جامعة الإمام عبد الرحمن بن فيصل
IMAM ABDULRAHMAN BIN FAISAL UNIVERSITY

Environmental Engineering Department

Program Bulletin
Handbook & Course Catalogue

2023

Department of Environmental Engineering

-

Program Offering

B.Sc. in Environmental Engineering

Website: https://www.iau.edu.sa/en/colleges/college-of-engineering/departments/environmental-engineering-department

Environmental Engineering Department – An Introduction

The Department of environmental engineering is considered a pioneer since it is the first department to offer a bachelor's degree in environmental engineering in the Kingdom of Saudi Arabia. It concentrates on applying the fundamentals of sciences and engineering towards improving the environment (air, water, and earth resources) to provide potable and palatable water, clean air, and useful land to be used by humans and other living organisms and to treat polluted areas. Environmental engineering incorporates water and air quality management, pollution abatement, reuse and recycling, hazardous solid waste disposal, general health issues, and knowledge of related law to environmental engineering. Environmental engineering also involves environmental impact assessment for proposed projects in building and industry. An environmental engineer is concerned with environmental behavior and hazardous solid waste management in the form of studies to evaluate these hazards, offering advice regarding treatment and enclosure, and establishing systems to prevent accidents. Other concerns of the environmental engineer are the design of municipal and industrial water supply and wastewater treatment systems. This is in addition to the responsibilities all over the globe with environmental issues such as the effects of transboundary pollutants, ozone layer depletion, water pollution and air pollution from vehicles and industrial sources.

To obtain the B.Sc. degree in Environmental Engineering, the student must successfully complete 168 credit hours (Cr. Hr.), to satisfy four requirements: University requirements courses, Math plus basic sciences, basic engineering courses, and core courses of the program.

Environmental Engineering Program Vision

Create a distinguished program promoting excellence in environmental engineering education and research with effective community services.

Environmental Engineering Program Mission

Graduate distinguished engineers capable of developing sustainable solutions to environmental challenges, incorporating R&D and community services.

Environmental Engineering Program Goals

The main goals of the program are that it will prepare graduates with the following attributes:

1. Implement technical, collaborative, and communication skills with leadership principles, to pursue careers in Environmental Engineering.
2. Seek higher degrees in Environmental Engineering and embark on life-long learning.
3. Seek professional licensure, discharge their professional Environmental Engineering skills ethically, and be conscious of the impact of Environmental Engineering projects on society.

Environmental Program Educational Objectives

The Environmental Engineering Program and its various constituents discussed in successive meetings the ABET requirements for developing the Program's Educational Objectives (PEOs) by focusing on the main elements of the university's mission, such as creative knowledge, research, and professional community services. All those elements are the key focus points of PEOs of the program, and those PEOs can help us to envision the future of our prospective and current students. After several departmental meetings, the department, with the help of its constituents, including faculty, alumni, potential employers, and the external advisory committee (EAC) approved the following PEOs. Pursue advanced studies in environmental engineering or in other disciplines.

The approved PEOs for our program are to:

1. Pursue careers in environmental engineering or other fields and seek professional licensure.

2. Seek advanced degrees or continue to engage in life-long learning to adapt to evolving technologies and changing career opportunities.

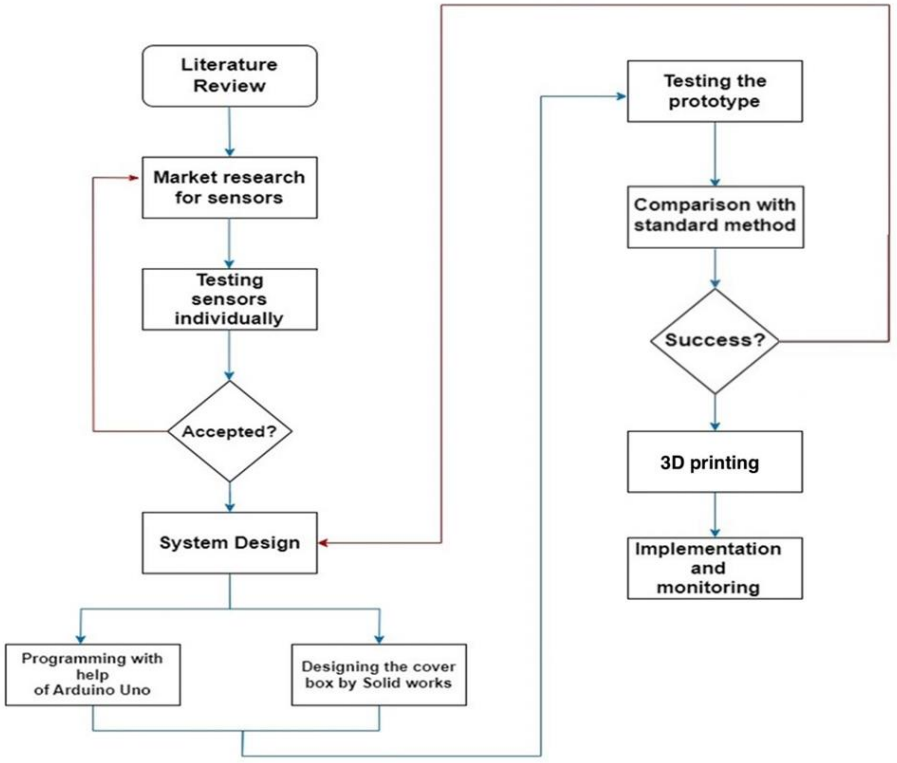
3. Attain leadership roles to be an advocate for their profession for the broader good of the community.

Student Outcomes

Student outcomes relate to the knowledge, skills, and competencies that the graduates of B.Sc. in Environmental Engineering program will possess. Students graduating from this program should have:

1. An ability to identify, formulate, and solve complex engineering problems by applying engineering, science, and mathematics principles.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. The ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to conclude.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Students working on HPLC Instrument



Senior Design Project: Building a Low-cost Outdoor Smart Air Quality Monitoring System.

Jobs Opportunities and Categories after Graduation

Environmental engineering graduates have numerous employment opportunities in the public and private sectors, such as government ministries, municipalities, and shared companies between public and private sectors. In the private sector, employment is possible nationally and internationally at engineering offices, industrial enterprises, or through national or global contracting companies with projects in the Gulf region or worldwide. Some sectors where environmental engineers can get a job are:

Table 1: Employment Locations & Possible Job Classifications after Graduation

Employment Locations After Graduation	
Waste management	National Center for Waste Management (NCWM)
General Environmental Engineering	Ministry of Environment, Water, and Agriculture (MEWA)
Policy and Regulation	National Center for Environmental Compliance (NCEC)
Energy sector	Saudi ARAMCO, SABIC
Engineering Offices or Research and Technology Development	Industrial Cities: Local & International Environmental Consulting Companies
Possible Job Classifications	
Quality Assurance Engineer	Site Engineer
Water/Wastewater Engineer	Design & Consultant Engineer
Waste Management Engineer	Design & Consultant Engineer
Air Pollution Control Engineer	Design & Consultant Engineer
Project Manager	Design & Consultant Engineer
Sustainability/Circular Economy/Carbon Capture	Design & Consultant Engineer
Environmental Engineer	Design & Consultant Engineer

Table 2 lists the enrollment and graduation data for the Bachelor of Science in Environmental Engineering program since its inception.

