

Mechanical Design

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

CRN: 19200

Class Time: 10:30 – 11:50 am MW. Classroom Building C205

Class Duration: Aug.22nd, 2022, Dec.1st, 2022.

Prerequisite: Mechanicals of Materials and Malt and Manufacturing Process

Professor: Methaq Abed, Ph.D., P.E.

Department: Aerospace and Mechanical Engineering

Office: A104

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Office Hours: Tuesday 1:00-2:30 pm, and students are welcome to set up an appointment to meet through Ms teams for another day and time if needed.



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:

At the end of this course, students 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) |

LEARNING MODULES

This course is designed using a modular format—that is, each week is "packaged" as a single module so that all the materials, lecture notes, submission areas, and discussion posts are in one place for a given week.

GRADES

Your grade for this course will be assessed based on your performance in:

Mid-term exams (65%)

Quizzes (15 %)

Homework (20%)

Anticipated Exams Dates:

Test #1: Monday, Sep.19th

Test #2: Monday, Oct.17th

Test #3: Monday, Nov.14th

Test #4: Wednesday, Dec.1st (optional)

Note: Any tests might be given on another day in the same week.

Drop/Withdrawal Deadline: October 28th, 2022.



Your final grade will be calculated based on the points you have accumulated as follows:

A	≥ 88
B	≥ 78 but < 88
C	≥ 68 but < 78
D	≥ 58 but < 68
F	< 58

Exams: There will be four exams. *No makeup exam will be given under any circumstances. If you miss two exams, the instructor has the right to drop you or assign you an "F" grade for the class. The exams' grades will be calculated based on the average of the three highest tests' grades. It means that the lowest test grade will be dropped. Students may work on projects in groups by April.1st.*

Homework: All homework assignments will be through McGraw Hill Connect. Therefore, all students are required to register for the course through McGraw Hill connect during the first week of class. If a student fails to register to the system after ten days of starting the class, the instructor has the right to drop them from class. No homework outside the McGraw Hill Connect will be accepted.

Register to the course through McGraw Hill connect through Blackboard by following the steps below:

- Log in to your course through Blackboard
- From the left side of the course shell, access the Week-1- folder
- Click on H.W.#1 to get the link to register for the course through McGraw Hill Connect.

Quizzes: The quizzes will be given in class/ Maybe through McGraw-Hill Connect if there are no F2F classes.

Participation: The students must log in to the Blackboard at least twice weekly. To ensure that the students were getting the materials posted on the Blackboard, you must take the reading quiz or respond to the discussion board depending on the activity for that week.

TECHNOLOGY REQUIREMENTS

Course content is delivered via the Internet through the Blackboard learning management system. Ensure your UTEP email account is working and you have access to the Web and a stable web browser. Google Chrome and Mozilla Firefox are the best browsers for Blackboard; other browsers may cause complications. When having technical difficulties, update your browser, clear your cache, or try switching to another browser.

You will need access to a computer/laptop, a scanner, a webcam, and a microphone. You will need to download or update the software: Microsoft Office, Adobe Acrobat Reader, Windows Media Player,



QuickTime, and Java. Check that your computer hardware and software are up-to-date and can access all course parts.

Suppose you do not have word-processing software. In that case, you can download Word and other Microsoft Office programs (including Excel, PowerPoint, Outlook, and more) for free via UTEP's Microsoft Office Portal. Click the following link for more information about [Microsoft Office 365](#) and follow the instructions.

IMPORTANT: If you encounter technical difficulties beyond your scope of troubleshooting, please contact the UTEP [Help Desk](#), as they are explicitly trained in assisting with the technological needs of students. Please do not contact me for this type of assistance. The Help Desk is much better equipped than I am to assist you!

EXCUSED ABSENCES AND COURSE DROP POLICY

According to UTEP Curriculum and Classroom Policies, "When, in the judgment of the instructor, a student has been absent to such a degree as to impair his or her status relative to credit for the course, the instructor may drop the student from the class with a grade of "W" before the course drop deadline and with a grade of "F" after the course drop deadline." See academic regulations in the UTEP Undergraduate Catalog for a list of excused absences. Therefore, if I find that, due to non-performance in the course, you are at risk of failing, **I will not drop you from the system**. However, if you cannot complete the course successfully, please let me know and then contact the [Registrar's Office](#) to initiate the drop process. If you do not, you risk receiving an "F" for the course.

