CE 57000: ADVANCED STRUCTURAL MECHANICS
School of Civil Engineering
Purdue University

Instructor: Arun Prakash
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Office Hours: 4119, Civil Engineering building
Mondays and Wednesdays: 1pm-3pm; Or email for an appointment.
Class Webpage: http://www.itap.purdue.edu/tlt/blackboard

Lecture Time and Location: M-W-F 11:30am-12:20pm, HAMP-2118

Course Description:
Studies of stress and strain, failure theories, and yield criteria; flexure and torsion theories for solid and thin-walled members; and energy methods. (See the list of topics for details).

Prerequisites: Graduate Standing; CE-270 Introductory Structural Mechanics; Vector Calculus, Some Computer Programming (MATLAB)

Text Book (required):
  (Available freely through Purdue Libraries)

Grading Basis:
• Homeworks 15% Assigned and due before lecture time on most Fridays.
• Quizzes (4 @ 15% each) 60% 6:30pm on: Sep 15, Oct 6, Oct 27, Nov 17
• Final Exam 25% TBA.
Total 100%

Make-up quizzes / exams for absences will not be given. Students must notify the instructor about any unavoidable conflicts with the scheduled quizzes / exams. Only under extremely unavoidable situations, the score for a missed quiz / exam may be adjusted at the sole discretion of the instructor.

Academic Integrity
• All work (assignments and exams) that you submit must be strictly your own work.
• Obtaining solutions from another student or from any other external source (and/or letting others copy from you) is absolutely not allowed.
• Collaboration in the form of giving and receiving help on concepts is allowed and encouraged.

Emergency Procedures
In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. Information regarding these changes will be posted on the course webpage and you will be intimated using the class email list.
List of Topics:
1. Introduction and Mathematical Preliminaries: Mechanics of solids/structures; Vector algebra; Tensors and matrices; Vector and tensor calculus
2. Kinematics of deformation: Deformation map and deformation gradient, rotation and stretch; Strain and physical significance; compatibility; Eulerian & Lagrangian formulations*; Time dependent motion; material derivatives; objective rates*
3. Stress and equilibrium of deformable bodies: Free body diagrams; Traction and stress; Equilibrium and balance principles; First and second Piola-Kirchhoff stresses; objective stress rates*
4. Material models: Material frame indifference; objectivity; Hyperelasticity; Isotropy; Hooke’s model; Thermodynamic considerations*; Plasticity*; Damage models*
5. Boundary value problems in solid mechanics: Strong and Weak forms, 1D problems; 2D Plane stress/strain, examples; 3D strong forms and solution methods, examples; Principle of virtual work
6. Numerical solutions to boundary value problems: Ritz method; Introduction to the Finite element method; Non-linear solution methods*
7. Structural mechanics of beams: Kinematic hypothesis; Stress resultants; Planar beam: Timoshenko & Bernoulli-Euler formulations
8. Energy Methods and Variational principles: Directional derivative; Vainberg’s theorem; Energy principles; Stability
9. Static stability and examples*: Basic concepts of Static stability; Bifurcation; Linearized buckling analysis
(* if time permits)

Other Reference Books: