Fall 2019

# ENE 262-001: Introduction to Environmental Engineering

A. Brook Crossan

# *ENE 262-001 – INTRODUCTION TO ENVIRONMENTAL ENGINEERING*

**Department of Civil & Environmental Engineering**
**New Jersey Institute of Technology**

**Fall 2019**


Instructor: A. Brook Crossan, Ph.D., P.E.
Office Hours: 9:30-9:55am and 1:40-2:10pm Wednesday, or by appointment
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*"Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.*

*Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office.* ***Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.*** *If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu"*

| *Week* | Date | Topic | Reading | Comments |
|---|---|---|---|---|
| 1 | 9/4 | -Introduction; Definitions, Regulations/Standards, Environmental Ethics, Environmental Justice, Global Warming | Ch. 1<br>Ch. 9 part | Tie the ASCE Code of Ethics, into environmental ethics, environmental justice, sustainability, & global warming. Papers for reading assigned for Week #2 discussion. |
| 2 | 9/11 | Global Warming<br>Sustainability and Green Engineering | Ch. 9 part<br>Ch. 13 | Civil Engineers and the infrastructure they design are on the front lines of response to global warming and sustainability. Papers for reading assigned for Week #3 discussion. |
| 3 | 9/18 | -Mass Balance<br>-Risk Assessments | Ch. 2<br>Ch. 3 | Homework #1 Assigned |
| 4 | 9/25 | -Water Resources Engineering<br>- Pick Groups and Topics for the Papers | Ch.4 | Homework #2 Assigned |
| 5 | 10/2 | - Water Pollution | Ch.7 | Homework #3 Assigned |
| 6 | 10/9 | -Water Chemistry<br>*Lab on Alkalinity meets in Colton 414* | Ch.5 | Approximately 1.25 hr of lecture prior to lab |
| 7 | 10/16 | - Water Chemistry<br>- Water Treatment<br>*Lab on Hardness meets in Colton 414* | Ch. 5<br>Ch. 6 | Approximately 1.25 hr of lecture prior to lab |
| 8 | 10/23 | Midterm | | |
| 9 | 10/30 | -Water Treatment<br>Submit Outline of Paper<br>*Lab on Jar Testing meets in Colton 414* | Ch.6 | Approximately 1.25 hr of lecture prior to lab |
| 10 | 11/6 | Noise | Ch. 10 | Homework #4 Assigned |
| 11 | 11/13 | - Air Quality | Ch. 9 | Homework #5 Assigned |

| | | | | |
|---|---|---|---|---|
| 12 | 11/20 | - Air Quality<br>-Wastewater Treatment | Ch. 9<br>Ch. 8 | |
| | Thanksgiving Week | | | |
| 13 | 12/4 | -Solid Waste<br>-Hazardous Waste | Ch. 11<br>Ch.12 | |
| 14 | 12/11 | *Paper Presentations* | | |
| | | Final Exam | | |

Note: There will occasionally be papers (on topic, but relatively short) assigned to be read prior to class so that they can be discussed in class. Those discussions will be part of the class participation grade.

ENE 262-001 Wednesday 10:00am to 1:35pm
Guttenberg Info Tech Center (GITC) 1100

General Notes:

Lecture slides and assigned papers will be placed on Moodle.
No late assignments accepted without pre-approval.

Texts: 1) Davis, M.L. and Cornwell, D.A., Introduction to Environmental Engineering,5th Edition, McGraw Hill Companies, New York, NY, 2013, ISBN 978-0-07-340114-0
2) Other postings on Moodle and class presentations

Grading:

| | |
|---|---|
| Midterm | 25% |
| Final Exam | 25% |
| Laboratories | 18% |
| Paper & Presentation | 17% |
| Homework | 10% |
| Class Participation | 5% |

**Department of Civil and Environmental Engineering**

**ENE 262 – Introduction to Environmental Engineering**

**Description:**

To introduce students to the integrated science, engineering, design and management concepts of engineered environmental systems. The course will cover environmental regulations and standards, environmental parameters, mass balance and natural systems, water quality management, water and wastewater treatment, air pollution control, noise pollution, and solid and hazardous waste management. Background material and laboratories in the environmental sciences and management areas will be covered. Group term papers and presentations will be required.

Prerequisites: CHEM 126, MATH 112, and PHYS 121. To introduce students to the integrated science, engineering, design and management concepts of engineered environmental systems. The course will cover environmental regulations and standards, environmental parameters, mass balance and natural systems, water quality management, water and wastewater treatment, air pollution control, noise pollution, and solid and hazardous waste management. Background material and laboratories in the environmental sciences and management areas will be covered. Group term papers and presentations will be required.

**Textbook(s)/Materials Required:**

1) Davis, M.L. and Cornwell, D.A., Introduction to Environmental Engineering,5th Edition, McGraw Hill Companies, New York, NY, 2013, ISBN 978-0-07-340114-0
2) Handouts and class presentations

**Course Objectives:**

1. Provide students with the most relevant environmental regulations and standards; the driving forces behind environmental science and engineering projects.
2. Provide students with the ASCE Code of Ethics and an environmental code of ethics and how that relates to environmental justice, sustainability and the response to global warming
3. Provide students with the scientific background needed to assess environmental quality in terms, of the physical, chemical and biological aspects.
4. Provide students with the basic scientific and engineering principles of sustainability and green engineering, water and wastewater treatment, air pollution control, noise pollution, and solid and hazardous waste management.
5. Introduce students to environmental report writing.

**Topics:**

Definition of Environmental Engineering
Impact of engineering projects on the environment.
Environmental legislation. Regulations and standards (current and proposed).
Environmental ethics. Environmental justice.
Health effects. Risk assessment and management.
Physical, chemical and biological sciences and parameters.
Mass balance and natural systems in the environment.
Water quality management.
Water & wastewater treatment.
Air pollution (including greenhouse gases) and control.
Noise pollution and control.
Solid and hazardous waste management.
Sustainability and green engineering
Environmental report writing – case study.
Laboratory Experiments in the environmental sciences.

**Schedule:** Lecture/Recitation- 3 hours per week
Laboratory- 1 hour per week

**Professional Component:** Engineering Topics
**Program Objectives Addressed:** 1 to 5

**Prepared By:** Prof. Crossan **Date:** 07/19/2019

Course Objectives Matrix – ENE 262 Introduction to Environmental Engineering

| Strategies, Actions and Assignments | ABET Student Outcomes (1-7) | Program Educational Objectives | Assessment Measures |
|---|---|---|---|
| **Student Learning Outcome 1: Describe and discuss relevant environmental regulations ethics and standards; the driving forces behind environmental science and engineering projects.** | | | |
| Define environmental science and engineering | 4, 7 | 1 | Homework, class, discussions and examinations. |
| Explain and discuss current and proposed relevant regulations, standards and ethical rules. | 4 | 1 | Homework and examinations. |
| **Student Learning Outcome 2: Assess environmental quality in terms of the physical, chemical and biological aspects.** | | | |
| Provide an overview of environmental sciences and parameters. | 1, 2 | 1, 2 | Homework, class discussions, and examinations. |
| Conduct experiments in the environmental sciences. | 6, 5 | 1, 2 | Laboratory group discussions and laboratory reports. |
| **Student Learning Outcome 3: Illustrate mass balance in environmental systems.** | | | |
| Illustrate the mass balance approach. | 1, 2 | 1, 2 | Homework, class examples and examinations. |
| **Student Learning Outcome 4: Recognize the basic scientific and engineering principles of water and wastewater treatment, air pollution control, noise pollution, and solid and hazardous waste management.** | | | |
| Introduce the scientific and engineering principles of water treatment. | 2 | 1, 2 | Homework, class discussions and examinations. |
| Introduce the scientific and engineering principles of wastewater treatment. | 2 | 1 | Homework, class discussions, and examinations. |
| Introduce the scientific and engineering principles of air pollution and control | 2 | 1 | Homework, class discussions and examinations. |
| Introduce the scientific and engineering principles of noise pollution and control. | 2 | 1 | Class examples, and examinations. |
| Introduce the scientific and engineering principles of solid and hazardous waste management. | 2 | 1 | Homework, class discussions, and examinations. |
| **Course Objective 5: Practice environmental report writing.** | | | |

| | | | |
|---|---|---|---|
| Provide the mechanisms of environmental report writing. | 3 | 1, 2 | Class discussions and case study paper. |

**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 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 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

Revised: 2/13/18

**EnE 262-001 Papers- Fall 2019**

***Select a paper topic and group (3-4 students to a group) by 25 September 2019. Once you select a topic as a group, only one other group will be able to select that same topic. You must follow the manuscript guidelines discussed on the next page and use the most relevant and latest peer-reviewed publications as references. An outline of the paper with a list of preliminary references and organizational group structure (total not exceeding 3 pages) are due 30 October 2019. Final papers are due Wednesday 11 December 2019. Presentations, utilizing Power Point, not exceeding 12 minutes per group will be required of all groups on that date. All group members must present.***

***The following submissions on that date are required:***

- ***Paper copy of the paper, stapled in the upper left corner;***
- ***Electronic copy of the paper (Word); and***
- ***Electronic copy of the presentation (Power Point).***

*Paper Topics*

1. **Reduction of Greenhouse Gases: innovative regulatory approaches, such as incentive-based mechanisms (including a tax on carbon), to achieve reductions fairly and efficiently**

2. **Removal of heavy metals in sediment by in-situ processes; comparison of technologies**

3. **Nanomaterials for drinking water treatment**

4. **Approaches for reducing $CO_2$ emissions from deforestation and forest degradation; compare and contrast US with the rest of the world**

5. **Performance of innovative policy approaches, including economic incentives, and voluntary programs for reducing pollution (water and/or air)**

6. **Life cycle analysis of hybrid, electric, & hydrogen vs. conventional (gasoline and diesel) vehicles**

7. **Green and sustainable technologies for construction materials**

8. **Intelligent transportation systems for environmental protection**

9. **Nanoparticles in Personal Care Products: types; characteristics; problems; & regulatory response**

10. **Non-point and point sources of nitrogen in the water: regulations; & methods of control and removal**

11. **Analysis of the performance of policy instruments for improving water quality**

12. **Arsenic in water: sources and methods of source reduction; methods of removal**

13. **Hormones and medicines in our drinking water: issues and solutions**

14. **State of the art options for the removal of nutrients from wastewater**

15. **Radionuclides: Radon and other radiochemicals in the air and water, methods of control and removal**

16. **Ozonation & chlorination of drinking water: processes; advantages and disadvantages of each; & market penetration in different regions of the world**

17. **Formation and reduction of smog in the atmosphere: chemistry of formation; regulations and treaties, including historical trends; & solutions.**

18. **State of the Art of Landfilling Municipal and Hazardous Waste: comparison of closure or abandonment of old landfills constructed by different means; assessment of the significance of outstanding issues**

19. **Impact of more intense rainfall events on appropriate design standards for both stormwater infrastructure and floodplain regulations. Have standards and regulations kept pace with weather changes?**

20. **Sea level rise – 20th and 21st century and beyond: amount & rate of rise (historic and projected); comparison of impacts and responses for two or three regions of your choice (e.g. NJ, NY & FL; USA, Netherlands, and India; barrier islands and major cities)**

**Manuscript Preparation**

**General: Manuscripts must be typewritten, double-spaced with wide margins on one side of white paper. Good quality printouts with a font size of 12 or 11 pt are required. Authors should retain a copy of their manuscript since the manuscript submitted will be kept on file. The manuscript should not exceed 10,000 words.**

