

DEPARTMENT OF AERONAUTICS AND ASTRONAUTICS

AA 432 COMPOSITE MATERIALS FOR AEROSPACE STRUCTURES (Elective)

WINTER QUARTER

CATALOG DATA: COMPOSITE MATERIALS FOR AEROSPACE STRUCTURES, 3 credits

Introduction to analysis and design of aerospace structures, utilizing filamentary composite materials. Basic elastic properties and constitutive relations of composite laminates. Failure criteria, buckling analysis, durability, and damage tolerance of composite structures. Aerospace structure design philosophy and practices. Prerequisite: AA 332. Offered: W.

PREREQUISITES BY TOPIC:

- 1) Junior level structural analysis courses (AA 330, 331, 332 or equivalent)

TEXTBOOK:

- 1) R. M. Jones, Mechanics of Composite Materials, Taylor & Francis, 1975.

REFERENCES:

- 1) B. C. Hoskin and A. A. Baker, "Composite Materials for Aircraft Structures," AIAA Education Series, 1986*.

OBJECTIVES:

- 1) To provide the student with knowledge of advanced composite materials as well as analysis methods and design criteria.

OUTCOMES:

- 1) Students will understand the basic elastic properties, strengthening mechanisms and constitutive relations of fiber reinforced composites.
- 2) Students will understand failure criteria, buckling, stress and stiffness analysis of composite laminates.
- 3) Students will have an understanding of aerospace composite structures, manufacturing, analysis and design.

TOPICS:

- 1) Introduction, materials and properties, composite fabrication methods (4 classes)
- 2) Micromechanics, shear transfer, elastic constants and strength of a ply (4 classes)
- 3) Stress-strain relations of a lamina in the material and reference axes (3 classes)
- 4) Bending and stretching of laminated plates, analysis of ply stresses (4 classes)
- 5) Failure criteria and laminate strength analysis procedures (4 classes)
- 6) Bending and buckling of composite laminates (3 classes)
- 7) Environmental effects and durability (3 classes)
- 8) Notched strength, damage tolerance of composite structures (3 classes)
- 9) Tests (2 classes)

CLASS SCHEDULE: Three 50-minute lectures per week

* Subject to change.

LABORATORY PROJECTS: None

COMPUTER USAGE: Not required, but suggested for some assignments

PROFESSIONAL COMPONENT: Structures, Space structures

RELATIONSHIP TO PROGRAM OUTCOMES:

- A) Graduates will demonstrate a solid mastery of fundamentals in the following aerospace engineering disciplines: structures.
- B) Graduates will have a combination of analytical, computational, and experimental skills.

RELATIONSHIP TO ABET OUTCOMES:

- a) An ability to apply knowledge of mathematics, science, and engineering
- b) An ability to design and conduct experiments, as well as to analyze and interpret data
- e) An ability to identify, formulate and solve engineering problems
- k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

COORDINATOR: K. Y. Lin, Professor of Aeronautics and Astronautics

PREPARED BY: K.Y.. Lin, Professor, February 2007

ASSESSMENT:

- 1) Homework
- 2) In-class problem solving
- 3) Exams