

CENTER FOR ENVIRONMENTAL STUDIES VIRGINIA COMMONWEALTH UNIVERSITY(VCU)

ENVS 591: Introduction to Environmental Engineering Fall Semester

COURSE TIME/ROOM: Monday 7:00-9:40 PM

**Room 103, Trani Life Sciences Center
1000 W. Cary Street, VCU Park Monroe Campus.**

CREDITS: 3 Credit Hours

INSTRUCTOR:

Dr. M. A. Karim, P.E.

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COURSE SYLLABUS:

Introduction to environmental engineering issues, legal aspects, engineering solution, and basic approaches to abatement system design; Hydrology and Hydrologic cycle; Sources of water and wastewater; Water demand, Water and wastewater treatment; Water and wastewater quality assessment and monitoring; An overview of water supply and wastewater drainage system design; Water quality management; Air pollution; Solid and hazardous waste management and environmental impacts.

COURSE OBJECTIVES:

After taking the course, the students will be able to -

- define and identify the environmental issues and legal aspects;
- understand the concept of hydrology and hydrologic cycle;
- understand the concept of water and wastewater quality assessment, monitoring, and treatment;
- acquaint themselves with the concept of design and operations of water supply and wastewater drainage system;
- understand the concept of air pollution and process of water quality management and pollutant transport;
- define and characterize solid and hazardous wastes from technical and regulatory points of view; and

- understand the concept of solid and hazardous waste management, processing, minimizing, separation at the source, recycling, reuse, universal waste management and recycling, and their environmental impacts.

TEXTS:

Introduction to Environmental Engineering by Mackenzie L. Davis and David A. Cornwell, McGraw-Hill Book Company, Current Edition (Third Edition, 1998).

COURSE OUTLINE AND TENTATIVE SCHEDULE:

Lecture 1:	Introduction to environmental engineering issues, legal aspects, engineering solution, and basic approaches to abatement system design.	Chapter 1 & Handouts
Lecture 2:	Hydrologic cycle and surface and groundwater hydrology.	Chapter 2 & Handouts
Lecture 3:	Definition and identification of parameters for water and wastewater quality assessment and monitoring.	Handouts
Lecture 4:	Definition and identification of parameters for water and wastewater quality assessment and monitoring. <i>Continued from Lecture 3.</i>	Handouts
Lecture 5:	Physical, chemical, and biological treatment of water. <i>Review for Mid Term Exam 1.</i>	Chapter 3
Lecture 6:	EXAM 1 (MID TERM 1)	
Lecture 7:	Water quality management in rivers and lakes.	Chapter 4
Lecture 8:	Physical, chemical, and biological treatment of wastewater.	Chapter 5
Lecture 9:	An overview of water supply and wastewater drainage systems layout and design. <i>Review for Mid Term Exam 2.</i>	Handouts
Lecture 10:	EXAM 2 (MID TERM 2)	
Lecture 11:	Introduction to air pollution and its control.	Chapter 6
Lecture 12:	Introduction to waste management; definition, types, characteristics, generation, storage, collection, treatment, and disposal, perspective, waste processing, minimization,	Chapter 8 & Handouts

and separation in the source, recycling and reuse of waste, and environmental impacts.

Lecture 13: Definition, types, characteristics, generation, storage, collection, treatment, and disposal of hazardous waste. Risk perception, assessment, and management. Chapter 9 & Handouts

Lecture 14: Continued from Lecture 13. *Review for the Final Exam.* Handouts

Lecture 15: FINAL EXAM

GRADING POLICY:

1. Mid Term 1	- 25%
2. Mid Term 2	- 25%
3. Final Exam	- 35%
4. Homework	- 10%
5. Class participation & quizzes	- 5%
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TOTAL	- 100%

GUIDELINES

- 1. Homework:** All problem assignments must be submitted in the next class following the class in which the topic is discussed. Late homework WILL NOT be accepted. Exceptions may be considered in case of illness and other serious emergencies. However, appropriate evidence must be presented in order to qualify for exceptions. All homework must be submitted on 8.5"x12" white paper or on engineering design paper.
- 2. Exams:** All exams are closed books and notes unless advised otherwise. NO make-up exams will be given. Exceptions may be considered in case of illness and other serious emergencies. However, appropriate evidence must be presented in order to qualify for exceptions.
- 3. Cheating:** Cheating on assignment and particularly on the examinations will not be tolerated. If you are caught cheating, you will get zero on the exam. I will ask you to move if I see you looking at another student's work.
- 4. Term Paper/Presentation:** No term paper/presentation for this course.

