

**THE UNIVERSITY OF ALABAMA**  
**Department of Aerospace Engineering and Mechanics**  
**AEM 250-Mechanics of Materials**

**Course Coordinator:** Dr. M. E. Barkey

**Textbook Information:**

Mechanics of Materials, 3<sup>rd</sup> Edition. by Roy R. Craig, Jr., Published by Wiley  
(Various formats are available, including e-book editions).

**Office Hours:** To be announced in class.

**Prerequisite:** MATH 126 or MATH 146 and AEM 201. (Calculus II and Statics).

**Course Description:**

Concepts of stress and strain; analysis of stresses and deformation in bodies loaded by axial, torsional, and bending loads; combined loads analysis; statically indeterminate members; thermal stresses; columns; and thin-walled pressure vessels.

**Objectives:**

The primary objectives of this course are to introduce engineering students to the stress, strain, and deformation behavior and analysis of engineering materials and structures. Basics of engineering design are brought into the course by way of selected homework problems and class discussions.

**Goals:**

The goal of this course is to introduce the students to the mechanics of materials method of problem formulation and solution procedures for solving mechanics problems in deformable solids.

**Outline of Topics:**

1. Uniaxial normal stress, normal strain, and axial deformation behavior. (5 hours)
2. Stresses on an inclined plane in an axial deformation member. (1 hour).
3. Uniaxial and multiaxial stress-strain relations. (3 hours)
4. Shear stress and shear strain. (1 hour)
5. Thermal stresses and misfits. (1 hour)
6. Torsion of prismatic bars and systems of bars. (3 hours)
7. Equilibrium of beams including shear and moment diagrams. (2 hours)
8. Review of moments of inertia of plane cross-sections. (1 hour)
9. Stresses and strains from beam flexure and transverse shear. (4 hours)
10. Deflection of prismatic beams. (4 hours)
11. Stress and strain transformation including Mohr's Circles of stress and strain. (6 hours)
12. Pressure vessels and combined loading. (3 hours)
13. Elastic column buckling. (2 hours)
14. Stress concentrations and failure criteria. (2 hours)
15. Three exams. (3 hours)
16. Final Exam

**Homework:** Every assigned set of homework problems is due at the beginning of the next lecture class. **It will not be accepted late.** Selected problems will be randomly graded. Only the problem(s) selected for grading will be returned. Ungraded homework sets may be counted as a portion of the homework score. Copying homework solutions from other student papers or a solution manual/website and turning it in as your own work is **dishonest** and **constitutes grounds for charges of academic misconduct.**

**Regular Exams and Final Exam:** There will be three (3) 90-minute exams. The Final Exam has a time limit of 2-1/2 hours and will be strictly enforced. All exams are comprehensive to the date on which they are given, and are closed-book and closed note exams. Exams will be given at the scheduled evening exam date and time or during the lecture period if time allows (i.e. summer semesters).

**Missed Exam Policy:** If an acceptable excuse is provided, it is the option of the instructor to either require the student to take a make-up exam or replace the missed exam score with the student's score from the final exam. The replacement of a missed exam score with the final exam score may only occur once in a semester.

**Grading Policy:**

The final course grade is determined as follows:

Homework	10%
Scheduled Regular Exams	55%
Final Examination	35%

**Attendance:** Attendance at all class meetings is expected. Unannounced attendance quizzes may be given to determine attendance. Attendance quiz credit, if any, will be given only for students that are in class when the attendance quiz is collected.

**Tutors:** A member of the department staff may be available for tutoring. To be announced.

**Make-up Classes:** In the event a scheduled class is cancelled due to inclement weather, etc., the homework assignment will be doubled up at the next scheduled class meeting. In the event that an exam is missed due to class cancellation, instructions will be announced by email.

**Electronic Communication:** Students are expected to check their University e-mail account regularly throughout the semester for information regarding the course. Other email systems will not be used.

**Wireless Devices:** Cell phones and other wireless devices must be set to silent or otherwise disabled **before the start of class.**

### **Academic Honor Code**

All students in attendance at The University of Alabama are expected to be honorable and to observe standards of conduct appropriate to a community of scholars. The University of Alabama expects from its students a higher standard of conduct than the minimum required to avoid discipline. At the beginning of each semester and on tests and projects at the discretion of the professor, each student will be expected to sign an Academic Honor Pledge. The pledge reads as follows:

I promise or affirm that I will not at any time be involved with cheating, plagiarism, fabrication, or misrepresentation while enrolled as a student at The University of Alabama. I have read the Academic Honor Code, which explains disciplinary procedures that will result from the aforementioned. I understand that violation of this code will result in penalties as severe as indefinite suspension from the University.