Table 2: Student enrollment and graduation data

Academic Year	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Enrollment	18	20	18	47	54	41
Graduation	11	13	9	18	9	-

Department Faculty, Staff, and Laboratories

There are nine faculty members, one lecturer, two teaching assistants, one administrative member, and six technicians and engineers in the Environmental Engineering Department. Two teaching assistants are currently on scholarship, pursuing higher degrees in the UK and USA. Table 3 below lists the current faculty members, their significant fields, specialties, and their highest degree university.

Table 3: Faculty members in Environmental Engineering Department

No.	Name	Academic Rank	Specialty	Highest Degree University
1	Omer Aga	Professor	Ph.D., Environmental Engineering	Middle East Technical University, Turkiye
2	Cevat Yaman	Professor	Ph.D., Environmental Engineering	Drexel University, USA
3	Nuhu Dalhat Muazu	Associate Professor	Ph.D., Environmental Engineering	King Fahd University of Petroleum & Minerals, Saudi Arabia
4	Ismail Anil	Associate Professor	Ph.D., Environmental Engineering	Gebze Technical University, Turkiye
5	Ibrahim AlJamaan	Assistant Professor	Ph.D., Electrical Engineering	University of Calgary, Canada
6	Gulraiz Khan	Lecturer	M.Sc., Oil & Gas Technology	Aalborg University, Denmark
7	Mohammed Saood Manzar	Lecturer	M.Tech., Environmental Engineering	Aligarh Muslim University, India
8	Aleem Qureshi	Lecturer	M.Sc., Microbiology	Swamiramanand Teerth Marathwada University, India
9	Mohammad Barghouti	Lecturer	M.Sc., Analytical Chemistry	Middle East Technical University, Turkiye
10	Mukarram Zubair	Lecturer	Ph.D., Environmental Engineering	Universiti Sains, Malaysia
11	Ayse Burcu Yaman	Lecturer	M.Sc., Environmental Engineering	Gebze Technical University, Turkiye
12	Muhammad Al Yahya	Technician	B.Sc, Biochemistry	King Saud University, Saudi Arabia
13	Wamda Faisal Elmobarak Elhaj	Teaching Assistant	Ph.D., Chemical Engineering	Qatar University, Qatar

The Environmental Engineering Department is equipped with a host of state-of-the-art laboratories. The Computer Lab is available for students to complement student learning and enhance their skills by using modern engineering tools necessary for engineering practice. The laboratories are used by all the departments in the College of Engineering for the introductory engineering courses common to all engineering programs. Table 4 lists the different department labs along with the associated equipment.

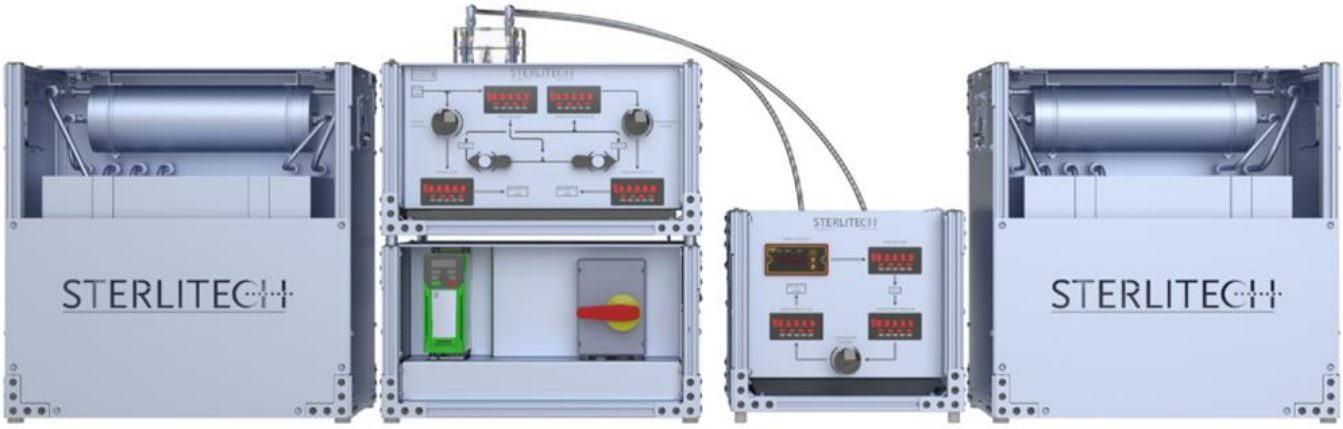
Table 4: Laboratories and the Associated Lab Equipment

No.	Laboratory Name	Associated Lab Equipment
1	Environmental Chemistry	UV-VIS spectrophotometer Biochemical oxygen demand (Oxitop box) Chemical oxygen demand (Thermo reactor) Muffle Furnace - Nabertherm Drying and Heating Oven - E28 series, Binder Desiccator for Drying/Storage– Sicco, Bohlender Kjeldahl Steam Distillation Unit – Behr Automatic Kjeldahl Distillation Unit - VELP Scientifica Vacuum Filtration System – VWR pH, conductivity, turbidity, and color meter Sonicator/shaker/ water bath
2	Environmental Microbiology	Autoclaves Incubators Laminar Air Flow Centrifuges Microscopes Colony counter Hot air oven Biosafety cabinet Incufridge Refrigerator Balance Water bath Digital inverted microscope Coriolis µ microbial air sampler for cleanrooms
3	Air Pollution	Aethalometer (Elemental & Organic Carbon) HHPC Airborne Particle Sampler Laser Aerosol Spectrometer pH Meter Air Canister Volatile Organic Compound Monitor Gas Monitor Coriolis Bio-Aerosol Sampler Dichotomous particulate matter Sampler High-volume particulate matter sampler Volatile Organic Compound Sampler (Puffs) Rotary evaporator
4	Air Pollution Control	Multi cyclone system Venturi scrubber system Spray chamber system Pulsed-jet bag filter system Electrostatic precipitator system
5	Environmental Analysis	Inductively Coupled Plasma - MS Inductively coupled plasma – OES Atomic Absorption Spectrometer equipped with Hydride Generation unit as well as Graphite Furnace unit. Fourier transform infrared spectroscopy Microwave digestion system Distillation and deionized water systems

6	Solid Waste Management	CHNS element analyzer Total organic carbon analyzer Surface area and pore size analyzer TCLP Calorimeter Distillated water system
8	Biotechnology Research	Fermenter / Bio reactor Furnace Automatic titration unit Sonicator/shaker/ water bath Zeta potential Tubular furnace Centrifugation system Oven Weighing machine CO_2 capture column
9	Membrane Technology & Corrosion Research	UV-VIS spectrophotometer Fermenter / Bio reactor Furnace Distilled water system pH, conductivity, turbidity, and color meter Automatic titration unit Sonicator/shaker/ water bath Electrospinning Machine Ultrasonicator Microwave reactor
10	Wastewater & Organic Analysis	Gas chromatography coupled with mass spectrometry. Liquid chromatography High-performance liquid chromatography Furnace Rotary evaporator Automatic titration unit

Mobile Air Pollution Monitoring Station

Unit Operation Lab: Flocculation precipitation system



Reverse Osmosis and Forward Osmosis Benchtop Desalination and Membrane Treatment System

Wastewater Lab: Shimadzu Prominence Ultra-Fast Liquid Chromatograph

Environmental Chemistry Lab: Filtration apparatus

Air Pollution Lab: High Volume Air Sampler

B.Sc. Program Curriculum

The B.Sc. in Environmental Engineering program curriculum is a four-year program preceded by a one-year Preparatory-Year Program during which a student is taught English and some pre-college subjects and skills. The number of credits required for the degree of B.Sc. in Environmental Engineering is 132, while for the Preparatory-Year Program is 36 credit hours. Students need a total of 168 credit hours to graduate.

The B.Sc. in Environmental Engineering program curriculum has been designed to satisfy the requirements set forth by the Accreditation Board for Engineering and Technology (ABET), USA, in that it has:

(a) a minimum of 30 semester credit hours (or equivalent) of a combination of college-level mathematics and basic sciences with experimental experience appropriate to the program
(b) a minimum of 45 semester credit hours (or equivalent) of engineering topics appropriate to the program, including engineering and computer sciences and engineering design and utilizing modern engineering tools.
(c) a broad education component that complements the technical content of the curriculum and is consistent with the program's educational objectives, and
(d) a culminating significant engineering design experience that 1) incorporates appropriate engineering standards and multiple constraints and 2) is based on the knowledge and skills acquired in earlier course work.

Tables 5 and 6 lists the sequence of courses for the Preparatory Year and the Bachelor of Science in Environmental Engineering programs for the two-semester system, respectively. Since the start of the academic year 2022-2023, a trimester system has been followed at IAU without any changes to the total program credit hours. In the trimester system, each term is of 10-week duration, and in order to be consistent with the definition of a credit hour, which is a 50-minute lecture session each week over a 15-week term, a multiplication factor of 1.5 is used to keep the same amount of lecture contact hours as in a 15-week period. Consequently, the average course loads each term have also been reduced by the same factor. Table 7 lists the study plan for the trimester Bachelor of Science in Environmental Engineering program effective from Academic Year 2022-2023.

Table 5: Preparatory-Year Program Courses

Semester	Course			Category (Credit Hours)			
	Course Number		Title	Math and Basic Sciences	Engineering Topics		Broad Education Component
					Science	Design	
First Preparatory Semester 1st	ISLAM	181	Creed and Family in Islam				2.0
	ENGL	101	General English Language*				7.0
	MATH	111	Math I	3.0			
	ARCH	121	Basic Design Studio I*			3.0	
	LRSK	141	Learning & Searching Skills		2.0		
	PHEDU	162	Physical Education*				1.0
Second Preparatory Semester 2nd	ARAB	182	Arabic Language Skills				2.0
	ENGL	102	English for Academic and Specific Purpose				3.0
	MATH	112	Math II	3.0			
	ARCH	122	Basic Design Studio II*			3.0	
	PHYS	132	Physics	3.0			
	LRSK	142	Communication Skills				2.0
	COMP	131	Computer Skills*		2.0		

(*) indicates that the course includes tutorial/laboratory/experimental experience.

Table 6: Bachelor of Science (B.Sc.) in Environmental Engineering Curriculum

Semester	Course			Category (Credit Hours)			
	Course Number		Title	Math and Basic Sciences	Engineering Topics		Broad Education Component
					Science	Design	
First Freshman Semester 3rd	HUMAN	201	Library Skills*				1.0
	ENGL	211	English Composition				3.0
	CHEM	221	General Chemistry*	3.0			
	ENG	251	Introduction to Engineering*		1.0		
	MATH	261	Calculus I	4.0			
	PHYS	271	Physics I*	4.0			
	HIST	281	History and Civilization of Kingdom				2.0
Second Freshman Semester 4th	COMP	212	Computer Programming*		2.0		
	ENG	222	Engineering Drawings*		3.0		
	ENG	232	Statics		3.0		
	MATH	262	Calculus II	4.0			
	PHYS	272	Physics II*	4.0			
	ISLM	282	Islamic Ethics and Values				2.0
First Sophomore Semester 5th	HUMN	301	Oral Communication and Public Speaking				1.0
	CHEM	311	Environmental Chemistry	3.0			
	CHEM	321	Organic Chemistry	2.0			
	ENG	321	Fluid Mechanics		3.0		
	ENVEN	311	Environmental Engineering Fundamentals			3.0	
	MATH	331N	Differential Equations*	3.0			
Second Sophomore Semester 6th	MATH	302	Linear Algebra	3.0			
	GEOL	312	Geology	2.0			
	ENVEN	322	Environmental Microbiology		3.0		
	ENG	332	Engineering Materials		2.0		
	ENVEN	342	Water Supply Engineering			3.0	
	ENVEN	352	Water Quality		2.0		
	ENVEN	333	Summer Training I			0.0	
	BUS	381	Entrepreneurship				2.0

Semester	Course		Title	Category (Credit Hours)			
	Course Number			Math and Basic Sciences	Engineering Topics		Broad Education Component
					Science	Design	
First Junior Semester 7th	ENG	441	Thermodynamics, Mass and Heat Transfer		3.0		
	CONEN	431	Fundamentals of Soil Mechanics		3.0		
	ENVEN	411	Unit Operation and Processes 1			3.0	
	ENVEN	421	Air Pollution		2.0		
	ENVEN	431	Engineering Hydrology		2.0		
	MATH	411	Probability and Statistics*	3.0			
	ENG	401	Technical Writing				2.0
Second Junior Semester 8th	HUMN	402	Research Methodology				1.0
	ENVEN	422	Wastewater Engineering 1			3.0	
	ENVEN	432	Unit Operations and Processes 2			3.0	
	ENVEN	442	Air Pollution Control			3.0	
	ENG	412	Engineering Economics		2.0		
	ENVEN	452	Introduction to Geo-Tech and Geo-Env Engineering			2.0	
	MATH	472	Numerical Methods	3.0			
	ENVEN	444	Summer Training II			0.0	
First Senior Semester 9th	HUMN	501	Professional Practice and Ethics				2.0
	ENVEN	501	Design of Environmental Projects			3.0	
	ENVEN	521	Senior Design Project 1*			2.0	
	ENVEN	531	Wastewater Engineering 2			3.0	
	ENVEN	462	Solid and Hazardous Waste Management			3.0	
	ENVEN	5xx	Elective 1		3.0		
Second Senior Semester 10th	ENVEN	522	Senior Design Project 2*			4.0	
	HUMN	512	Environmental Law and Regulations		2.0		
	ENVEN	5xx	Elective 2		3.0		
	ENVEN	5xx	Elective 3		3.0		
	ENVEN	5xx	Elective 4		3.0		
				Math and Basic Sciences	Engineering Topics		Broad Education Component
					Science	Design	
Total Basic-Level Environmental Engineering Program Requirements				38	45 + 35 = 80.0		16

Semester	Course		Category (Credit Hours)			
	Course Number	Title	Math and Basic Sciences	Engineering Topics		Broad Education Component
				Science	Design	
Overall Total for Environmental Engineering Degree			**134.0**			
ABET Requirements: Minimum Semester Credit Hours			**30**	**45** (including Design Component)		Broad Education Component

(*) indicates that the course includes tutorial/laboratory/experimental experience.

