MECH 3334 Mechanical Design

Course Syllabus

Fall 2023

COURSE MOTIVATION

- Continuation of learning the basic principles and applications of Statics MECH 1321 and Mechanics of Materials MECH 2322
- Application of these principles to the structural designing and the revision of already designed systems and/or components

SCHEDULED MEETING TIMES

Section CRN	Time	Location
14782	M W 1330 - 1450	Classroom Building C305

PROFESOR: Dr. Edel Arrieta **E-MAIL:** egarrieta@utep.edu

OFFICE HOURS: TR 1:00 - 2:30 pm, or by appointment **OFFICE:** Engr. Bldg. E#108

TA: TBA **E-MAIL:** TBA

TEXTBOOK: Mechanical Engineering Design: Shigley's 11th ed. by Richard G. Budynas and J. Keith Nisbett

BLACKBOARD: Instructor will be using Blackboard for uploading lecture videos, updating the syllabus (if necessary), and communicating with students via "Announcements" and email.

COURSE DESCRIPTION:

This three-credit-hour class is intended to provide the students with intensive learning about the three dimensions of the analysis and design concepts for beams and rods. Besides, to learn how to calculate the deflections of the essential elements in the structure at critical locations. New ideas about the consideration of the buckling in the design process will be discussed, as well as determining the final design factor for the component. The use of software to compare the analysis results for a project may be needed.

COURSE OBJECTIVES: The student, upon completion of this course, will be able to:

- Understand the economics, tolerances, safety, and probability of failure.
- Study the mechanical properties of materials, including the hard work, hardness, effects of temperatures, and creep. Identify the material as brittle or ductile.
- Study in-depth the analysis of structural and mechanical components under statics loads in 2D and 3D.
- Understand how to use Mohr's circle to calculate the principal stresses in 2D and 3D.
- Analyze any given type of structure or machine and identify the principal stresses at the critical sections.
- Use the superposition method and tables to calculate the deflection for determinate and indeterminate structures.
- Learn and apply the principles of buckling into mechanical elements that are subjected to compression loads.
- Understand the cracks propagation and failure criterion.
- Calculate the fatigue and include the essential factors.

TOPICS

1. Introduction (Chapter 1)
2. Materials (Chapter 2)
3. Load and stress analysis (Chapter 3)
4. Deflection and stiffness (Chapter 4)
5. Failures resulting from static loading (Chapter 5)
6. Failures resulting from variable loading (Chapter 6)

COURSE SCHEDULE

Week of	Topics	Readings Due	Assignments Due	Notes
8/28	*Class introduction *Syllabus, *Review of Statics	Review syllabus, Bb Lect. 1&2		
9/4	*Introduction to Mechanical Design *Materials	Lect-3 Review * Chapter-1-	H.W.#1	**9/4 labor day Holiday**
9/11	Design *Materials *Load and Stress Analysis	*Chapter -2- *Chapter -3- part-1		
9/18	*Load Analysis by Using Singularity Method	*Chapter -3- part-1 *Chapter -3- part-2	H.W.#2	
9/25	* Mohr's Circle		Quiz#1	
10/2	* Mohr's Circle * Elastic Strains, Normal and Shear Stresses for 2D	*Chapter -3- part-2	**Test #1**	
10/9	*2 Plane Bending *3D Structural Analysis and Stress Calculation	*Chapter -3- part-2	H.W.#3	
10/16	*3D Structural Analysis and Stress Calculation *Torsional Stress for 2D and 3D Structures.	*Chapter -3- part-3	H.W.#4 Quiz#2	
10/23	* Deflections Calculations by Superposition Method and Using Tables	*Chapter -4- part-1		
10/30	* Buckling for Compression Members	*Chapter -4- part-2	H.W.# 5	

11/6	* Failure Resulting from Statics Loadings * Failure Criterion	*Chapter-5- part -1 *Chapter-5- part -2	**Test #2**	
11/13	* Failure Criterion * Introduction to Fracture Mechanism	*Chapter-5- part -2 *Chapter-5- part -3	H.W.#6	
11/20	*Fatigue Failure Resulting from Variable Loads *Stress-Life Method and S-N Diagrams	*Chapter-6- Part-1 Fatigue	Quiz#3 H.W.#7	
11/27	*Fatigue Stress Concentration Factor	Chapter-6-part-1 Fatigue		
12/4	*Characterizing the Fluctuating Stress	Chapter-6- part-2 Fatigue	**Test #3**	
12/1			**Final Exam 12/13 See UTEP's Finals Schedule**	

GRADING: Your grade for the course will be determined using the following criteria:

You MUST obtain a grade of +60 in at least ONE exam to approve this course

Exams	15% Each	×3	45%
Final Exam	35%		35%
Quizzes	5%	×3	15%
Homework	5%		5%

A (100-90): B (89-80): C (79-66): D (65-60): F (59 and below)

The detailed instructions on lectures, class participations, quizzes, exams and projects are given below.

LECTURES

- In addition to in-person lectures, presentation notes and other support material will be provided.
- The material will be uploaded in Blackboard but may not considered a substitute for text book.

QUIZZES AND EXAMS

- No Restroom breaks during exam time, be prepared
- The quizzes and exams will be during class time.
- Quizzes may be also given through Blackboard allotted of designated time (as specified in the questions) to answer and upload your answer in the blackboard.
- Upload time beyond the designated time will be considered as "Late Submission" with deducted points.
- No makeup exams will be given. See Section "Department's Policies" for more information on the exam rules.

