MECHANICAL ENGINEERING PROGRAM

ABET COURSE SYLLABUS

ME 412: Composite Materials Analysis and Design (4) Elective

Course Description: (2019-20 Catalog)	Behavior of unidirectional fiber composites. Properties of short-fiber composites, and orthotropic lamina. Analysis of laminated composites. Strength and hygrothermal behavior of composite materials. Structural optimization. 3 Lectures. 1 Laboratory.
Prerequisite Courses:	AERO 331 or ME 328.
Prerequisites by Topic:	Load, stress/strain transformation. materials, design, calculus, differential equations
Textbook: **(and/or other required material)**	Analysis and Performance of Fiber Composites, 3rd Edition 2006, Agarwal, Broutman, and Chandrashekhara, John Wiley & Sons, Inc.
References:	
Course Coordinator/Instructor:	Eltahry Elghandour, Associate Professor and Sthanu Mahadev, Assistant Professor of ME
Course Learning Outcomes:	The student will be able to: 1. Ability to analyze the stresses and strains in continuous-fiber composites. 2. Ability to compute the first-ply failure load of laminated composite structures. 3. Ability to synthesize or design simple composite structures in the form of plates, beams, cylinders, rings, and torque tubes. 4. knowledge of manufacturing processes currently used in fabricating laminates, application of prepreg manufacturing method 5. Appreciation of the strengths and limitations of current predictive methods used in composite laminate design. 6. knowledge of composite testing methods
Relationship of Course to Mechanical Engineering Student Outcomes:	SO 1: Mastered (M) SO 2: Mastered (M) SO 3: SO 4: SO 5: Mastered (M) SO 6: Mastered (M) SO 7: Mastered (M)

Topics Covered:

1. Review of isotropic material behavior
2. Classification of composite materials.
3. Behavior of unidirectional composites.
4. Analysis of orthotropic lamina
5. Analysis of laminated composites
6. Design applications
    a. Structural optimization.
    b. Composite beams (including I-beams and sandwich beams).
    c. Thin-walled pressure vessel design.
    d. Torque tube design.
7. Use of interactive computer programs for the design of simple composite structures.
8. Fabricate small test panels of graphite-epoxy laminates (extended laboratory project).
9. Perform tests to determine the quality of the fabricated test panels and to determine the mechanical behavior of composite materials.
10. Perform tests and compare the test results with predicted behavior of student-fabricated composite structures (extended laboratory project).

Laboratory Projects: Composite testing, composite fabrication, composite design, analysis and fabrication

Class/Lab Schedule: 3 lectures, 1 lab

Contribution of Course to Meeting the Professional Component:

(a)	College-level mathematics and basic sciences:	2 credits
(b)	Engineering Topics: Design	2 credits
(c)	General Education:	0 credits
(d)	Other:	0 credits

Prepared by: Eltahry Elghandour **Date:** February 2, 2020