Table 7: The Trimester Bachelor of Science (B.Sc.) in Environmental Engineering Curriculum Effective since Academic Year 2022-2023

Semester	Course			Category (Credit Hours)			
	Course Number		Title	Math and Basic Sciences	Engineering Topics		Broad Education Component
					Science	Design	
First Freshman Semester	ENGL	211	English Composition				3.0
	MATH	261	Calculus I	4.0			
	PHYS	271	Physics I*	4.0			
	HIST	281	History and Civilization of Kingdom				2.0
Second Freshman Semester	CHEM	221	General Chemistry*	3.0			
	ENG	251	Introduction to Engineering*		1.0		
	MATH	262	Calculus II	4.0			
	PHYS	272	Physics II*	4.0			
Third Freshman Semester	HUMN	201	Library Skills*				1.0
	COMP	212	Computer Programming*		2.0		
	ENG	222	Engineering Drawings*		3.0		
	ENG	232	Statics		3.0		
	ISLM	282	Islamic Ethics and Values				2
First Sophomore Semester	MATH	302	Linear Algebra	3.0			
	CHEM	321	Organic Chemistry	2.0			
	ENG	321	Fluid Mechanics		3.0		
	GEOL	312	Geology	2.0			
Second Sophomore Semester	MATH	331 N	Differential Equations*	3.0			
	ENG	332	Engineering Materials		2.0		
	ENVEN	311	Environmental Engineering Fundamentals			3.0	
	CHEM	311	Environmental Chemistry	3.0			
Third Sophomore Semester	BUS	381	Entrepreneurship				2.0
	HUMN	301	Oral Communication and Public Speaking				1.0
	ENVEN	342	Water Supply Engineering			3.0	
	ENVEN	352	Water Quality		2.0		
	ENVEN	322	Environmental Microbiology		3.0		

Semester	Course			Category (Credit Hours)			
	Course Number		Title	Math and Basic Sciences	Engineering Topics		Broad Education Component
					Science	Design	
	ENVEN	333	Summer Training I			0.0	
First Junior Semester	MATH	411	Probability and Statistics*	3.0			
	ENG	401	Technical Writing				2.0
	ENG	441	Thermodynamics, Mass and Heat Transfer		3.0		
	CONEN	431	Fundamentals of Soil Mechanics		3.0		
Second Junior Semester	ENG	412	Engineering Economics		2.0		
	ENVEN	411	Unit Operation and Processes I			2.0	
	ENVEN	421	Air Pollution		2.0		
	ENVEN	431	Engineering Hydrology		2.0		
	ENVEN	452	Introduction to Geo-Tech and Geo-Env Engineering			2.0	
Third Junior Semester	HUMN	402	Research Methodology				1.0
	MATH	472	Numerical Methods	3.0			
	ENVEN	432	Unit Operations and Processes II			3.0	
	ENVEN	442	Air Pollution Control			3.0	
	ENVEN	422	Wastewater Engineering, I			3.0	
	ENVEN	444	Summer Training II			0.0	
First Senior Semester	HUMN	501	Professional Practice and Ethics				2.0
	ENVEN	521	Senior Design Project I*			2.0	
	ENVEN	501	Design of Environmental Projects			3.0	
	ENVEN	531	Wastewater Engineering II			3.0	
	HUMN	512	Environmental Law and Regulations		2.0		
Second Senior Semester	ENVEN	5xx	Elective I		3.0		
	ENVEN	5xx	Elective II		3.0		
	ENVEN	522	Senior Design Project II*			4.0	
Third Senior Semester	ENVEN	462	Solid and Hazardous Waste Management			3.0	
	ENVEN	5xx	Elective III		3.0		

Semester	Course			Category (Credit Hours)			
	Course Number		Title	Math and Basic Sciences	Engineering Topics		Broad Education Component
					Science	Design	
	ENVEN	5xx	Elective IV		3.0		
				Math and Basic Sciences	Engineering Topics		Broad Education Component
					Science	Design	
Total Basic-Level Environmental Engineering Program Requirements				38	45 + 45		16
					80.0		
Overall Total for Environmental Engineering Degree				134.0			
ABET Requirements: Minimum Semester Credit Hours				30	45 (including Design Component)		Broad Education Component

(*) indicates that the course includes tutorial/laboratory/experimental experience.

The B. Sc. Program in Environmental Engineering allows flexibility in course offerings through four choices for Elective courses related to the field to enhance student learning experience. A list of the elective courses offered by the program is given in Table 8.

Table 8: Elective Courses

Course Number	Course Title	Credit hours	Lecture hours	Lab hours
ENVEN 503	Environmental Impact Assessment	3	3	0
ENVEN 513	Integrated Water Resources Management	3	3	0
ENVEN 523	Environmental Project Management	3	3	0
ENVEN 543	GIS for Environmental Engineers	3	3	0
ENVEN 553	Waste Containment Structures	3	3	0
ENVEN 563	Noise Pollution and Control	3	3	0
ENVEN 573	Ground Water Engineering and Contamination	3	3	0
ENVEN 583	Pollution Control in Petroleum Engineering	3	3	0
ENVEN 593	Site Remediation	3	3	0
ENVEN 504	Wastewater Reclamation and Reuse	3	3	0
ENVEN 514	Desalination Technologies	3	3	0
ENVEN 524	Hydraulic Structures	3	3	0
ENVEN 534	Public Health in Engineering Projects	3	3	0
ENVEN 544	Marine Pollution and Control	3	3	0
ENVEN 554	Environmental Toxicology	3	3	0
ENVEN 564	Industrial Wastes Management	3	3	0

Course Number	Course Title	Credit hours	Lecture hours	Lab hours
ENVEN 574	Hazardous Waste Engineering and Management	3	3	0
ENVEN 584	Coastal Engineering	3	3	0
ENVEN 594	Special Topics in Environmental Engineering	3	3	0

Courses Descriptions

A brief description of the core and elective courses offered by the Bachelor of Science in Environmental Engineering program is provided below and indicates the Course number, credit hours, lecture hours, laboratories/practical/tutorial hours, and the required prerequisites. Courses are listed according to their order in the program curriculum listed in Table 7 and then as electives as listed in Table 8.

ENGL 211: English Composition

Credit Hours: 3 Lecture hours: 4.5 Lab/Practical hours: 0 Prerequisite: None

This course will enable the student to improve his ability to write expository essays. The course topics include Investigation of topic-selection processes, development of thesis statements, outlining as it relates to support for a selected thesis statement, both in sentence and slug-style, and practice and emphasis on critical thinking skills. The course is designed to introduce the general process of communicating meaning through writing and to enable students to practice writing short personal essays drawn from explorations of memory, observation, conversation, and reading.

MATH 261: Calculus I

Credit Hours: 4 Lecture hours: 6 Lab/Practical hours: 0 Prerequisite: None

In this course, students will learn the basics of the calculus of functions of one variable. They will also apply these ideas to a wide range of problems to improve their ability to think critically and analyze and solve a problem using a wide array of tools. The course topics include Functions and graphs, polynomials, exponential, logarithmic, and trigonometric functions. Limits and continuity, Limits at infinity, infinite limits, properties of continuous functions, and the intermediate value theorem. The derivative, differentiation techniques, chain rule, implicit differentiation, L'Hopital rule, and applications. Integration, definite and indefinite integrals, fundamental theorem of calculus, integration by substitution, integration by parts, improper integrals, and applications.

PHYS 271: Physics I

Credit Hours: 4 Lecture hours: 4.5 Lab/Practical hours: 3 Prerequisite: None

The course will introduce to the student concepts of Physics and Measurement, Motion in One Dimension, Vectors, Motion in Two Dimensions, The Laws of Motion, Circular Motion and Other Applications of Newton's Laws, Energy of a System, Conservation of Energy, Linear Momentum and Collisions, Rotation of Rigid Objects About a Fixed Axis, Angular Momentum, Static Equilibrium, and Elasticity.

HIST 281: History and Civilization of Kingdom

Credit Hours: 2 Lecture hours: 2 Lab/Practical hours: 0 Prerequisite: None

University-mandated course. Description to be provided by the concerned department.

