REGULAR COURSE SYLLABUS

College of: Professional Studies

Department: Engineering Technology

Prefix & Course Number: MET 4370  Crosslisted With*: ____

Course Title: Advanced Composite Structures: Design, Damage, Repair and Testing

Transcript Course Title (30 characters): Advanced Composite Structures

Check All That Apply:  
- Required for Major: ____  
- Required for Minor: ____
- Specified Elective: ____
- Required for Concentration: ____  
- Elective: X  
- Service Course: ____

To receive Title IV financial aid funds, all institutions of higher education must comply with the federal definition of a credit hour. The Higher Learning Commission requires institutions to maintain policies and procedures for verifying compliance with this definition.

**Federal Credit Hour Definition:** A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than:

1. One hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time; or (2) at least an equivalent amount of work as required in paragraph (1) of this definition for other activities as established by an institution, including laboratory work, internships, practica, studio work, and other academic work leading toward the award of credit hours. 34CFR 600.2 (11/1/2010)

Credit Hours: 3 (1.5+1.5)  

Schedule Type: B  
Grade Mode: L

Face-to-Face or Equivalent Hours per course:
- Lecture 22.5  
- Lab 45  
- Internship ___  
- Practicum ___  
- Other (please specify type and hours): ____

Additional Student Work Hours per course: 90

Variable topics umbrella course: No X  
Yes ____ If yes, number of credits/repeats allowed ____.  

Specified repeatable course: No X  
Yes ____ If yes, number of credits/repeats allowed ____.  

Prerequisite(s): MET 3215 with grades of "C" or better

Corequisite(s): NONE

Prerequisite(s) or Corequisite(s): NONE

APPROVED:  

Department Chair OR Program Director  
Date 11/10/2014

Dean OR Associate Dean  
Date 11/21/14

Associate VP, Academic and Student Affairs  
Date

*If crosslisted, attach completed Course Crosslisting Agreement Form
Prefix and Course Number: MET 4370

Banner Enforced Coding:
Prerequisite(s): MET 3215 with grades of “C” or better.
Corequisite(s): 
Prerequisite(s) or Corequisite(s): ______

Registration restrictions: Level _____ Class _____ Program/Major _____ Student attribute _____

Catalog Course Description:
This lecture/laboratory course is the introduction of the student to the characterization methods for the anisotropic properties of advanced composite materials consisting of high performance fibers suspended in polymeric matrices. This course includes study and practical application of design, damage control, composite repair, processes and tooling. Also overviews the concepts, principles, and methods employed for nondestructive evaluation (NDE) of composite structures and materials.

Specific Variable Topics Course Description (if applicable, umbrella course description included above):

Required Reading and Other Materials will be equivalent to:

Specific, Measurable Student Behavioral Learning Objectives:
Upon completion of this course the student should be able to:

1. Distinguish various classes of advanced composite materials
2. Use fundamental equations to obtain orthotropic material properties for a specific composite laminate
3. Design of laminated composite structures: laminated beam, laminated plate, other design issues
4. Select appropriate manufacturing methods based on the product form and material properties
5. Evaluate various composites through use of laboratory experiments for mechanical and environmental performance
6. Evaluate the elastic properties of both long and short fiber composites based on the constituent properties.
7. Evaluate the failure analysis of laminates: damage mechanisms, progressive failure analysis for a laminate.
8. Understand nondestructive testing technologies and their applications to composites manufacturing.

Detailed Outline of Course Content (Major Topics and Subtopics) or Outline of Field Experience/Internship (experience, responsibilities and supervision):

I. Design and Analyses with Composite Material
   A. Anisotropic Elasticity and Composite Laminate Theory
   B. Derivation of the Anisotropic Elastic Stiffness and Compliance Matrices
   C. The Physical Meaning of the Components of the Orthotropic Elasticity
   D. Methods to Obtain Composite Elastic Properties from Fiber and Matrix Properties
   E. Time-Temperature Effects on Composite Materials
   F. Engineering Analysis
II. Repair of composite structures
   A. Types of Damage
   B. Damage detection
   C. Repair instructions
   D. Scarfing
   E. Curing methods
III. Failure analysis of laminates
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A. Damage mechanisms
B. Progressive failure analysis

IV. Basic principles of non-destructive testing (NDT)
   A. Definition and importance of NDT
   B. Types of NDT methods
      1. Visual inspection methods
      2. Penetrant methods
      3. Radiographic techniques
      4. Ultrasonic inspection
      5. Eddy current techniques
      6. Thermal imaging
      7. Other inspection techniques
   C. Comparison of different NDT methods
   D. New developments in NDT
   E. Inspection methodology
   F. Applications of NDE to manufacturing, aging structures, and composite materials.

V. Health and safety
   A. Routes of exposure
   B. Hazards associated with matrix systems
   C. Hazards associated with fibers
   D. Personal protective equipment

Evaluation of Student Performance:
1. Quizzes
2. Assignments
3. Lab reports
4. Exams