Fall 2024

ENE 262 - 001: INTRO TO ENVIRONMENTAL ENGR

Paul Schorr

SYLLABUS ENE 262 – INTRODUCTION TO ENVIRONMENTAL ENGINEERING – rev.1-2-2024, 7-14-2024
Department of Civil and Environmental Engineering
New Jersey Institute of Technology
Fall 2024 – each Tuesday beginning September 3 to December 17
Section 001: CRN

Instructor: Adjunct Professor: Paul Schorr, PE, PP, BS ChE, MS CE, M ASCE; 609-933-3900 cell; schorr@njit.edu
Office hours, call cell, Tuesday 2:30-3 pm; Colton Hall
Class hours Thursday 10 AM to 2:20 PM, Class room CKB #315
Field Trips: wastewater and water treatment utilities during agreed upon hours:
Lab: Hardness, Alkalinity & Jar Testing, dates tbd, Colton Rm 420
Teaching & Laboratory Assistant: tbd

Prerequisites: Chemistry 125; Math 112, Physics 121

Required Text (T): Davis, M.I. and Cornwell, D.A., Introduction to Environmental Engineering, 5th Edition, McGraw Hill Companies, New York, N.Y., 2013, ISBN 978-0-07-340114-0, or digital

Analog tools to be provided: mason's level

Supplemental References to be provided: American Water Works Assn. OPFLOW Certification Corner

Internet References: Passaic Valley Water Commission Annual Water Quality Report; United States Geological Survey stream gage 01389005; New York City Division Water and Sewer Bond Prospectus; Rockaway Valley Regional Sewerage Authority; Water Power, C.C.Vermeule, 1894; Instream Aeration, 1970, Whipple.

Objectives:

a. Provide **concepts and analytical tools** for equitable use of water, air and land resources during normal and extreme conditions, such as drought, floods, air inversions, heat waves, hazardous waste spills and pandemics that disrupt public health, safety and welfare;
b. Encourage use of vetted, **open and affordable materials** from NOAA, USEPA, USGS, NJDEP, New York City, Trenton, Wickapedia, Utube, university libraries, professional societies ;
c. Provide **educational credits** for exams for the Introductory License to Operate a Water or Wastewater Treatment Plant. See website (https://www.state.nj.us/dep/watersupply/dws_train.html) for the experience and educational requirements required by the State to take the exam.
d. Provide an **engineering approach to problem solving** for written and oral presentations:
    1. **provide a title** page to identify – prob. #, name, class, date; professor, university,
    2. **restate** the problem, **define** knowns, unknowns, and assumed terms and their **units**;
    3. **draw to scale** a representation of the problem and solution;
    4. **propose** a qualitative and quantitative mathematical or graphical **solution procedure**;
    5. **substitute** numerical values into the solution procedure **to derive a suggested answer**;
    6. **provide a quantitative error** based on statistics, instruments, data sources, mathematical formulas, graphical techniques, conversion and scaling factors, or alternative tests;
    7. **provide a disclaimer** based on your limitations of time, skill and experience;
    8. **cite references** by page and author and **acknowledge contributions** of individuals.
e. **Provide** each student with experience in giving **oral presentations**.

f. **Compare design concepts of textbooks, lab work, field visits, contractors and operators**

ASSIGNMENTS: Each student will have one assignment each week from a List of Assignments, to be posted before each class. Each student must use the **approach to problem solving** for oral and written assignments**:**

ABBREVIATIONS: **CC** = Certification Corner; **CS** = chap-sect; **D** = Discussion Questions; **E** = example**; Eq** = equation; **F**= Figure; **FE** = FE Exam Formatted problems; **NSPE** = National Society of Professional Engineers; **P** = problems; **R** = Chapter Review; **T** = Table.