CHEM 221: General Chemistry

Credit Hours: 3	*Lecture hours: 3*	*Lab/Practical hours: 3*	*Prerequisite: None*

This course will introduce the student to the basic vocabulary used in different branches of chemistry and to significant concepts in the field (e.g., stoichiometry, thermochemistry, etc.), emphasizing problem-solving. The course topics include General chemistry concepts. Thermo-chemistry, bonding, solid-state structures, organic chemistry fundamentals, and polymers. Solution chemistry, thermodynamics, kinetics, equilibrium, acids and bases, electrochemistry, and nuclear chemistry. Use of computers for data acquisition and multimedia resources. Introduction to atomic theory, chemical reactions, bonding, stoichiometry, nomenclature, gas laws, colligate properties, colloids, and solutions. Oxidation-reduction reactions, kinetics. Acid and base equilibria, buffers, transition elements, solubility, complex ions, hybridization. Laboratory study of the chemical properties and semi-micro qualitative analysis of the representative group elements of the periodic table.

ENG 251: Introduction to Engineering

Credit Hours: 1	*Lecture hours: 0*	*Tutorial Hours: 1.5*	*Prerequisite: None*

This course is designed to allow students to explore engineering through case studies and problem-solving using computers. Students will learn about the various aspects of the engineering profession and acquire technical and non-technical skills. The course topics include the Engineering profession, computer applications, and programming related to engineering. A broad overview of the different fields of engineering, including professional societies and their student chapters, professional licensing and registration, professional codes of ethics, introduction to engineering design, and problem-solving techniques. Students learn design, teamwork, written and oral communication skills through participation in a conceptual design project.

MATH 262: Calculus II

Credit Hours: 4	*Lecture hours: 6*	*Lab/Practical hours: 0*	*Prerequisite: MATH 261*

The course topics include Analytic geometry in calculus, polar coordinates, area in polar coordinates, tangent lines and arc length, and conic sections. Three-dimensional space, vectors, parametric equations of lines and planes. Vector-valued functions, unit tangent, normal and binormal vectors, curvature. Partial derivatives, limits and continuity, chain rule, directional derivatives, gradients, maxima, and minima of functions of two variables, Lagrange multipliers. Multiple integrals, double and triple integrals.

PHYS 272: Physics II

Credit Hours: 4	*Lecture hours: 4.5*	*Lab/Practical hours: 3*	*Prerequisite: PHYS 271*

The course will introduce Electric Fields; Gauss's Law; Electric Potential; Capacitance and Dielectrics; Current and Resistance; Direct Current Circuits; Magnetic Fields; Sources of the Magnetic Field; Faraday's Law; Inductance.

HUMN 201: Library Skills

Credit Hours: 1	*Lecture hours: 1.5*	*Tutorial Hours: 0*	*Prerequisite: None*

This course will enable the student to distinguish among various library and information resources, recognize citation elements, search databases, use print indexes, and locate books in a classified system. The course topics include the Use of libraries and information sources, both print and electronic, including locations and services of the University Library, emphasizing basic library

research tools and information literacy concepts. Library skills. Library research. Brainstorming. Library orientation. Call Numbers. Library cataloging & Classification System (Library of Congress & Dewey Decimal). General care and maintenance of books and library. Library language. Finding a book using the library computer. Introduction to Databases and efficient use of it for research purposes.

COMP 212: Computer Programming

Credit Hours: 2	*Lecture hours: 1.5*	*Lab/Practical hours: 3*	*Prerequisite: None*

This course aims at providing the concepts of algorithms, programming language, and programs and developing basic problem-solving skills for the learner. The course topics include an Overview of computer programming and programming languages (machine, assembly, and High-level languages). Programming principles of algorithm and flow of control, including sequential execution, selection, iteration, and subroutine. Basics of a typical programming language (e.g., MATLAB). Introduction to computer methods and algorithms for analyzing and solving engineering problems using numerical methods in a workstation environment (Numerical integration, roots of equations, simultaneous equation solving, and matrix analysis).

ENG 222: Engineering Drawings

Credit Hours: 3	*Lecture hours: 4.5*	*Lab/Practical hours: 0*	*Prerequisite: None*

This course aims at helping the learner to develop clear concepts and perception of form, and proportion and the skill of expressing three-dimensional and two-dimensional objects into professional language. The course topics include Fundamental graphics. Introduction to computer-aided drafting and modeling. Practice in creating and evaluating typical designs drawn from different specialty areas (Electrical, Electronics, and Mechanical). Use of CAD packages to illustrate and quantify design alternatives.

ENG 232: Statics

Credit Hours: 3	*Lecture hours: 4.5*	*Lab/Practical hours: 0*	*Prerequisite: None*

This course enables the students to learn the tools necessary to understand the principles of applied mechanics and the modeling of force systems in engineering statics. The course topics include Analysis of forces on engineering structures in equilibrium. Properties of forces, moments, couples, and resultants. Equilibrium conditions, friction, Section properties (centroids, area moments of inertia).

MATH 302: Linear Algebra

Credit Hours: 3	*Lecture hours: 4.5*	*Lab/Practical hours: 0*	*Prerequisite: MATH 262*

In this course the student will appreciate the importance of linear algebra and learn its applicability to practical engineering problems. Topics include Systems of linear equations, row reduction and echelon forms, solution sets of linear systems, linear transformations. Matrix algebra, matrix operations, inverse of a matrix, matrix factorizations, subspaces of the Euclidean n-space, dimension, and rank. Determinants, Cramer's rule. Eigenvalues and eigenvectors, diagonalization. Inner product, length, and orthogonality, Gram-Schmidt process.

CHEM 311: Environmental Chemistry

Credit Hours: 3	*Lecture hours: 3*	*Lab/Practical hours: 1*	*Prerequisite: CHEM 221*

Review of basic concepts from general chemistry Environmental sampling Sample preparation methods .Water chemistry Pollution and purification of water Metals, soils, sediments, and waste disposal. Atmospheric chemistry. Energy and climate change. Toxic compounds and their measurements Laboratory analyses of physical and chemical pollution parameters: pH, color, solids, conductivity, acidity, alkalinity, hardness, COD, BOD, chlorides, nitrates, phosphates.

CHEM 321: Organic Chemistry

Credit Hours: 2 Lecture hours: 2 Lab/Practical hours: 0 Prerequisite: CHEM 221

Classification of organic compounds, Functional groups, Aliphatic compounds, Heterocyclic compounds, Alkanes and Cycloalkanes stereochemistry, Nucleophilic substitution and elimination reactions, alkenes, and alkynes molecules

GEOL 312: Geology

Credit Hours: 2 Lecture hours: 3 Lab/Practical hours: 0 Prerequisite: None

This course explores the fundamentals of geology applied to energy engineering problems. Topics include rock and mineral types, soil properties, rock mechanics, geologic structures, active tectonics and earthquake hazards, slope stability and landslides, groundwater, rivers, and flood hazards. Instruction is conducted through lectures and field trips.

ENG 321: Fluid Mechanics

Credit Hours: 3 Lecture hours: 2 Lab/Practical hours: 1 Prerequisite: None

The main purpose of this course is to apply the basic concepts of fluid mechanics for solving engineering problems involving compressible and incompressible fluids, determine the pressure variation in a given flow process, relate the conservation principles, apply basic concepts of orifice, weirs, and open channel flows for solving related engineering problems and use analytical skills to solve problems in the areas of fluid statics and fluid dynamics. The plan is to introduce main concepts with the help of illustrations or videos as students are weak in English and can't grasp the full meaning of the text.

MATH 331N: Differential Equations

Credit Hours: 3 Lecture hours: 3 Lab/Practical hours: 3 Prerequisite: MATH 262

This course covers some major mathematical methods that are useful for engineering applications. The student will learn the relation between mathematics, physics, and engineering. The course topics include Solutions and Initial Value problems, Existence and Uniqueness of Solution. First-Order Differential Equations, linear and exact equations, special integrating factors, substitutions, and transformations. Linear second order differential equations, fundamental solutions of homogeneous equations, homogeneous linear equations with constant coefficients. Superposition and non-homogeneous equations. Laplace transform, and inverse Laplace transform.