MAKEUP WORK

Makeup work will be given *only* in the case of a *documented* emergency. Note that makeup work may be in a different format than the original, require more intensive preparation, and may be graded with penalty points. You will receive a zero if you miss an assignment and the reason is not considered excusable. It is therefore essential to reach out to me—in advance if at all possible—and explain with proper documentation why you missed a given course requirement. Once a deadline has been established for makeup work, no further extensions or exceptions will be granted.

ALTERNATIVE MEANS OF SUBMITTING WORK IN CASE OF TECHNICAL ISSUES

I strongly suggest you submit your work with plenty of time to spare if you have a technical issue with the course website, network, and computer. I also offer you to save all your work (answers to discussion points, quizzes, exams, and essays) in a separate Word document as a backup. This way, you will have evidence that you completed the work and will not lose credit. If you are experiencing difficulties submitting your work through the course website, please contact the UTEP Help Desk. You can email me your backup document as a last resort.

INCOMPLETE GRADE POLICY

Incomplete grades may be requested only in exceptional circumstances after you have completed at least half of the course requirements. Talk to me immediately if you believe an incomplete is



warranted. If granted, we will establish a contract of work to be completed within deadlines.

ACCOMMODATIONS POLICY

The University is committed to providing reasonable accommodations and auxiliary services to students, staff, faculty, job applicants, applicants for admissions, and other beneficiaries of University programs, services, and activities with documented disabilities to provide them with equal opportunities to participate in programs, services, and activities in compliance with sections 503 and 504 of the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act (ADA) of 1990 and the Americans with Disabilities Act Amendments Act (ADAAA) of 2008. Reasonable accommodations will be made unless it is determined that doing so would cause undue hardship to the University. Students requesting an accommodation based on a disability must register with the [UTEP Center for Accommodations and Support Services](#) (CASS). Contact the Center for Accommodations and Support Services at 915-747-5148, email them at cass@utep.edu, or apply for accommodations online via the [CASS portal](#).

SCHOLASTIC INTEGRITY

Academic dishonesty is prohibited and a violation of the UTEP Handbook of Operating Procedures. It includes but is not limited to cheating, plagiarism, and collusion. Affairs may involve copying or providing information to another student, possessing unauthorized materials during a test, or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or knowingly represents the words or ideas of another as one's own. Collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. All suspected violations of academic integrity at The University of Texas at El Paso must be reported to the [Office of Student Conduct and Conflict Resolution](#) (OSCCR) for possible disciplinary action. To learn more, please visit [HOOP: Student Conduct and Discipline](#).

COPYRIGHT STATEMENT FOR COURSE MATERIALS

All materials used in this course are protected by copyright law. The course materials are only for the use of students currently enrolled in this course and only for this course. They may not be further disseminated.

Course Resources: Where you can go for assistance

UTEP provides a variety of student services and support:

Technology Resources

- [Help Desk](#): Students experiencing technological challenges (email, Blackboard, software, etc.) can submit a ticket to the UTEP Helpdesk for assistance. Contact the Helpdesk via phone, email, chat, website, or person if on campus.

Academic Resources

- [UTEP Library](#): Access a wide range of resources, including online, full-text access to thousands of journals and eBooks, plus reference service and librarian assistance for enrolled students.



- [University Writing Center \(UWC\)](#): Submit papers here for assistance with writing style and formatting, ask a tutor for help and explore other writing resources.
- [Math Tutoring Center \(MaRCS\)](#): Ask a tutor for help and explore other available math resources.
- [History Tutoring Center \(HTC\)](#): Receive assistance with writing history papers, get help from a tutor and explore other history resources.
- [RefWorks](#): A bibliographic citation tool; check out the RefWorks tutorial, Fact Sheet, and Quick-Start Guide.

Individual Resources

- [Military Student Success Center](#): Assists personnel in any branch of service to reach their educational goals.
- [Center for Accommodations and Support Services](#): Assists students with ADA-related accommodations for coursework, housing, and internships.
- [Counseling and Psychological Services](#): Provides various counseling services, including individual, couples, and group sessions, as well as career and disability assessments.

ACES & Tutoring Center

Please note there are tutoring services available in the ACES center. Tutoring is free to you; the department pays them. If tutors are not used, the department may stop funding them. Check the schedule of the tutors and make use of the services. For more details, visit the

ME Advising Blackboard -> cc mech acadav: MECH Academic Advising -> Tutoring & Resources

You can find tutor schedules, the location of the ACES center, and the list of tutors available at the link. For more information, send an email to METutors@utep.edu.

Weekly Calendar (Subject to Change)

This calendar provides an overview of the course. More details and a weekly checklist are available in the weekly modules in Blackboard. The due date for major writing assignments is ALWAYS Sunday at 11:59 pm (MST). No late work will be accepted.



Weeks	Topics	Readings Due	Assignments Due	Notes
Week 1 8/22-8/28	*Class introduction *Syllabus, *Review of Statics	Review syllabus, Bb Lect. 1&2		
Week 2 8/29-9/4	*Introduction to Mechanical Design *Materials	Lect-3 Review * Chapter-1-	H.W.#1 due 9/4	
Week 3 9/5-9/11	Design *Materials *Load and Stress Analysis	*Chapter -2- *Chapter -3- part-1	Quiz#1 due Wednesday	9/5 labor day Holiday
Week 4 9/12-9/18	*Load Analysis by Using Singularity Method	*Chapter -3- part-1 *Chapter -3- part-2	H.W.#2 due 9/18	
Week 5 9/19-9/25	* Mohr's Circle * Elastic Strains, Normal and Shear Stresses for 2D	Test#1 *Chapter -3- part-2	Test #1 due 9/19	
Week 6 9/26-10/2	*2 Plane Bending *3D Structural Analysis and Stress Calculation	*Chapter -3- part-2	Quiz#2 due on Wednesday H.W.#3 due 10/2	
Week 7 10/3-10/9	*Torsional Stress for 2D and 3D Structures. *Power, Speed, and Torque	*Chapter -3- part-3		
Week 8 10/10-10/16	*Closed and Open Thin-Walled Tubes and Sections * Deflections Calculations by Superposition Method	*Chapter -3- part-3 *Chapter -4- part-1	H.W.#4 due 10/16 Quiz#3 due on Wednesday	



Week 9 10/17-10/23	* Deflections Calculations by Superposition Method and Using Tables	Test#2 *Chapter -4- part-1	Test #2 due 10/17	
Week 10 10/24-10/30	* Buckling for Compression Members	*Chapter -4- part-2	H.W.# 5 due 11/01	
Week 11 10/31-11/06	* Failure Resulting from Statics Loadings * Failure Criterion	*Chapter-5- part -1 *Chapter-5- part -2	*Quiz#4 Due on Wednesday	Discuss the optional projects
Week 12 11/07-11/13	* Failure Criterion * Introduction to Fracture Mechanism *	*Chapter-5- part -2 *Chapter-5- part -3	H.W.#6 Due to 11/13	
Week 13 11/14-11/20	*Fatigue Failure Resulting from Variable Loads *Stress-Life Method and S-N Diagrams	Test#3 *Chapter-6- Part-1 Fatigue	Test #3 Due to 11/14th	Optional project, Due on Nov.28th
Week 14 11/21-11/27	*Fatigue Stress Concentration Factor	Chapter-6-part-1 Fatigue	H.W.#7 due 11/29 (for practice) Thanksgiving Holiday	
Week 15 11/28-12/01	*Characterizing the Fluctuating Stress	Chapter-6- part-2 Fatigue	Test #4 due 12/01	End

The above schedule, policies, and assignments in this course are subject to change in the event of extenuating circumstances or by mutual agreement between the instructor and the students.