1. CEE 4190 (5190) – Advanced Mechanics of Materials

2. Course credit hours: 3
   Contact hours per week: 3
   Credit category: Engineering Topics

3. Course coordinator: Y. Jane Liu

4. Textbook: A*dvanced Mechanics of Materials,* Arthur P. Boresi and Richard J. Schmidt, 6th edition

   Supplemental materials:
   a. *Foundation of Solid Mechanics,* Y. C. Fung, Prentice-Hall, 1965.
   b. *Advanced Strength and Applied Stress Analysis,* Richard G. Budynas, 2nd Edition, McGraw-Hill, 1999.
   c. *Advanced Mechanics of Materials,* Roman Solecki and R. Jay Conant, Oxford University Press, 2003.
   d. *Intermediate Mechanics of Materials*, J. R. Barber, McGraw-Hill, 2001.
   e. *Stresses in Plates and Shells,* Ansel C. Ugural, 2nd Edition, McGraw-Hill, 1999.

5. Course information:

2020 Catalog description	Advanced topics; fracture mechanics, elastic support, non-circular shafts, curved beams, thick-walled cylinders, introduction to plates, thin shells of revolution.
Prerequisite(s)	CEE 3110, MATH 2120 or consent of instructor
Course type	Selected Elective

6. Course instructional outcomes:

Course Outcome No.	Course Outcome (CO)	ABET Student Outcome
CO1	Relate loading and deformation states to the proper components of stress and strain	1
CO2	Relate displacement to strain using small strain theory and strain to stress using Hooke's law for anisotropic materials	1
CO3	Calculate the directions and magnitudes of principal stresses	1
CO4	Apply classical approaches to failure analysis	1
CO5	Apply Castigliano's Theorem to straight and curved beams subjected to shear forces, normal forces, bending moments, and twisting moments	1
CO6	Recognize the assumptions associated with My/I and aPL^3/EI for straight beams and apply alternate approaches when the straight beam assumptions are not satisfied (shear center, asymmetric bending, curved beam stresses, plates and shells)	1
CO7	Use Symbolic-Computational System MAPLE	1

ABET criterion 3 Student Outcomes addressed by this course:

SO No.	Student Outcome (SO)
3.1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

7. Course topics:
   1. Review: math and mechanics of materials (5%)
   2. Theory of 3-D stress and strain (10%)
   3. Stress transformation and principal stresses by solving eigenvalue problem (15%)
   4. Constitutive equations for isotropic, orthotropic, anisotropic materials (15%)
   5. General failure theories for ductile materials: maximum shear, maximum principal stress, Von Mises (10%)
   6. Fundamental concepts of energy method: Castigliano's Theorems (15%)
   7. Application on deflections for statically determinate and indeterminate structures (10%)
   8. Application on deflection of curved beams (10%)
   9. Introduction to elastic stability of columns: elastic buckling (5%)
   10. Bending for nonsymmetrical straight beam (5%)

   Program criteria (curriculum) addressed by this course:
   1. Apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of basic science
   2. Analyze and solve problems in at least four technical areas appropriate to civil engineering

8. Additional topics, assignments, or requirements for dual-level (4000/5000) course:
   Additional course project will be assigned to the graduate students registered for the CEE/ME5190. The topic for the project should be in the general area of the course. The results of the project will be presented in the form of an oral presentation or a poster.

9. Date: 02/10/2020