

Bioproducts and Biosystems Engineering (BBE)

Course Title: BBE 4523/5523 Ecological Engineering Design

(3 cr; QP- CE 3400; SP- EEB 3xxx (recommended), CE 3502; upper div IT or grad IT major; A-F only; 3 lect per week).

Course Description: Application of the principles of ecological engineering to design of remediation systems for problems associated with environmental degradation. Much of the course is driven by analysis of case studies of construction of artificial ecosystems or restoration of natural ecosystems. Applications include wetland restoration, constructed wetlands, biological engineering for slope stability, waste treatment using biological systems, restoration of ecological service functions of watersheds.

Instructor:

John L. Nieber, Room 203, BAE Building, 5-6724, nieber@umn.edu.

Course Outcome Objectives:

Students completing this course should be able to:

1. Describe the basic principles of ecology and the framework of complex ecosystems. Should be able to describe thermodynamic principles as they apply, and also how to quantify energy fluxes in ecosystems.
2. Construct algorithms for quantifying functions (storage, transformation, flux, adaptation) in complex biological systems.
3. Apply the principles of ecology and engineering to the design of artificial ecosystems and the restoration of natural ecosystems.
4. Apply economics (market and engineering) to cost/benefit analysis of ecosystem restoration.

Text:

No text required

Reference Materials:

1. Kangas, P.C., Ecological Engineering, Principles and Practice, Lewis Publishers, 2004
2. Mitsch, W.J. and S.E. Jorgenson, Ecological Engineering and Restoration Ecology, 2003
3. van Andel, J. and J. Aronson, Restoration Ecology, Blackwell Publishing, 2006
4. Selected journal articles

Semester Topics Covered:

1. Review of ecological principles as applied to ecological engineering practice
2. Getting engineers to think in ecological systems terms

3. Modeling complex systems
4. Quantifying economic benefits of ecosystem construction/restoration
5. Treatment wetlands
6. Soil bioengineering
 - a. Slope stabilization
 - b. Bioremediation of contaminated soils
7. Restoration of watershed ecosystem functions
 - a. Natural wetlands
 - b. Streams
 - c. Ground water recharge
8. Control of exotic species
9. Ecological engineering treatment of the solid waste problem
 - a. The consumer waste conundrum
 - b. Solid waste systems as ecosystems
 - c. Industrial ecology

Quality Control:

It is required that all materials turned in for credit by the student have to be of presentable quality. This means that the material presented has to be of a quality such that the instructor can decipher it easily. Any presentation requiring extra deciphering work will be returned to the student for correction. Also, material must be handed in on time to receive credit. Late papers will not be accepted for credit unless prior permission for lateness is granted by the instructor. The student can use the following guidelines in preparation of assignments.

Homework assignments:

1. All work done in pencil with legible printing.
2. Clearly defined problem statement.
3. Clearly defined solution steps and solution results.

Design project report format:

1. Table of contents.
2. Abstract, conclusion, and summary statements.
3. Clear statements of problem and problem solution.
4. All text material and tables prepared with a typewriter or word processor. Equations can be written by hand. All figures drawn clearly with adequate captions and legends. Computer output and other materials to be placed in appendices must be indexed.

Evaluation: The final grade for this course will be based on the following weighting of course components.

Category	Final Grade
Homework	10
Design Project	25
Lab Assignments	25
Midterm Exam	20
Final Exam	20

Statement on Academic Honesty:

The following statement is from the IT Student Guide;

"The Institute of Technology expects the highest standards of honesty and integrity in the academic performance of its students. Any act of scholastic dishonesty is regarded as a serious offense, which may result in expulsion. The Institute of Technology defines scholastic dishonesty as submission of false records of academic achievement; cheating on assignments or examinations; plagiarizing; altering, forging or misusing an academic record; taking, acquiring, or using test materials without faculty permission; acting alone or in cooperation with another to obtain dishonestly grades, honors, awards, or professional endorsement. Aiding and abetting an act of scholastic dishonesty is also considered a serious offense".

This statement will be held to in BBE 4xxx/5xxx as the definition for academic honesty. If at any time you have a question about what might constitutes an academically dishonest act, please feel free to contact me.