

## Mechanical Design

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

**CRN:** 12262

**Class Time:** 1:30 – 2:50 pm MW Online

**Class Duration:** Aug.24<sup>th</sup>, 2020 - Dec.3<sup>rd</sup>, 2020

**Prerequisite:** Mechanicals of Materials

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

**Department:** Mechanical Engineering

**Office:** A104

**Email:** [msabed@utep.edu](mailto:msabed@utep.edu)



**Office Hours:** Virtually via Blackboard Collaborate, Wednesday 10:30-12:00 pm, and Thursday 3:00-4:30 pm. Another time by appointment.

### COURSE DESCRIPTION:

This three-credit-hour class is intended to provide the students with intensive learning about the analysis and design concepts for beams, rods in three dimensions. Besides, to learn how to calculate the deflections of the essential elements in the structure at the critical locations. New concepts 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 cold 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 structures or machines 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 included 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, discussion posts are in one area for a given week.

**GRADES**

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

**Mid-term exams (60%)**

**Quizzes (10 %)**

**Homework (20%)**

**Participation [Through reading quizzes, and discussion boards] (10%)**

Anticipated Exams Dates:

- |   |                           |
|---|---------------------------|
| Test #1: Monday, Sept.21 <sup>st</sup>  | Maybe on-campus or online |
| Test #2: Monday, Oct.19 <sup>th</sup>   | Maybe on-campus or online |
| Test #3: Monday, Nov.16 <sup>th</sup>   | Maybe on-campus or online |
| Test #4: Wednesday, Dec.2 <sup>nd</sup> | Online                    |

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

**Drop/Withdrawal Deadline: Oct.30<sup>th</sup>, 2020.**



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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' grade will be calculated based on the average of the three highest tests' grade. It means that the lowest test grade will be dropped. If a student misses only one test for any reason, and it can be for technical issues, that would be his/her lowest test to be dropped.*

**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 course after 10 days of starting the class, the instructor has the right to drop him/her 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 content area
- Click on H.W.#1 to get the link to register to the course through McGraw Hill connect.

**Quizzes:** All quizzes will be given through McGraw-Hill Connect.

**Participation:** The students are expected to log in to the Blackboard at least two times a week. To ensure that the students were getting the materials posted in the Blackboard, you are required to take the reading quiz, or respond to discussion board depends 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 that 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 to have access to a computer/laptop, a scanner, a webcam, and a microphone. You will need to download or update the following software: Microsoft Office, Adobe Acrobat Reader,



Windows Media Player, QuickTime, and Java. Check that your computer hardware and software are up-to-date and able to access all parts of the course.

If you do not have a word-processing software, 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 trained specifically 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!

**Course Communication:** How we will stay in contact with each other?

Because this is an online class, we won't see each other in the ways you may be accustomed to: during class time, small group meetings, and office hours. However, there are a number of ways we can keep the communication channels open:

- **Office Hours:** We will not be able to meet on campus, but I will still have office hours for your questions and comments about the course. My office hours will be held on Blackboard Collaborate and during the following times:

Wednesday: 10:30 –12 pm Mountain Time

Thursdays: 3:00–4:30 pm Mountain Time

- **Email:** UTEP email is the best way to contact me. I will make every attempt to respond to your email within 24-48 hours of receipt. When emailing me, be sure to email from your UTEP student account, and please put the course number in the subject line. In the body of your email, clearly state your question. At the end of your email, be sure to put your first and last name and your university identification number.
- **Discussion Board:** If you have a question that you believe other students may also have, please post it in the Help Board of the discussion boards inside of Blackboard. Please respond to other students' questions if you have a helpful response.
- **Announcements:** Check the Blackboard announcements frequently for any updates, deadlines, or other important messages.

## NETIQUETTE

As we know, sometimes, communication online can be challenging. It's possible to miscommunicate what we mean or to misunderstand what our classmates mean, given the lack of body language and immediate feedback. Therefore, please keep this netiquette (network etiquette) guidelines in mind. Failure to observe them may result in disciplinary action.