Class Date Week # - month/day	**Topics**	**Text to be read before class**	**List of assignments for following week**	**Concepts/Keywords**
1- 9/3	Book organization, Instructor background, Approach to problem solving, Operator Testing	**CS-Introduction** 1-11 (pgs 1-18) List or Elements, Periodic Table, About the Authors, Preface, Acknowledgements, Contents, Index, Appendix A, B, C	**F**1,2 4; **T** 3,4,5,6 **P**1,2,3,4,5, 6,7,8, 9,10,11; **D**1,2,3,4,5,6,7; **FE**1,4 **NSPE-BER 72-9**	Ethics & transparency; Approach to Problem Solving; mass & energy; institutional vs hydrologic boundaries, water & air properties
2- 9/10	**CS - Materials & Energy Balances**: Unifying theories, Materials Balances, Time	**CS** 1,2,3, time, (pgs 25-37)	**E** 1,2,3,4,5 **R** 1,2,3,4,5 **P** 1,5,9 **D** 1,3 **FE** 1, 4	Dimensional homogeneity; loading = flow rate x concentration; kinetic+potential + internal energy= (Bernoulli's equation)
3- 9/17	**CS – Materials & Energy** Mixing, Reactions Losses Thermodynamics, Heat Transfer 2nd Law Thermo **CS Risk Assessment**, probability, data	**CS** – plug flow, CSTR (pgs 37-53); units, conduction, convection, radiation (pgs 57-70) **CS** 1, 2,3 (pgs 89-103)	**E** 6,7,8,9,12,13,14 **F** 2,3,4,7,8,9,15 **T 4** (water) **R** 6,7,8 15,18; **P** 11,14, 19,22, 31,40 (Edinger) **D** 1 **R** 1,2,4,7,8 ; **Eq** 2,9 ; **R** 1, 4; **P** 1,7	Steady vs Unsteady states; Material & Energy flows from high to low- temp., elev., voltage, concentration; change of state - e.g. vapor/ condensate/ precipitation/ burden=concentration x exposure; mixing; toxicity acute-nitrate,

	collection, toxicity, exposure			secondary - MTBE, OSHA - formaldehyde
4- 9/24	**CS** Water Resources Engineering,	**CS** 1,2,3 (pgs124-126) CS 5 (pgs 131-150) CS 6,7 (pgs159-169, 177-181)	**R** 1 to 9, 11 to 14, 19 to 23, 31; **P** 1,6,14,21,25,33, 37, 43,54; **D** 2, **FE** 1,3,4	Recharge; Vermeule; Harry's Brook, flood plain & groundwater; mason's level-slope; starting condition; Manning formula; Reynold's number
5- 10/1	**CS** Water Chemistry Lab- alkalinity & hardness	**CS** 1 to 6 (pgs 216-241);	**R** 1 through 11 **P** 1 to 44 **R** 4, 7, 5	Water and wastewater treatment; East Palestine Ohio Hazardous wastes
6- 10/8	Water Chemistry continued Water Treatment -	**CS** 5 **CS** 6 (pgs 250 to 282, 297 to 365);	**R** 2 through 45; **P** 1-11, **P** 30 to 66; **D** 1 to 6; **FE** 1 to 4 **R** 14,7,5	Volatility; density; solubility; diffusion Residence time; mixing; effluent standards;
7- 10/15	Water Treatment Lab Jar tests	**CS** 6 continued	Clinton Bogert Engg & USEPA manuals	Scale up from lab bench/pilot/full; Concept to asbuilt;
8- 10/22	Field Trip		Passaic Valley Water Commission	
9- 10/29	Water Pollution	**CS** 7 (pgs 388-440);	**R** 1-35; **P** 1 to 16, **P** 7-19 to P 7-47; **D** 1 to 7 **FE** 1 to 4	Analog vs digital simulation of BOD/DO for Instream Aeration; ORSANCO, East Palestine water impact
10- 11/5	Wastewater Treatment	CS 8	RVRSA website California OWP;	Oxidation ditch, residence time / volume
11- 11/12	Wastewater Treatment	Chapter 8	Two Bridges field California OWP	Ultra Violet Radiation & DNA
12- 11/19	Air Pollution Hazardous Waste	Chapter 9 (pgs 455-557) Chapter 12	National Transportation Safety Board	East Palestine air dispersion by temp, wind, nomograph

13- 11/26	Air Pollution	Chapter 9 ; R8,9	USEPA Ohio EPA	First Responder/ Engg Operator/ Bridge on River Kwai
14- 12/3	Noise Pollution Solid Waste Mgt	Chapter 10 Chapter 11	Acapulco Hurricane	Institutional/ Engg/ Political Differences
15- 12/10	Sustainability and Green Engineering	Chapter 13	Climate Change	Carbon sequestration, Transportation Engg Architectural Coor.
16 – 12/17	Final Presentations Team Projects; Final exam		Assignments TBD	

GRADING (subject to revision)__________ % of total grade Raw Score range for assignments

Final Exam	**15%**	**0-10; 1 point/step app. to problem solving**
Team Field Trip Report	**10%**	**0-10; 1 point/step app.to problem solving**
Assigned 10 written problems	**30%**	**0-10; 1 point/step app.to problem solving**
Oral presentations no more than 8	**20%**	**0-10; 1 point/step app.to problem solving**
Team/Individual lab reports	**15%**	**0-10; 1 point/step app.to problem solving**
Certification Corner questions	**10%**	**0-10; 1 point/step app.to problem solving**

A = 4.0	90 to 100%
B+ =	87 to 89%
B = 3.0	80 to 86%
C+ =	70 to 79%
C = 2.0	60 to 69%
D =	50 to 59%
F =	Below 50%

*The NJIT Honor Code will be upheld, and any violations will be brought to the immediate attention of the Dean of Students.