ASSIGNMENTS

Homework assignments will be given during the semester. They might include concept questions and problems. The solutions of assigned homework problems will be collected. Solutions for the homework may be provided but you are encouraged to try to solve the problems with no help and use the provided solution only as guidance, support and verification.

ABET PROGRAM OUTCOMES: This class addresses the following ABET objectives:

Outcomes 1 - 7	Evidence
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Homework; Exams; Quizzes; Design project
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	N/A
3. An ability to communicate effectively with a range of audiences	Design project report and presentation
4. An ability to recognize ethical and professional responsibilities in engineering solutions and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts	Classroom discussion of sustainability; Design project
5. An ability to function effectively on a team whose members together provide leadership, create collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	Design project
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions	Design project; classroom example and homework problems
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Homework; Final report for the design project

ACCOMODATIONS: 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.

Department's Policies

ACADEMIC HONESTY

During exams and quizzes, you are not allowed to use any form of wifi enabled electronic device, including cell phones or other electronic communication devices or methods (wrist watches, earbuds, etc.). No wrist watch or other electronic device may be worn. Calculators and watches may be subject to inspection. You may be asked to temporarily remove glasses to allow for their inspection.

You may not bring backpacks, hats, bulky coats or hoodies into the exam room. Lockers are not available at the exam site so plan and leave your belongings in a secure location. You may NOT sit them in a corner of the exam room.

You must show your work for all problems. You must use the paper provided by the instructor. If no work is shown you may not receive credit. After the exam, the instructor may require you to explain how you solved a problem on the exam. If you refuse to or cannot explain your work you may be subject to disciplinary action.

No electronic version of the book, loose paper print-outs of the book or extra sheets of paper of any kind are allowed unless explicitly mentioned in writing by the instructor. As a part of the zero-tolerance policy, if you have a cellphone or other electronic device capable of communication on your person; or if any proctor sees or hears any electronic device during the exam or if you share your work with someone else, you will be reported to the proper authorities and you may receive a zero on the exam or an F in the class. Other actions including suspension may also be pursued.
No one will be allowed to leave the room during an exam. This includes restroom breaks.

University approved recording devices may be located at various locations in the room and may be out of sight of the students. These recordings will be managed according to the UTEP approved regulations for such media. The instructor may create a record of your activity during the exam and may take photographs of your work during the exam.

If you are suspected of scholastic dishonesty you may or may not be directly confronted about your conduct by the instructor or proctor. You will however, be reported to the Office of Student Conduct and Conflict Resolution (OSCCR) and your exam may not be admissible. Your grade in the class may not be available until OSCCR makes a final ruling, this may adversely impact your ability to enroll in other classes.

If you arrive more than 15 minutes late to an exam, you will not be allowed to take the examination. There will be no makeup exams administered. If you have a university approved excuse, your instructor will have a process for determining how to handle the missing grade outlined in the syllabus. However, no makeup exams will be given.

If you miss more than one exam, the instructor may choose to administratively drop you from the class. This may adversely impact a visa and financial aid.

No food or drink may be brought into the examination room.

Departmental policy allows for the use of assigned seats. All students must present their UTEP issued ID prior to and during every exam and may be required to sign in. Not having a UTEP issued ID when asked will result in forfeiture of the exam. No other IDs will be accepted.

Scholastic dishonesty on homework, lab assignments and all other class assignments will be held to the same standards and requirements of academic honesty as quizzes and exams.

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. Anyone who is present and not registered in the class will be subject to disciplinary action unless the instructor gives prior approval.

EXCUSED ABSENCE FOR EXAMS

The UTEP catalog allows Exam Absence to be excused ONLY for University-Recognized Activities and very specific other situations. Medical absence is NOT allowed in the UTEP catalog. For consistency with the catalog, students will NOT be excused from exams due to

illness.

HARASSMENT POLICY

The University (see Handbook of Operating Procedures 1.2.2.4) has a zero-tolerance policy for harassment. Engagement in any behavior considered harassment will be reported to the proper authorities. In addition to generally understood forms of harassment, the department also treats the following behavior as harassment:

- Repeated emails and/or calls regarding subjects that have already been addressed. Once a decision has been made or a question answered, a student who continues to ask the same question will be given a warning by the recipient of the email/call. If the student continues, the behavior will be reported. Questions that seek understanding of course material are not harassment; but repeated questions about a grade or an administrative decision are.
- Grades are NOT negotiable, ever. If you believe a grading mistake has been made, you must follow the process described in the UTEP catalog. Any request for a grade elevation that is NOT based on a mistake is considered harassment and will be reported immediately.
- Remaining in an office after the occupant requests you leave is considered harassment and potentially threatening. You will be reported immediately without warning and depending on the severity, may be reported to law enforcement.

Similar behavior towards department staff, and student advisors will also be treated as harassment, including persistent phone calls, emails, and badgering. Department staff and student advisors are there to help students, and should be treated with due respect.

Few Notes

- If you face any issue with anything, please send me an e-mail. In that case, I could arrange something for you while respecting UTEP's and Department's policies, norms and rules.
- All the due dates and times are specified in the associated questions (say quizzes, exams, and projects). Please follow them.
- I am always with you to help! on time! Do not let adverse situations to grow.