODS IN ENVIRONMENTAL EARTH SCIENCE
CR: 3

Laboratory and field experiences will vary, methods may include work with petrographic microscope, sedigraph, ICP, XRF, and GPR.

2040-585: EARTH SYSTEM SCIENCE AND THE ENVIRONMENT
CR: 3

An integrated approach to studying the Earth, its origin, composition, structures, antiquity and the forces which shaped it. This very environmentally oriented course focuses on interaction between geologic, biologic and oceanographic processes. The course provides a basic understanding of systems operating within the geosphere, atmosphere, hydrosphere and biosphere. Half of the course is devoted to developing an understanding of the interactions between these systems, including consequences of population and economic growth, industrial development and land-use changes.

2040-586: ENVIRONMENTAL GEOCHEMISTRY
CR: 3

Overview of low-temperature geochemistry through the treatment of a selection of geochemical issues of Environmental significance. It will emphasize in each unit geochemical topics in the context of a broader geological perspective.

2040-587: ENVIRONMENTAL GEOPHYSICS
CR: 3

The environmental geophysical application methods to the investigation of near-surface physicochemical phenomena which are likely to have (significant) implications for the management of the local environment. An emphasis is based upon the use of geophysics in civil engineering and environmental groundwater investigations. This provide an in depth analysis of the very latest developments in environmental geophysics.

2040-588: GROUNDWATER GEOLOGY
CR: 3

The study of the subsurface waters of the earth, their entry, circulation and distribution, storage and interaction with earth materials, and their chemical and physical properties. Evaluation development, and management of groundwater resources and assessment of environmental problems associated with groundwater use.

2040-589: ENVIRONMENTAL COASTAL GEOLOGY
CR: 3

A study of coastal erosional, depositional and tectonic processes, morphology and coasts classification; sediments and wave-related processes active in the present and geologic past. Major topics include beach, near-shore estuarine processes; barrier island, lagoon, coastal sabkha, salt marsh development; quaternary sea-level fluctuations and man-made modifications of coastal environment and related erosional-depositional patterns.

2040-590: DESERTIFICATION AND LAND DEGRADATION
CR: 3

The problems of desertification and land use degradation, and work out a plan of controlling this phenomenon and its after-effects. It highlights the role of United Nations in the struggle against desertification processes. This course will also emphasis on measuring techniques, instruments and basic procedures used to perform experiment and field measurements/observations of different factors and phenomena that are related to desert and desertification.

2040-591: INTRODUCTION TO ATMOSPHERIC SCIENCE
CR: 3

Atmospheric sciences is an umbrella term for the study of the atmosphere, its processes, the effects other systems [such as the oceans] have on the atmosphere, and the effects of the atmosphere on these other systems. Meteorology includes atmospheric chemistry and atmospheric physics with a major focus on weather forecasting. Climatology is the study of atmospheric changes (both long and short-term) that define average climates and their change over time, due to both natural and anthropogenic climate variability. Aeronomy is the study of the upper layers of the atmosphere, where dissociation and ionization are important.

2040-592: TOPICS IN ENVIRONMENTAL SCIENCES
CR: 3

The course content is selected by the instructor and is designed to address special areas of the environmental science, which are not covered by other courses in the curriculum. The course content vary from year to year and it may include fundamental elements of environmental science and engineering, field projects and data collection, data analysis and report writing.

2040-593 PROJECT
CR: 3

The student undertakes an independent project on a research topic of theoretical and/or experimental focus under the supervision of a faculty member listed in the supervisory list of the College of Graduate Studies. The objective is to provide the student with an opportunity to integrate and apply the knowledge gained throughout the course of study in a practical problem. The student must document the project in a scientific report following standard research writing guidelines and give a public presentation to the project examination committee.

2040-597: THESIS
CR: 0

2040-598: THESIS
CR: 0

2000-599: THESIS
CR: 9