MAE 593. Structural Composite Design – Spring 2010

Instructor: Dr. E. J. Barbero
Schedule: **Tu-Th**, Rm.
Office hours: TBA

Textbook:

E. J. Barbero, Introduction to Composite Materials Design, Taylor & Francis (1999), ISBN 1-56032-701-4

SOFTWARE THAT MUST BE INSTALLED IN G78:
          ANSYS, CADEC, and MATLAB

Prerequisites:

An introductory course in Mechanics of Composite Materials (MAE 446) and Math (C or better in MATH 261) are indispensable prerequisites for this course. A placement exam will be administered during the first week of class to assess mastery of very basic knowledge of introductory composite mechanics. The grading will be pass/fail only. Those failing the exam will be asked to drop the course.

Course Objective:

The objective of this course is to present analysis and design techniques used to design composite structures.

References:

1. Handouts from the 2nd edition of the textbook, to appear Fall 2010.
2. CADEC, download from http://www.mae.wvu.edu/barbero/cadec.html
3. Reddy, J. N., Mechanics of Laminated Composite Plates-Theory and Analysis, 2nd ed., CRC Press, Boca Raton, FL, 2003, ISBN=0849315921,

Outline
1. Introduction (weeks 1-2)
    a. Reliability-based (limit states) design
    b. Essential Matlab Programming
    c. Essential Ansys Modeling
2. Review Classical Lamination Theory (weeks 3-4)
    a. Analysis of a Lamina (review)
    b. Laminate Stiffness (review)
    c. Modern Laminate Strength Prediction
3. Beams (weeks 5-7)
    a. Preliminary Design
    b. Thin Walled Beams
4. Plates (weeks 8-10)
    a. Plate Bending
    b. Plate Buckling

  c. Stiffened Panels
5. Shells (weeks 11-12)
  a. Shell of Revolution
  b. Cylindrical Shell with General Loading
6. Composite strengthening of reinforced concrete (13-15)
  a. Beam Bending
  b. Beam Shear
  c. Columns
  d. Beam-columns

Grading:

Homework	10%	Individual
Projects	40%	Team
Midterm	20%	Individual
Final Exam	30%	Individual

Teamwork:
Teams of 2 students will be formed. Teams, not individuals, will submit projects. Although help and discussions are encouraged among the class at large, various teams are forbidden to work together and/or present essentially similar work. Similarities in their work will be penalized. Innovative content and presentation quality will be rewarded.

Computer usage: CADEC will be used. "Light" FEM will be done with Ansys. "Light" programming will be done in Matlab. Excel must be used for plots. MSWord or LaTeX can be used for typed reports. Ansys, Matlab, Excel, MSWord and LaTeX are available in G78. Vista will be used for team communications. Other software is discouraged unless agreed in class. Learning the use of software is a lifelong learning trait that you must acquire on your own. All these applications have tutorials and online help for that purpose.

NO AUDIT STUDENTS ALLOWED, WITHOUT EXCEPTION.