

## ESM 212 Introduction to Environmental Materials Engineering (Elective)

### Course Catalog description:

Multidisciplinary, materials-oriented approach to environmental and civil engineering, incorporating the concept of sustainable development: basic principles, including pollutant transport, water quality, waste and waste water treatment, energy systems and energy efficiency, use of sustainable building materials, 'green' manufacturing and pollution prevention, engineering materials issues unique to construction. Use of field and laboratory sensors and analytical tools will be discussed and demonstrated. Project and problem-based approach to design of structures and materials engineering, incorporating environmental considerations.

*3 credits*

**Pre- or Corequisite(s):** ESG 100 or ESG 201; ESG 198 or equivalent

### Text(s) or other required material:

### Course learning outcomes:

Understand impact of toxic chemicals on the environment  
Use of basic principles of energy efficiency and the role of materials selection in designing energy efficient structures  
Being able to describe several sustainable building materials

### Topics Covered:

Week 1. Design needs of environmental engineering and sustainable design Policy and global issues  
Week 2. Basics of environmental materials chemistry  
Week 3. Pollutant transport Basics of biogeochemical principles  
Week 4. Water resource engineering Materials for water treatment technologies  
Week 5. Methods of environmental remediation Wastewater treatment  
Week 6. Materials in environmental remediation systems Filtration, barriers, bioremediation  
Week 7. Pollution prevention and energy conservation in manufacturing Midterm  
Week 8. Materials for energy generation and infrastructure development  
Week 9. Basic concepts of building design and construction  
Week 10. Materials for civil and construction engineers  
Week 11. Material and soil mechanics  
Week 12. Development and use of sustainable building materials Design of "green" buildings  
Week 13. Sustainable engineering and development Methods and case studies  
Week 14-15 Class presentations on semester projects Course final exam

### Class/ Laboratory Schedule, i.e. number of sessions each week and duration of each session:

ESM	212	Environmaterials Engineering	LEC	1	TU	3:50 PM	6:40 PM
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### Contribution of Course to meet requirement of Criterion 5:

This course will integrate several areas of engineering and science, such as materials, environmental, chemical engineering and environmental chemistry, in order to design various engineering solutions addressing contemporary environmental issues. It will show that only by holistic and interdisciplinary

approach they can make a substantial progress in environmental design. The course will also outline various other areas, which can significantly affect the engineering solutions, such as ethical, legal and economic issues.

**Relationship of course to program outcomes:**

Understand impact of toxic chemicals on the environment (60%)

Use of basic principles of energy efficiency and the role of materials selection in designing energy efficient structures (20%)

Being able to describe several sustainable building materials (20%)

**Person(s) who prepared this description and date of preparation:**

Alexander Orlov

1/12/09