**Cover: Title of the Paper, Course Number (ENE 262-001), Group Number, Names of Authors (including email addresses and full postal addresses)**

**Abstracts: The article should be preceded by an abstract of no more than 200 words, describing the entire paper and a keyword list (5-10 words). The key word list does not need definitions.**

**Text: Follow this order when typing manuscripts: Cover, Abstract, Keywords, Introduction, Main text in sections as appropriate, Conclusions or Summary, Acknowledgements, Appendix, References. All other footnotes (except for table footnotes) should be identified with superscript Arabic numbers.**

**Units: The SI system should be used for all scientific and laboratory data; if in certain instances it is necessary to use other units these should be added in parentheses. Temperatures should be given in degrees Celsius (with Fahrenheit in parentheses). The unit "billion" is ambiguous and should be qualified when used. Where abbreviations are likely to cause ambiguity or not be readily understood by an international readership, units should be given in full.**

**Symbols: Special symbols should be identified in the margin. Care should be taken to vvavoid confusion between letters and numerals.**

**Math: Formulae should be numbered consecutively in the right hand side of the column. Vectors and matrices should be clearly indicated.**

**References: All publications cited in the text should be presented in a list of references following the text of the manuscript. In the text refer to the author's name (without initials) and year of publication (e.g. "Since Amos (1996) has shown that..." or "This is in the agreement with results obtained later (Botch et al, 1995)"). For three or more authors use the first author followed by "et al.", in the text. The list of references should be arranged alphabetically by authors' names. The manuscript should be carefully checked to ensure that the spelling of authors' names and dates are exactly the same in the text as in the reference list.**

**References should be given in the following form:**

**Arno, S.F., 1996. The seminal importance of fire in ecosystem management: impetus for this publication. In: Hardy, C.C., Arno, S.F. (Eds.), The Use of Fire in Forest Restoration. General Technical Report INT-GTR 314. United States Department of Agriculture Forest Service. Intermountain Research Station, Missoula, MT, pp. 1-5.**

**Botch, M.S., Kobak, K.I., Vinson, T.S., Kolchugina, T.P., 1995. Carbon pools and accumulation in peatlands of the former Soviet Union. Global Biogeochemical Cycles 9 (1), 37-46.**

**Grainger, A. 1992. Characterization and assessment of desertification. In: Chapman, G.P. (Ed.), Desertified Grasslands: their Biology and Management. Academic Press, London, pp. 17-33.**

**Press, W.H., Teukolsky, S.A., Vetterling, W.T., Flannery, B.P., 1992. Numerical Recipes: The Art of Scientific Computing, 2nd ed. Cambridge University Press, Cambridge.**

**Illustrations: All illustrations should be original, clear and professionally made. Photographs, charts and diagrams are all to be referred to as "Figure(s)" and should be numbered consecutively in the order to which they are referred. All illustrations should be clearly marked with the figure number and the author's name. All figures are to have a caption.**

**Photographs: Original photographs must be supplied as they are to be reproduced (e.g. black and white or color). If necessary, a scale should be marked on the photograph. Please note that photocopies of photographs are not acceptable.**

**Tables: Tables should be numbered consecutively and given a suitable caption. Footnotes to tables should be typed below the table and should be referred to by superscript lowercase letters. Tables should not duplicate results presented elsewhere in the manuscript, (e.g. in graphs).**

**Grading:**

- **Carefully read and follow all instructions. Deductions in grade will be made for missing components (e.g. no key word list), or incorrect components (e.g. use of English units alone)**
- **Edit the report when complete to ensure that the style of writing is consistent throughout**
- **Part of the presentation grade will be based on the Power Point document**
    - **Visually appealing and useful graphics**
    - **Appropriate font size (not too many words on the slide)**
- **Do not read the slides when making your presentation**