### **Activities Considered a Violation of the Academic Honor Code**

Activities that violate the academic honor code include, but are not limited to the following:

- **copying homework solutions** from other students, **solution manuals**, or **websites**;
- **copying** or looking at another student's exam **during the testing period**;
- **altering a returned examination** in an attempt to get additional points.

AEM 250 students that are suspected of violating the academic honor code will be promptly referred to the College of Engineering Academic Misconduct Monitor.

**Policy on Re-examination of Exam Questions:** You must work your testing using pencil. Any marks made on your exam after it is returned to you must be in ink.

If you submit a graded exam for consideration of additional points, you must disclose any alterations that you have made to your exam. Undisclosed alterations will lead to academic misconduct proceedings.

Any additional pencil marks or erasures made on the exam problem in question after it is returned to you will be considered an alteration of your exam and your case will be promptly referred to the academic misconduct monitor.

**Exam Procedures:** Every effort will be made to ensure that students have enough personal space during tests. Larger classrooms may be assigned for exams, and with notice given at the start of the semester, exams may be held at times other than the standard lecture time. Students may be asked to move at the beginning of the exam or during the exam and assigned seating may be enforced for some or all exams. Students can request to be moved to a new seating location before or during an exam.

Cellphones must be set to silent or disabled during exams and put away for the duration of the exam. Students leaving the exam room while still participating in the exam must leave their cellphones in the exam room. Wireless functions on calculators must be disabled during exams, and stored files and/or equations must be purged from calculators at the start of the exam. Caps with brims must be removed or placed backwards during exams.

Students are to write only on the front side of each page. Extra paper will be provided if it is needed. Work on the back of any page will not be graded.

**Students that are registered with ODS should immediately schedule their final exam with ODS.** The final examination schedule published by the registrar's office should be consulted when scheduling the exam. If you are unable to schedule an exam time with ODS, you will be provided an appropriate length testing period that is proctored with a teaching assistant at a time and date set by the instructor. Other exams will need to accommodate this date and time.

If you have a disability, but have not contacted the Office of Disability Services, please call 348-4285 to register for services.

Students who may need course adaptations because of a disability are welcome to make an appointment to see me during office hours. Students with disabilities must be registered with the Office of Disability Services before receiving academic adjustments.

Instructor class notes are scanned after each lecture and posted on the course web page. ODS students that need a note taker will be referred to the website to download the notes.

**Course Website:** Sample problems, homework handouts, and additional course policy information can be found at <http://mbarkey.eng.ua.edu>. Students are responsible for examining this material on a regular basis and bringing handouts with them at the appropriate times.

**Blackboard:** Additional course information may be available at the Blackboard Learn section for the course. Grades may be posted to Blackboard for the convenience of the students, but the official grade records are maintained by the instructor. If changes to exam or homework grades are made by the instructor, they will not be updated on Blackboard. Students are welcome to use the forum and communication functions of Blackboard although instructor participation may vary.

**Tegrity and Youtube:** Some lectures are available on Tegrity and, when possible, uploaded to Youtube. Various worked out examples and homework problems are available on Tegrity. Students may request videos for additional problems. Tegrity

video lectures may be assigned on days that exams are returned or if the instructor is unavailable due to required travel.

**Disclaimer:** Assignment sheets and course content are subject to modification when circumstances or sound pedagogy dictate and as the course progresses. If changes are made, you will be given due notice.

### **Some expectations from Pre-requisite Courses:**

#### *AEM 201 Statics:*

Be able to draw a proper free body diagram. A ‘free’ body diagram is a simple sketch of the structure that is ‘freed’ from its supports and shows the loads and reactions applied to the body. Supports **must not** be drawn on a free body diagram, but are instead replaced with the idealized reactions that the supports impart to the structure.

Be able to find support reactions and internal forces and moments for simple truss structures, bars and beams subjected to axial, torsional, bending, and combined loading; calculate statically equivalent forces and moments from distributions of load; sketch shear force and bending moment diagrams; determine beam shear force and bending moment equilibrium equations as a function of position.

