Course: ENCE 300 Fundamentals of Engineering Materials

Session 0101  Session 0102
Lect. Tu. 12:30-2:30pm  Tu. 12:30-2:30pm (EGR 0110)
Labs Th. 12:30-2:30pm  Th. 2:30-4:30pm (EGL 0106A)

Office Hours
Tu 2:30-4:00pm, Th 12:30-2:00

Course Description
Behavior, physical, mechanical and chemical properties, design and performance of civil engineering materials, including aggregates, cement, concrete, asphalt binders and mixtures, plastics and geosynthetics, timber, metals and alloys. Modified and advanced highway materials (polymer and rubber modified mixtures, high performance concrete, composites, smart materials). Laboratory testing with hands-on experience on aggregates, Portland cement concrete, asphalt mixtures, timber and metals as per SUPERAVe, ACI design methods, and ASTM standards and specifications.

Prerequisite
ENES 220 Mechanics of Materials and permission of department.

Instructor
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Teaching Assistant:
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Textbooks:

Class Web-site (Notes)
http://www.civil.umd.edu/classes/ence300/
(12 files)

Recommended Reading:
"Materials for Civil and Construction Engineers," Mamlouk & Zaniewski, Addison Wesley, 1999

Other Readings:
ASTM Standards
Topics

Introduction
- Cost and Availability of Materials
- Elastic Parameters

Aggregates
- Aggregate Requirements for Specific Projects.
- Lab(s)

Concrete/Cement-based Materials
- Cements Types.
- Hydration Process and Hardening Reaction, Properties of Main Compounds
- Proportioning and Mixing of PCC.
- Failure Mechanisms and microcracking. Strength of Concrete
- Creep deformation and fracture
- Lab(s)

Asphalt Materials
- Physical Properties of Asphalt Cements, Temperature Susceptibility, Hardening.
- Properties and design of Asphalt Concrete.
- Performance of Asphalt Concrete and Failure Mechanisms. SHRP results.
- Use of Asphalts for Roofing and Paving Applications
- Lab(s)

Timber:
- Wood Structure. Physical Characteristics.
- Mechanical Properties.
- Lab

Metals & Alloys
- Crystalline and Glass Structure. Structure of Solutions, Grain and Phase Boundaries.
- Equilibrium Constitution and Phase Diagrams for Alloys.
- Mechanical Behavior of Steel. Mechanical Testing Procedures.
- Lab(s)

Plastics & Geosynthetics
- Plastics, and Polymerization Process.
- Properties, Durability, and Chemical composition.
- Applications

Reclaimed /Recycled Waste Products and Environmental Impact
- Reclaimed Materials.
- Waste products in Civil Engineering Applications.
Course Grade:

Part I 50% of Total
Laboratory Reports
(100 points with each one having a relative weight on total lab grade)
Part II 50% of Total
Assignments (10-20 points each)
Exam(s) (60-80 points each)
Term Project (assignment 100 points, and presentation 60-70 points)

Computer usage: report writing, data analysis, PowerPoint presentations.

Library impact: significant library impact.

Course Goals & Learning Objectives

• Understanding of behavior, physical, mechanical, and chemical properties of civil engineering materials.
• Significance and reasons of testing, specifications and standards.
• Hands-on experience on step by step analysis of aggregates for composite materials (PCC, AC), timber, metals, as per ASTM
• Learn mix design of PCC as per ACI, and of AC as per ASTM and SUPERPAVE.
• Hands-on experience on how to perform tests to check compliance with ASTM specs.
• Laboratory and Technical Reports writing, Technical Presentations.
• Acquaint and familiarize with literature and technical publications, preparation of technical synthesis, analysis and presentations that are part of the daily activities of a practicing civil engineer.
• Ability to interpret, explain and synthesize technical findings and information.
• Writing of technical reports, and provide effective and clear presentations.
• Ability to work in teams, test your leadership and interact with your colleagues. Ability to prepare professional presentations.