ENVEN 311: Environmental Engineering Fundamentals

Credit Hours: 3 Lecture hours: 4.5 Lab/Practical hours: 0 Prerequisite: None

The main purpose of this course is to give the students an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

ENVEN 322: Environmental Microbiology

Credit Hours: 3 Lecture hours: 3 Lab/Practical hours: 3 Prerequisite: None

The main purpose of this course is to give the students' knowledge in the fields of air, water, and soil microbiology and to make sure student to learn the scientific underpinnings of fundamental of

environmental microbiology with laboratory skills including the applications in environmental remediation and pollution control.

ENG 332: Engineering Materials

Credit Hours: 2	*Lecture hours: 1*	*Lab/Practical hours: 1*	*Prerequisite: None*

Understand the fundamental concepts of stress and strain and the relationship between both through the strain-stress equations. Understanding of the properties of materials in relation to response of materials to applied load and force-deformation relationship. Solve problems relating to torsional deformation of bars. Solve problems relating to thermal stress.

BUS 381: Entrepreneurship

Credit Hours: 2	*Lecture hours: 2*	*Lab/Practical hours: 0*	*Prerequisite: None*

University mandated course. Description to be provided by concerned department.

HUMN 301: Oral Communication and Public Speaking

Credit Hours: 1	*Lecture hours: 1.5*	*Lab/Practical hours: 0*	*Prerequisite: None*

In this course the students will develop their ability to speak confidently and effectively in a variety of public speaking situations. Students will prepare and present several different types of speeches that arts managers are often required to make. Particular attention is paid to style, persuasion, and credibility in public speaking.

ENVEN 342: Water Supply Engineering

Credit Hours: 3	*Lecture hours: 2*	*Lab/Practical hours: 1*	*Prerequisite: None*

Sources of water supply sources, factors, and criteria for source selection. General introduction to water purification technologies. Water use trends, planning and forecasting. Water distribution systems components, general considerations, and design.

ENVEN 352: Water Quality

Credit Hours: 2	*Lecture hours: 2*	*Lab/Practical hours: 0*	*Prerequisite: ENVEN 311*

Sources of water resources; quality principles, problems, and issues. Standard methods for assessing water quality; practical approaches in solving water-related problems. Field methods used to sample and assess various biological, physical, and chemical components in water resources Water quality monitoring and assessment, water quality statistical analysis and reporting, Standard sampling techniques, Sample preservation, and safety; Water quality modeling and applications; Saudi water quality standards, regulations, and guidelines.

MATH 411: Probability and Statistics

Credit Hours: 3	*Lecture hours: 3*	*Lab/Practical hours: 3*	*Prerequisite: MATH 302, MATH 331N*

In this course students will acquire an understanding of probability and statistics through mathematical formulas, and examination of data. Students will apply probability and statistics concepts through class activities and projects related to the engineering field. Topics include Presentation of data, textual, tabular, and graphical, sampling techniques. Measures of central tendency, mean, median, mode. Measures of variation, range, variance, standard deviation. Probability distributions, counting techniques, uniform, binomial, normal, and exponential distributions. Test of hypothesis, test concerning means, variation, and proportion. Analysis of variance, combinatorial mathematics, fundamental principles of counting, binomial theorem.

ENG 401: Technical Writing

Credit Hours: 2	*Lecture hours: 3*	*Lab/Practical hours: 0*	*Prerequisite: None*

This course focuses on effective written, oral, and visual technical communication processes for academic settings. Topics include Various forms of academic and personal essay writing. Original essay writing and class criticism and discussion. Model essays and essays on the craft of writing, reading and discussion for verbal logic, communicative power, and visceral appeal.

ENG 441: Thermodynamics Mass and Heat Transfer

Credit Hours: 3	*Lecture hours: 2*	*Lab/Practical hours: 1*	*Prerequisite: None*

Understand the basic concepts of thermodynamics' first and second laws and their applications in engineering problems. Effective analysis of the basic thermodynamic power and refrigeration cycles. Formulate and solve thermal systems problems and integrate this analysis into the optimal design of thermal systems. Effectively use thermodynamics in the practice of engineering.

CONEN 431: Fundamentals of Soil Mechanics

Credit Hours: 3	*Lecture hours: 2*	*Lab/Practical hours: 1*	*Prerequisite: GEOL 312*

Introduce soil mechanics to structures. Provide advanced testing technology. To study the mechanical behavior of soil materials. To improve the ability to conduct experiments, analyze and interpret data, function on multidisciplinary teams, and encourage communicating effectively. To increase the ability to use the techniques, skills, and modern engineering tools necessary for geotechnical engineering practice. To identify, formulate, and solve engineering problems related to soil mechanics.

ENVEN 411: Unit Operations and Processes I

Credit Hours: 3	*Lecture hours: 2*	*Lab/Practical hours: 1*	*Prerequisite: None*

Basics of wastewater treatment; mass balance, flow models and reactors design. Unit operations and Processes of water and wastewater; preliminary unit operations; Flow and quality equalization, primary treatment units; screening, bar rack, grit chamber design; Sedimentation: Discrete and non-discrete settling tanks, sedimentation theory and design and construction details. Coagulation, flocculation, and water softening; Redox reaction in water and wastewater treatment; Rapid and slow mixing units' design. Clarifiers and types and removal mechanisms, filtration; slow sand Filters, Rapid Sand filtration, Down and up flow filtration flotation units. Adsorption and ion exchange resins processes; Membrane processes

ENG 412: Engineering Economics

Credit Hours: 2	*Lecture hours: 3*	*Lab/Practical hours: 0*	*Prerequisite: None*

This course equips students to acquire engineering economy concepts, principles, and methods. The focus of this course is to provide an understanding of engineering economic principles and methods and apply them in the engineering field. The course has is designed to teach students to formulate cash flow, perform analysis on engineering economic problems and evaluate between alternative of engineering investment/projects to make decisions to teach students to perform cost estimates using traditional and current costing techniques in the production process, prepare simple financial statement and interpret financial performance of business firms for decision and control. Interpretation and use of accounting reports and supplemental information for engineering economic analyses, consideration of cost-volume-profit analyses, use of discounted cash flow techniques.

ENVEN 421: Air Pollution

Credit Hours: 2 Lecture hours: 1 Lab/Practical hours: 1 Prerequisites: None

The atmosphere and its composition. Sources and scales of air pollution. Effects of air pollution on humans, animals, plants, and structures. Atmospheric chemistry and photochemical smog. Ambient air sampling, measurement, and analysis. Air pollution monitoring. Role of meteorology on air pollution. Air quality criteria. Emission and emission standards. Stack gas sampling and analysis. Dispersion of air pollutants. Emission inventory. Introduction to air pollution modeling. Sound and measurement. Noise concepts. Sources of noise. Noise standards and guidelines. Techniques for managing noise.

ENVEN 431: Engineering Hydrology

Credit Hours: 2 Lecture hours: 3 Lab/Practical hours: 0 Prerequisite: None

Hydrologic cycle. Forms & measurement of precipitation. Hydrological data. Hydrological equation. Water losses (Evaporation, infiltration, transpiration, water shed leakage). Catchment's characteristics. Soil moisture, Runoff processes. Flood estimation and control. Flood & reservoir routing. Arid and semi-arid regions. Hydrograph analysis. Groundwater occurrence, distribution, movement, exploration, and recharge. Well hydraulics and design, the interaction of ground and surface water. Pumping test design. Introduction to groundwater models, leaky aquifers. Saltwater intrusion

HUMN 402: Research Methodology

Credit Hours: 1 Lecture hours: 1.5 Lab/Practical hours: 0 Prerequisite: HUMN 201

In this course, students learn the tools to be familiar with their theses regarding research questions and design, methodology, data collection, and analysis. Topics include Research methodology concepts and definitions. Research ethics. Problem identification. Research plan preparation. Data gathering and compilation. Data presentation and analysis. Design of research report. Case study.

MATH 472: Numerical Methods

Credit Hours: 3 Lecture hours: 4.5 Lab/Practical hours: 0 Prerequisite: MATH 331N

In this course, the students learn an introduction to numerical methods and error analysis, numerical solutions of nonlinear equations, numerical solutions of systems of linear equations, interpolation, numerical differentiation and integration, numerical solutions of 1st–order differential equations, and numerical solutions of some partial differential equations.

ENVEN 422: Wastewater Engineering I

Credit Hours: 3 Lecture hours: 2 Lab/Practical hours: 1 Prerequisite: ENVEN 322

Wastewater characteristics. Wastewater sources. Wastewater flows. Plumbing. Wastewater collection systems: components, layout, hydraulic features, operation, maintenance, and performance. Rehabilitation of wastewater systems. Flow models (Info-works, Micro drainage, or mouse).

ENVEN 432: Unit Operations & Processes II

Credit Hours: 3 Lecture hours: 2 Lab/Practical hours: 1 Prerequisite: ENVEN 311

Introduction to continuous culture kinetics inhibited growth kinetics. Chemostat cultures, deviation from the ideal, chemostat cultures with biomass recycle. Plug-flow cultures. Feed-batch and repeated batch cultures. Biological oxidation. Oxygen transfer and aeration. Biological unit processes. Oxidation ponds, aerated lagoons, activated sludge process, trickling filters, rotating physical discs, and anaerobic treatment. Handling and disposal of wastewater solids. Introduction to activated

sludge process kinetics. Nitrification and denitrification systems. Basics of anaerobic suspended culture systems. Microbiology of wastewater treatment.

ENG 501: Professional Practice and Ethics

Credit Hours: 2	*Lecture hours: 3*	*Lab/Practical hours: 0*	*Prerequisite: None*

This course examines ethical frameworks and moral issues related to the profession. Topics include Examination of the non-technical issues dealt with by design professionals, including professional ethics, marketing and business development, professional engagement, personnel and project management, risk management, professional liability insurance, and dispute resolution.

ENVEN 521: Senior Design Project I

Credit Hours: 2	*Lecture hours: 0*	*Lab/Practical hours: 6*	*Prerequisite: None*

This course is an integral part of the final project program. The course emphasizes identifying and developing practical and technical ideas and concepts, which are to be researched, analyzed, programmed, and documented in an effective and efficient professional report. The research should include pertinent analysis, solutions, and issues in an integrated form. The student is responsible for the independent development of the study under the direction of a faculty advisor with expertise in the areas of investigation. Individual research in a field of particular interest under a faculty member's supervision is required for the B.Sc. degree, culminating in a written report/thesis. The central goal is a substantive paper or written report containing significant analysis and interpretation of a previously approved topic. The Graduation Project is divided into two semesters. The methodology is developed, and pre-data is collected in the first semester. Experiments are run, data is analyzed, and conclusions are sought in the second semester.

ENVEN 452: Intro to Geo-technical & Geo-environmental Engineering

Credit Hours: 2	*Lecture hours: 2*	*Lab/Practical hours: 0*	*Prerequisite: None*

Conventional saturated soil mechanics to unsaturated soil behavior, rock mechanics, hydrogeology and geosynthetics. Geoenvironmental Problem Identification and Risk Management; Physiochemistry of Soils for Geoenvironmental Engineering; Contaminant Hydrogeology; Barrier Systems; Geosynthetics in Liquid-Containing Structures; Covers for Waste; Monitoring of Contaminants and Consideration of Risk; In-situ, Containment and Treatment of Contaminated Soil and Groundwater; Management of Contaminated Soil in Engineering Construction.

ENVEN 501: Design of Environmental Projects

Credit Hours: 3	*Lecture hours: 2*	*Lab/Practical hours: 1*	*Prerequisite: None*

Methodological basis for engineering design. Engineering solutions to specific needs using graphical, oral, and written means. The practice of professional engineering. Progression in engineering design skills with emphasis on computer usage in design, oral communication of solutions and team skills. Computer usage in design. Structured programming and database management software. Applications in environmental engineering. Solving open-ended problems. Model simulation, sensitivity analysis.

ENVEN 531: Wastewater Engineering II

Credit Hours: 3	*Lecture hours: 2*	*Lab/Practical hours: 1*	*Prerequisite: ENVEN 411*

Wastewater treatment plant design. Primary (grit removal, screening, sedimentation), secondary (Activated sludge, trickling filter, stabilization ponds, oxidation ditches, biological contactors), tertiary (filtration, nitrification and de-nitrification, phosphorous removal, ion exchange resins,

disinfection). Sludge handling (digestion, stabilization, and dewatering). Final disposal. Wastewater reclamation and reuse. Land treatment systems and onsite systems. Effluent concerns. Standards and regulations. Wastewater laboratory work.

ENVEN 522: Senior Design Project II

Credit Hours: 4 Lecture hours: 0 Lab/Practical hours: 12 Prerequisite: ENVEN 521

This course provides individual research in a field of special interest under the supervision of a faculty member as a requirement for the B.Sc. degree, culminating in a written report/thesis. The central goal of which is a substantive paper or written report containing significant analysis and interpretation of a previously approved topic. The Graduation Project is divided into two semesters. The methodology is developed and pre-data is collected in the first semester. Experiments are run, data is analyzed, and conclusions are sought in the second semester.

HUMN 512: Environmental Law & Regulation

Credit Hours: 2 Lecture hours: 2 Lab/Practical hours: 0 Prerequisite: None

Principles of environmental legislation. Obligations under environmental legislation. The Environmental Protection Act. Appropriate and realistic environmental management model through environmental law and regulations. To support the idea of sustainable development via environmental law. Saudi Arabian Environmental Laws and Regulations. Environmental Ethics.

ENVEN 462: Solid and Hazardous Waste Management

Credit Hours: 2 Lecture hours: 2 Lab/Practical hours: 0 Prerequisite: None

Types and sources of solid waste. Chemical and physical properties of municipal and industrial refuse. Solid waste collection methods. Solid waste treatment and disposal techniques with emphasis on landfill disposal, incineration, composting and pyrolysis. Salvage, reclaiming, and recycling operations. Economics of disposal methods. Advantages and disadvantages of each; special and hazardous waste handling; operation and management of solid and hazardous waste programs.

Elective Courses

ENVEN 503: Environmental Impact Assessment

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

Assessing the potential impacts of major developments on the environment in its broadest sense. Applying EIA to new infrastructure projects, such as power plants, desalination plants, refineries, highways, pipelines, dams, mines, airports, incinerators, and landfills. Specialist areas of EIA application include water quality, minerals, waste, hydrology, air quality, landscape, visual impact, ecology, community, and socio-economic aspects. The course is genuinely interdisciplinary, with involvement from staff from several departments and external speakers from industry and government.

ENVEN 513: Integrated Water Resources Management

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

IWRM principles. Definition of IWRM. How to implement IWRM (enabling environment, institutional role, management instruments). Management and planning of natural and constructed water systems. Integrated management and case studies of water use and environmental resources.