#### *MA 126 Calculus II:*

Basics of derivatives and integrals for functions of one variable.

#### *Additional topics in mathematics:*

These topics will be discussed through handouts and homework to assist in the development of Mechanics of Materials equations and concepts. These topics will be formally taught to you in courses beyond Calculus II. You will not be required to perform these tasks on exams—but you will be responsible for the result, i.e. the Mechanics of Materials equation.

Integration of functions of two variables; determination of the volume under a surface; basic sinusoidal solution of a second order ordinary differential equation.

## **Required Statements from The University of Alabama**

### **Disability Statement**

If you are registered with the Office of Disability Services, please make an appointment with me as soon as possible to discuss any course accommodations that may be necessary.

If you have a disability, but have not contacted the Office of Disability Services, please call (205) 348-4285 (Voice) or (205) 348-3081 (TTY) or visit 1000 Houser Hall to register for services. Students who may need course adaptations because of a disability are welcome to make an appointment to see me during office hours. Students with disabilities must be registered with the Office of Disability Services, 1000 Houser Hall, before receiving academic adjustments.

### **UAct: Ethical Community Statement**

The University of Alabama is committed to an ethical, inclusive community defined by respect and civility. The UAct website ([www.ua.edu/uact](http://www.ua.edu/uact)) provides a list of reporting channels that can be used to report incidences of illegal discrimination, harassment, sexual assault, sexual violence, retaliation, threat assessment or fraud.

### **Policy on Academic Misconduct**

All students in attendance at The University of Alabama are expected to be honorable and to observe standards of conduct appropriate to a community of scholars. The University of Alabama expects from its students a higher standard of conduct than the minimum required to avoid discipline. At the beginning of each semester and on examinations and projects, the professor, department, or division may require that each student sign the following Academic Honor Pledge: "I promise or affirm that I will not at any time be involved with cheating, plagiarism, fabrication, or misrepresentation while enrolled as a student at The University of Alabama. I have read the Academic Honor Code, which explains disciplinary procedure resulting from the aforementioned. I understand that violation of this code will result in penalties as severe as indefinite suspension from the University."

See the [Code of Student Conduct](#) for more information.

## **Severe Weather Guidelines**

The guiding principle at The University of Alabama is to promote the personal safety of our students, faculty and staff during severe weather events. It is impossible to develop policies which anticipate every weather-related emergency. These guidelines are intended to provide additional assistance for responding to severe weather on campus.

UA is a residential campus with many students living on or near campus. In general classes will remain in session until the National Weather Service issues safety warnings for the city of Tuscaloosa. Clearly, some students and faculty commute from adjacent counties. These counties may experience weather related problems not encountered in Tuscaloosa. Individuals should follow the advice of the National Weather Service for that area taking the necessary precautions to ensure personal safety. Whenever the National Weather Service and the Emergency Management Agency issue a warning, people in the path of the storm (tornado or severe thunderstorm) should take immediate life saving actions.

When West Alabama is under a severe weather advisory, conditions can change rapidly. It is imperative to get to where you can receive information from the [National Weather Service](#) and to follow the instructions provided. Personal safety should dictate the actions that faculty, staff and students take.

**The Office of University Relations will disseminate the latest information regarding conditions on campus in the following ways:**

- Weather advisory posted on the UA homepage
- Weather advisory sent out through UA Alerts to faculty, staff and students
- Weather advisory broadcast over WVUA at 90.7 FM
- Weather advisory broadcast over Alabama Public Radio (WUAL) at 91.5 FM
- Weather advisory broadcast over WVUA-TV/WUOA-TV, and on the website at <http://wvuatv.com/content/weather>. WVUA-TV Home Team Weather provides a free service you can subscribe to which allows you to receive weather warnings for Tuscaloosa via e-mail or cell phone. Check <http://wvuatv.com/content/free-email-weather-alerts> for more details and to sign up for weather alerts.

In the case of a tornado warning (tornado has been sighted or detected by radar; sirens activated), all university activities are automatically suspended, including all classes and laboratories. If you are in a building, please move immediately to the lowest level and toward the center of the building away from windows (interior classrooms, offices, or corridors) and remain there until the tornado warning has expired. Classes in session when the tornado warning is issued can resume immediately after the warning has expired at the discretion of the instructor. Classes that have not yet begun will resume 30 minutes after the tornado warning has expired provided at least half of the class period remains.