The approach to problem solving requires that those individuals who have collaborated or contributed to assignments be acknowledged.

Plagiarism is defined as taking credit for work by others and will be considered a violation of the NJIT Honor Code. Use of AI must be specifically cited and answers independently verified

All disputes about points and grades must be written and specific to the exam, problem, report or presentation in question.

Changes to grades must be made with the approval of the Program Chair and within the University time frame for making changes.

WEBEX classes may be recorded to verify presence and participation. Chat may also be used to verify presence and participation.

The use of electronic devices that interferes with problem solving for individuals or teams is strictly prohibited.

Any reference obtained from an electronic device must be identified sufficiently to verify accuracy.

Written assigned problems or CC must be submitted electronically as WORD documents

Raw scores will be provided for assigments not letter grades

Field Trip reports and Lab reports must be submitted individually when specified.

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ADDITIONAL REFERENCES

https://abcnews.go.com/US/toxic-chemicals-train-derailed-ohio-originally-reported-data/story?id=97080179

https://www.youtube.com/watch?v=EV2fKrRFGRE

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CEE Mission, Program Educational Objectives and Student Outcomes

The **mission** of the Department of Civil and Environmental Engineering is:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarship among our faculty and students
- to promote service to the engineering profession and society

Our **program educational objectives** are reflected in the achievements of our recent alumni:

1 – Engineering Practice: Alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working toward safe, practical, resilient, sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.

2 – Professional Growth: Alumni will advance their technical and interpersonal skills through professional growth and development activities such as graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as business and law through further education.

3 – Service: Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable

giving and other humanitarian endeavors.

Our **student outcomes** are what students are expected to know and be able to do by the time of their graduation:

1. an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics

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. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which 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 together 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 draw conclusions

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Outcomes Course Matrix - Prepared By: Adjunct Professor Schorr

Strategies, Actions and Assignments	ABET Student Outcomes (1-7)	Program Educational Objectives	Assessment Measures
Student Learning Outcome 1: Describe and discuss environmental regulations, standards, ethics and the driving forces behind environmental science and engineering projects			
Define environmental science and engineering as practiced by agencies and individuals; read and rewrite problems in engineering terms. Listen to Operators and managers of systems that did not meet design expectations	1, 3	1, 3	Weekly assignments scored by use of Approach to Problem Solving.
Explain and discuss past, present and proposed environmental regulations, standards, techniques and ethics, in terms of "environmental justice", equitable allocation of resources in average and in extreme situations. Listen to Operators and managers of systems that did not meet design expectations	1, 2, 3, 4	1, 2, 3	Weekly assignments scored by use of approach to problem solving and final exam.
Student Learning Outcome 2: Assess environmental quality in physical, chemical and biological terms in engineered systems and facilities			

Understand environmental and engineering parameters, unit, assumptions and conversion factors (physical and time dimensions). Listen to Operators and managers of systems that did not meet design expectations.	**1, 2, 3**	**1, 2, 3**	Weekly assignments and exams scored by use of approach to problem solving
Conduct laboratory tests for turbidity, hardness and for coagulation/flocculation by jar testing, explain assumptions (visual colors codes), apply those results to design and operation of water and wastewater systems and sensors .	**1, 2, 5, 6**	**1, 2**	Weekly assignments and exams and laboratory work.
Student Learning Outcome 3: Illustrate mass balances in environmental and engineered systems			
Draw problem to scale in 1,2 or 3 dimensions, to show the flux (rate of flow) of chemicals between air, water and land, through an engineered treatment, storage, and distribution systems and through a biological system.	2, 3	1	Weekly assignments, virtual or actual field trips and exams
Conceptualize mathematical models, equations and empirical formulas to calculate the rate (volume per unit time) and amount of chemicals (concentration per unit volume) in and through systems and the cycles or trends that may be occurring	2, 3	1, 2	Weekly assignments and exams
Student Learning Outcome 4: Apply basic scientific and engineering principles of water and wastewater treatment, air pollution control, and hazardous waste management			
Apply the standards to the design of water, wastewater, air pollution and hazardous waste facilities by using visual examples. Listen to Operators and managers of systems that did not meet expectations..	1,	1	Weekly assignments, virtual or actual field trips and exams
Apply control technology to the operation of water, wastewater, air pollution, and hazardous waste facilities.	2	1	Weekly assignments, virtual or actual field trips and exams

Explain potential sources of error in design and operation of systems and equipment and techniques to monitor and respond to unexpected circumstances.	2, 3, 7	1, 2, 3	Weekly assignments, virtual or actual field trips and exams
Cite references and acknowledgement any assistance	1-7	1-7	Weekly assignments, field reports, exams