SUPPLEMENTAL READINGS:

1. **Chemistry for Environmental Engineering** by Clair N. Sawyer and Perry L. McCarty, McGraw-Hill Book Company, Current Edition.
2. **Environmental Engineering** by Howard S. Peavy, Donald R. Rowe, and George Tchobanoglous, McGraw-Hill Book Company, Current Edition.
3. **Waste Management Practices, Municipal, Hazardous, and Industrial** by John Pitchel, Taylor & Francis Group, LLC, 2005 Edition.

HOMEWORK ASSIGNMENT

A number of problems from the book or supplemental problems will be assigned at the end of each lecture.

EXTENDED COURSE OUTLINE:

Lecture 1: Introduction to environmental engineering issues, legal aspects, engineering solution, and basic approaches to abatement system design.

Lecture 2: Hydrology and hydrologic cycle such as precipitation, evaporation, transpiration, interception, percolation, etc., an overview of surface and groundwater hydrology, rainfall and runoff analysis, storage of reservoirs, and groundwater and wells, etc.

Lecture 3: Definition, identification, and measurement of water and wastewater quality parameters such as pH, color, turbidity, alkalinity, hardness, iron, arsenic, calcium, nitrate, carbon dioxide, chloride, fecal coliform, total coliform, dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), other metal concentrations, etc. for water and wastewater quality assessment and monitoring.

Lecture 4: Definition, identification, and measurement of water and wastewater quality parameters such as pH, color, turbidity, alkalinity, hardness, iron, arsenic, calcium, nitrate, carbon dioxide, chloride, fecal coliform, total coliform, dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), other metal concentrations, etc. for water and wastewater quality assessment and monitoring. *Continued from Lecture 3.*

Lecture 5: Physical, chemical, and biological treatment of water such as sedimentation, filtration, chlorination, coagulation, flocculation, water softening, activated sludge, trickling filter, etc. and example problems. *Review for Mid Term Exam 1.*

Lecture 6: Mid Term Exam 1.

Lecture 7: Water quality management such as determination of BOD rate constant (k), development of DO sag curve using Streeter Phelps' equation for a stretch of stream/river, and example problems.

Lecture 8: Wastewater microbiology, characteristics of wastewater, physical, chemical and biological treatment of wastewater such as unit operations of pretreatment, primary treatment, unit processes of secondary treatment, disinfection, land treatment, sludge treatment, etc; sludge disposal and example problems.

Lecture 9: An overview of water supply and wastewater drainage systems layout, design and example problems. *Review for Mid Term Exam 2.*

Lecture 10: Mid Term Exam 2.

Lecture 11: Air pollution: definition, sources and types of air pollution, atmospheric chemistry, plume dispersion, plume height, adsorption, separation, etc., fate transport, and example problems.

Lecture 12: Introduction to waste management, definition and types of solid waste from technical and regulatory points of view, characteristics of solid waste, generation rate of solid waste in different regions and climate, process for storage, collection, treatment, disposal procedures, perspectives, waste processing, minimization, and separation in the source, recycling and reuse of waste, and environmental impacts.

Lecture 13: Definition of hazardous wastes from technical and regulatory points of view, Introduction to RCRA: waste management act and provisions/subtitles, evolution of RCRA legislation, components of RCRA, RCRA and its interrelationship to other environmental statutes, Identification of hazardous waste, hazardous waste exclusions and exemptions, types of hazardous waste: listed and characteristic hazardous wastes, mixture rule, hazardous waste recycling and universal wastes, hazardous waste generators and transporters, hazardous waste treatment, storage, and disposal facilities (TSDFs), land disposal restrictions, combustion, and permitting for TSDFs, and risk perception, assessment and management.

Lecture 14: *Continued from Lecture 13 and review for the Final Exam.*

Lecture 15: Final Exam