**MAE 446 Mechanics of Composite Materials**

**Fall 2018**

Prerequisite MATH 251 and MAE 243 (MAE 343 preferable)

Schedule T Th 2:00 - 3:15, 756 ESB (CRN: 88782)

Instructor: NITHI SIVANERI, Professor of MAE

nithi.sivaneri@mail.wvu.edu

Office hours: MWR 11:00 - 12:00

Make appointment for other times.

Office: Room 951 ESB; 293-3191

Text: Barbero, E.J., “Introduction to Composite Materials Design,” CRC Press, Boca Raton, 2018. ISBN: 13: 978-1-1381-9680-3

Grading Procedure: Homework 20%

2 Tests 50%

Final 30%

Attendance Requirements: This instructor very strongly feels that attending class lectures is the key to learning the material of this course and thus strongly encourages attending classes; but students will not have points taken off for missing classes.

Test Dates: Thursday September 27

Thursday November 15

Drop Date: Tuesday October 23

Final (comprehensive): Friday December 14, 8 a.m.

Policies: Homework is to be done on Engineering Paper and due in class at the beginning. Late homework loses 20% up to 24 hours beyond the deadline and 100% beyond that. A make-up test shall be given only if the student can show valid reason to miss the test. This has to be established before the regularly scheduled test. A student is limited to one make-up test for the course, including the Final.

Final grades are based on 90-100 *A*; 80-89 *B*; etc.

**Learning Outcomes**

Upon successful completion of MAE 446, students are expected to be able

(a) to analyze laminates composite bars, shafts, beams, and thin-walled pressure vessels.

1. to gain knowledge of elastic behavior of composite materials.

**Computer use**

It will be easier to set up many of the homework problems using MATLAB or EXCEL. Some of the homework may be required to be done with CADEC (Computer Aided Design Environment for Composites). The program is a specialized application package. Get access to CADEC using cadec-online.com.

# Syllabus

**1. Introduction (week 1)**

**2. Materials (in class and reading, week 2)**

**3. Processing and fabrication methods (in class and reading, week 2)**

**4. Micromechanics (2 weeks)**

4.1 Introduction

4.2 Prediction of stiffness values, simple and empirical models

4.4 Prediction of strength values, simple and empirical models

**5. Ply mechanics (2 weeks)**

5.1 Introduction

5.2 Stress-strain relations for plane stress

5.3 Off-axis stiffness

**6. Macromechanics (3.5 weeks)**

6.1 Plate stiffness and compliance including shear deformations

6.2 Computation of stresses

6.3 Special laminates

6.4 Laminate moduli

6.5 Laminate design using carpet plots

**7. Failure Mechanics (3.5 weeks)**

7.1 Ply failure criteria and strength ratio

7.2 Laminate failure analysis

7.3 Strength design

**8. Design of Thin-walled beams (2 weeks)**

8.1 Preliminary Design