ENVEN 523: Environmental Project management

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

Fundamentals of project scheduling techniques. Cost estimation, escalations, resource allocation, conflict resolution, human resources management. Computer based project management information system. Critical Path Method (CPM) analyses. Scheduling flexibility. Prediction of project duration "critical path". Proposal writing, bid preparation, laws, regulations and safety requirements related to economic project management and their environmental impacts will also be studied by real-life case studies.

ENVEN 543: GIS for Environmental Engineers

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

Basic concepts of geometrics, spatial data representation and organization, and analytical tools that comprise GIS applied to a variety of problems including watershed protection, environmental risk assessment, material mass balance, flooding, asset management, and emergency response to natural or man-made hazards. Geography and map projections, spatial statistics, database design and use, interpolation and visualization of spatial surfaces and volumes from irregularly spaced data, and decision analysis in an applied setting.

ENVEN 553: Waste Containment Structures

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

Characteristics of solid waste and management, introduction to landfill techniques, classifications and basic functions of design materials, construction and management of safe and economic sanitary landfills, equipment, and site planning for landfills. Reduce, reuse, and recycle, sanitary landfill, leachate, site planning for landfills.

ENVEN 563: Noise Pollution & Control

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

Understand the basic principles of noise pollution; Identify the significant factors affecting noise pollution; Apply analytical techniques to solve problems in noise pollution measurement and control; Indoor and outdoor sound. Noise reduction and isolation. Design noise control devices. To provide

students with an understanding of the measurement, assessment and control of noise emitted from transportation, construction, and industrial activities.

ENVEN 573: Ground Water Engineering & Contamination

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

Sources and types of groundwater contamination, contamination transport mechanisms. Sorption and other chemical reactions. Numerical modeling of contaminant transport. Non-aqueous phase liquids. Groundwater remediation and design. Basic definitions, occurrence of groundwater, ground water exploration, specifications, estimations of quantities, types of groundwater aquifers, basic studies and investigations. Ground water flows. Hydraulics of ground water. Well, hydraulics. Estimation of well discharges, observation wells, well design, well development. Ground water quality. Contaminant transport management t and remediation. Introduction to ground water modelling. Description of ground water in the kingdom.

ENVEN 583: Pollution Control in Petroleum Engineering

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

Drilling and production of operations, the environmental impact of drilling and production, environmental transport of petroleum wastes, planning for environmental protection, petroleum wastes treatment and disposal, remediation of contaminated sites, environmental regulations with respect to petroleum pollution.

ENVEN 593: Site Remedy

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

Soil pollution, level of pollution and remediation methods. Water sources effected by polluted soils, characterization of soil and water systems, local pollution and regional pollution, source apportionment of pollutants and their characterizations, metals and toxic chemicals in soil, effects of erosion over soil and water quality and pollution control regulations according to laws and directives. Risk based analysis. hazardous waste compositions and speciation. Remediation of polluted soil. Applications of stabilization / solidification, lime, ash, cement, and asphalt stabilizations. Transport to the groundwater and the atmosphere for different pollutants.

ENVEN 504: Wastewater Reclamation & Reuse

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

Types of waste. Quantities. Physical, chemical, biological, and bacteriological characteristics, radioactive and rheological properties, of water and wastewater. Criteria and Standards for Wastewater Reuse. Utilization of Reclaimed Wastewater (Beneficial Uses). Health Aspects of Using Reclaimed Water in Engineering Projects. Wastewater Reclamation and Reuse Treatment Technology and treatment processes and sludge treatment and disposal. Economics of Water and Reclaimed Wastewater Projects. Monitoring (sampling and analysis), and legal aspects of wastewater reclamation and reuse. Case Studies.

ENVEN 514: Desalination Technologies

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

Desalination fundamentals and other industrial aspects. The processes widely used in industry: multistage flash desalination and reverse osmosis. Other desalination processes with attractive features and high potential. Case studies extracted from existing desalination plants. Comparisons of model predictions and available experimental and industrial data. Several industries include similar Process fundamentals and design procedures of such unit processes and unit operation (evaporators, condensers, flashing units, membrane separation, and chemical treatment). Applications in industries and wastewater treatment, food, petroleum, petrochemical, power generation, and pulp and paper.

ENVEN 524: Hydraulic Structures

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

General hydraulics of water structures. Flow through porous media. Hydraulics and design of control structures (gates; valves; siphons intakes), Drop structures (Weirs; spillways). Water retaining structures (Walls and dams), water crossing structures (culverts; siphon aqueducts). Fluid forces on submerged bodies, Waves forces on offshore structures. Structural analysis and design of hydraulic structures.

ENVEN 534: Public Health in Engineering Projects

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

Health risks associated with water. Disease-causing pathogens. Types of diseases (water borne, water contact, water washed, water-vector-related, water based, Sanitation- related diseases). Chemicals and radiation health hazards. Plans and programs for disease prevention. Methods for control of disease-causing vectors (chemical methods, biological methods, environmental management methods – permanent, temporally, manipulation, integrated). Environmental health in certain engineering projects and systems.

ENVEN 544: Marine Pollution & Control

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

Present health of the red sea and Arabian gulf. The need for control of pollution. Anthropogenic effects on estuarine and marine ecosystems from local, regional, and global perspectives. Types of contaminants and pollutants, eutrophication, oxygen demanding waste, oil pollution and toxicity, polycyclic aromatic hydrocarbons (PAH), halogenated hydrocarbons, trace metals, radioactive waste, dredging and dredged-spoil disposal, and effects of electric generating stations. Global, regional, and national marine pollution control activities, selected case studies.

ENVEN 554: Environmental Toxicology

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

Principles of environmental toxicology, environmental fate of toxicants, toxicants in the environment, biological effects of toxicants. Experimental approaches, environmental and nutritional factors in cellular regulation and nutritional toxicants, perspectives in toxicology, perspectives in aquatic toxicology, environmental stress and development in marine organisms, food toxicology. Health risk assessment of toxicants, legal aspects of environmental toxicology, toxicant exposure, and dose assessment.

ENVEN 564: Industrial Wastes Management

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

The different types of industrial waste. Origin of wastes process wise and their impacts on human and environmental health. Different industrial wastes in plant control measures, evaluation, treatment facilities (physical, chemical, and biological) and management.

ENVEN 574: Hazardous Waste Engineering and Management

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

Introduction to hazardous waste. Types of hazardous waste. Hazardous waste and health impacts. Fate of hazardous wastes. Handling of hazardous waste. Regulations for managing hazardous waste. Environmental programs for hazardous wastes management. Case studies.

ENVEN 584: Coastal Engineering

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

The effect of natural forces associated with storms. Shore currents, Tidal waves and shore engineering, Saline intrusion, deep disposal, shore protections, sediment transport., the change of

waves as they approach shore, and wave forces on the shore; shore erosion and littoral drift; near-shore pollution in lakes and oceans; harbor, breakwater, and revetment design.

ENVEN 594: Special Topics in Environmental Engineering

Credit Hours: 3 Lectures: 3 Practical/Lab: 0 Prerequisite: Department consent

The latest developments in environmental engineering, locally, regionally, or internationally, are presented in this course.

Department Contact:

Head of Department

Dr. Ibrahim Aljamaan

Phone: +966138584331

Email: CE.EED@iau.edu.sa

Department Location:

College of Engineering

Imam Abdulrahman bin Faisal University

Dammam 31441, Saudi Arabia

URL: Imam Abdulrahman Bin Faisal University

College URL: College of Engineering

Department URL: Environmental Engineering Department

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