MECH 5390/6390: Computational Mechanics

Class Reference Number: 28917 (for MECH 5390)
28931 (for MECH 6390)

Required Textbook: Finite Element Simulations with ANSYS Workbench 19, Huei-Huang Lee

Required Software: ANSYS Student 19.2


Class/Lab Meeting: TR, 3:00 pm to 4:20 pm

Class Room: Liberal Arts Building 108

Prerequisite: MECH 5302 Solid Mechanics I

Instructor: Dr. Calvin M. Stewart, Ph.D.
Department of Mechanical Engineering
E-mail: cmstewart@utep.edu
Phone: 407-747-6179
Office: ENG A117
Office Hours: TR, 1:40pm to 2:40pm, only

Course Objective

An introductory course in computational mechanics. Students will learn how to apply mechanics theory into finite element analysis simulations. By the end of the course, students will have the skills to, given a mechanics problem, identify the appropriate boundary conditions, optimize the mesh, execute simulations, and analyze the results. Ideally, students will be able to determine if the results are realistic or fictitious using their knowledge of mechanics and critical thinking skills.

Topics Covered

1. Introduction
2. Sketching
3. 2D Simulations
4. 3D Solid Modeling
5. 3D Simulations
6. Surface Models
7. Line Models
8. Optimization
9. Meshing
10. Buckling and Stress Stiffening  
11. Modal Analysis  
12. Transient Structural Simulations  
13. Nonlinear Simulations  
14. Nonlinear Materials  
15. Explicit Dynamics

Grades

<table>
<thead>
<tr>
<th>Assignments</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>ANSYS Tutorials (Results &amp; Discussion)</td>
<td>90%</td>
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<tr>
<td>Project</td>
<td>10%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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**Grade Scale**

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Grade</th>
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<tbody>
<tr>
<td>100-90%</td>
<td>A</td>
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<tr>
<td>89-80%</td>
<td>B</td>
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<tr>
<td>79-70%</td>
<td>C</td>
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<tr>
<td>69-60%</td>
<td>D</td>
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<tr>
<td>&lt;60%</td>
<td>F</td>
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The instructor reserves the right to revise this grading plan.

**ANSYS Tutorials**

ANSYS Tutorials are provided in the textbook. Students are required to complete 45 tutorials during the semester. The tutorials will teach how mechanics problems can be implemented into FEA. Students are encouraged to communicate with peers to complete the assignments but ANSYS files may not be shared.

**Students are required to participate in the discussion forum.** The students must post

A) Results - screenshot of the results for each tutorial  
B) Discussion - requests for help, questions, answers, and comments

Each Discussion post is rated with 0-5 stars; the sum of the ratings becomes the grade for the week. The more you communicate and interact with your peers the better your grade.

**Project**

At the end of the semester, each student is required to turn in a final project. The project may be related to your job, research, or personal interest. Ideally, students working on a thesis can leverage this class to complete important work for graduation. Students may also repeat a project found in any reference, as long as the student recreates the work in ANSYS by themselves. Students are highly encouraged to study unique problems where a step-by-step solution do not exist. Extra credit may be given to compelling and
challenging projects.

Project Ideas
- Ballistic Impact of Armor
- Mechanics of Cellular Solids
- Structural Dynamics of a CubeSAT
- Irradiation Creep in Nuclear Reactors Cladding
- Thermomechanics of a Turbine Blade
- ThermoMechanics of a High Pressure Combustor

Class Attendance Policy

Attendance is mandatory. Anyone with 5 or more absences will be dropped from the class. A drop for not attending will count toward the State Allowed Six Drop Limit. If you are failing the class at the time of the drop you may also be given a WF designation. Be advised that a drop could adversely impact visa status, financial aid and other programs.

As per UTEP rules, you may be asked to show a UTEP ID at any time during class.

If a student is absent or misses an assignment due to university related duty, serious illness, or family emergency an excused absence/makeup may be arranged. For university related duty, the faculty advisor of the student organization must send notification to the professor before the planned absence. For serious illness or family emergency, the staff in the Office of Student Life can send notification to the professor of the absence. The student must visit the Office of Student Life and provide supporting documentation (e.g., a doctor’s note, letter from primary care provider) to verify illness or injury.

The instructor MUST be notified PRIOR to any absence.

Course Drop

It is the student’s responsibility to officially drop a course that s/he no longer wishes to take before the course drop deadline. Failure to do so WILL result in a grade of “F” on the student’s academic record. If you fall behind, do not give up and quit attending without dropping the course first. Athletes must receive permission from the Miner Athletic Advising Center before dropping a course. International students with F or J visas must receive permission from the Office of International Programs before dropping a course.

Disability and Accommodations

If you have a disability and need classroom accommodations, please contact The Center for Accommodations and Support Services (CASS) at 747-5148, or by email to cass@utep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass.