ABET Course Syllabus

ENAE 425 Mechanics of Composite Structures

Credits & Contact Hours: 3 credits (3 hours of lecture)

Course Status: Not required

Schedule: Offered every Spring semester

Course Description: Introduction to structures composed of composite materials and their applications in aerospace. In particular, filamentary composite materials are studied. Material types and fabrication techniques, material properties, micromechanics, anisotropic elasticity, introduction to failure concepts.

Pre-Requisites: ENAE324, ENES220, MATH241, and MATH246

Co-Requisites: None

Textbooks: None

Other Required Material: Course lecture notes and handouts

Course Oversight: Structures and Vibration Committee

Syllabus Prepared By/Date: Dr. Norman Wereley on June 10, 2011

Course Objectives/Student Learning Outcomes:

1. Be able to determine composite mechanical properties from constituent fiber and matrix material properties including longitudinal and lateral moduli, Poisson's ratio, and shear modulus.
2. Be able to determine the generalized stiffness and compliance matrix relating in-plane stresses to strains for a composite layer assuming plane stiffness.
3. Be able to apply classical laminated plate theory to determine extensional, coupling, and bending stiffnesses of a composite laminate. Also be able to perform this calculation using MATLAB for a composite laminate with many layers.
4. Be able to fabricate composite laminates and built-up composite structures such as I-beams, box beams, or model-scale aircraft wings using a composite manufacturing procedure.

Topics Covered:

1. Material types and fabrication techniques
2. Material properties
3. Micromechanics
4. Anisotropic elasticity
5. Introduction to failure concepts.

Relationship of Course Objectives to Program Outcomes

This course addresses program outcomes:

For X,Y,Z...use the attached table in the following manner: if a course is listed as "3" or "4" in a given row, include that outcome number in the list above. If the course has 0,1,2 listed in a row, do not list that outcome number.

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a. Ability to apply knowledge of mathematics, science, and engineering
    - Relevant Content:
    - Proficiency Demonstrated By:
    - Level of Coverage:
b. Ability to design and conduct experiments, as well as analyze and interpret data
    - Relevant Content:
c. Ability to design a system, component, or process to meet desired needs
    - Relevant Content:
    - Proficiency Demonstrated By:
    - Emphasis:
d. Ability to function on a multi-disciplinary team
    - Relevant Content:
e. Ability to identify, formulate, and solve engineering problems
    - Relevant Content:
    - Proficiency Demonstrated By:
    - Emphasis:
f. Understanding of professional and ethical responsibility
    - Relevant Content:
g. Ability to communicate effectively
    - Relevant Content:
h. Broad education necessary to understand the impact of engineering solutions in a global and societal context
    - Relevant Content:
i. Recognition of the need for, and an ability to engage in life-long learning
    - Relevant Content:
    - Proficiency Demonstrated By:
    - Emphasis:
j. Knowledge of contemporary issues
    - Relevant Content:
k. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
    - Relevant Content:
    - Proficiency Demonstrated By:
    - Emphasis: