ESM 335 STRENGTH OF MATERIALS

Class times: 5.20 pm to 6.40 pm (Tuesday, Thursday)

Course description: This course develops a fundamental understanding of the mechanical behavior of materials. Basic concepts in materials and mechanics such as defect structures, elasticity, plasticity and fracture are introduced and particular emphasis is placed on the materials and mechanics issues associated with fatigue and high temperature deformation of materials. Total life and damage tolerant approaches to fatigue are invoked to understand fatigue crack initiation, fatigue crack propagation and micro-mechanisms of fatigue damage. Advanced topics include smart materials.

Pre/Co- requisite(s): AMS 261 Applied Calculus III or MAT203 Calculus III with Applications; ESG 302 Thermodynamics.

References:

R. E. Reed-Hill and R. Abbaschian – Physical Metallurgy Principles, Third Edition, Thomas Engineering, 1991.
T. L. Anderson, Fracture Mechanics – Fundamentals and Applications, Second Edition, CRC Press, 1995.
N. Dowling, Mechanical Behavior of Materials, Second Edition, Prentice Hall, 1999.
S. Suresh, Fatigue of Materials, Second Edition, Cambridge University Press, 2003.
W. D. Callister, Jr., Materials Science and Engineering – An Introduction, Sixth Edition, John Wiley and Sons, 2003.

Course objectives:

1. Obtain familiarity with basic concepts of materials science, continuum mechanics and fracture mechanics.
2. Understand basic mechanisms of cyclic deformation and high temperature deformation in solids.
3. Identify fatigue crack initiation and damage progression processes.
4. Develop quantitative methods for life prediction using damage tolerant approach to fatigue crack propagation.

Course topics: Materials Science; Continuum Mechanics; Fracture Mechanics; Cyclic Deformation in Solids; Fatigue Crack Initiation; Total Life Approach Damage Tolerant Approach; Smart Materials

Contribution of Course to meet requirement of Criterion 5:

20% Engineering Science, Mathematics 30%, Basic Science 30%, General Education 20%

Relationship of course to program outcomes:

This course studied problems (through home works and exams) that were designed to quantitatively predict and understand failure in engineering structures such as bridges or airplanes and met the following program outcomes.

an ability to apply knowledge of mathematics, science and engineering
an ability to identify, formulate, and solve engineering problems
an understanding of professional and ethical responsibility
the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context
a recognition of the need for, and an ability to, engage in life-long learning
a knowledge of contemporary issues
an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Person(s) who prepared this description and date of preparation: T. A. Venkatesh, 06/23/09.