- Always consider the audience. This is a college-level course; therefore, all communication should reflect polite consideration of other's ideas.
- Respect and courtesy must be provided to classmates and the instructor at all times. No

harassment or inappropriate postings will be tolerated.

- When reacting to someone else's message, address the ideas, not the person. Post only what anyone would comfortably state in a face-to-face situation.
- Blackboard is not a public internet venue; all postings to it should be considered private and confidential. Whatever is posted on in these online spaces is intended for classmates and professor only. Please do not copy documents and paste them to a publicly accessible website, blog, or other space.

**Course Policies:** What do you need to do to be successful in the course

### **ATTENDANCE AND PARTICIPATION**

Attendance in the course is determined by participation in the learning activities of the course. Your participation in the course is important not only for your learning and success but also to create a community of learners. Participation is determined by completion of the following activities:

- Reading/Viewing all course materials to ensure understanding of assignment requirements
- Participating in an engaging discussion with your peers on the discussion boards.
- Participating in scheduled Blackboard Collaborate sessions
- Other activities as indicated in the weekly modules

Because these activities are designed to contribute to your learning each week, they cannot be made up after their due date has passed.

### **EXCUSED ABSENCES AND/OR 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 course.** However, if you feel that you are unable to 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 are at risk of receiving an "F" for the course.

### **BLACKBOARD COLLABORATE SESSIONS**

This class requires that you participate in scheduled Blackboard Collaborate sessions. The purpose of these sessions is for you to view live demonstrations of the course material and/or to participate in small discussion groups with your classmates. These sessions will be held on the following dates from 1:30 to-2:50 pm.

Expected Meeting dates: September 16<sup>th</sup>, October 14<sup>th</sup>, November 11<sup>th</sup>.

Students are expected to, at least occasionally, participate in these sessions with a webcam and microphone. The sessions will be recorded and provided so that classmates can review them at a later time. Students should not record the sessions and post them to any sites outside of Blackboard.



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If you are unable to attend a Collaborate session, please let me know as soon as possible so that accommodations can be made when appropriate.

### **DEADLINES, LATE WORK, AND ABSENCE POLICY**

#### Quiz and Blog/Discussion Assignments

- All quizzes and discussion board assignments will be due on Sundays at midnight (11:59 pm). No late work will be accepted if the reason is not considered excusable.

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#### **MAKE-UP 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 work, may require more intensive preparation, and maybe graded with penalty points. If you miss an assignment and the reason is not considered excusable, you will receive a zero. It is therefore important 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 that you submit your work with plenty of time to spare in the event that you have a technical issue with the course website, network, and/or your computer. I also suggest you save all your work (answers to discussion points, quizzes, exams, and essays) in a separate Word document as a back-up. 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 back-up 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 with 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 in order 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 on 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, or email them at [cass@utep.edu](mailto:cass@utep.edu), or apply for accommodations online via the [CASS portal](#).

### **COVID-19 Accommodations**

Students are not permitted on campus when they have a positive COVID-19 test, exposure or



symptoms. If you are not permitted on campus, you should contact me as soon as possible so we can arrange necessary and appropriate accommodations.

(*classes with on-campus meetings*) Students who are considered high risk according to CDC guidelines and/or those who live with individuals who are considered high risk may contact [Center for Accommodations and Support Services](#) (CASS) to discuss temporary accommodations for on-campus courses and activities.

### **SCHOLASTIC INTEGRITY**

Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from 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 ones' 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](#).

### **TEST PROCTORING SOFTWARE**

Two course assessments (the exams and quizzes) will make use of Respondus Lock Down Browser and Respondus Monitor inside of Blackboard to promote academic integrity. You are encouraged to learn more about how to use these programs prior to the first test.

Please review the following guidelines:

- The assessments will only be available at the times identified on the course calendar.
- A reliable Internet connection is essential to completing the exam. If you must go to a location to take the exam (such as the library), be sure to follow their health and safety requirements.
- You have 2 attempts to take the test. Once the window closes, your answers will be saved, and no changes can be made. The higher score will be recorded.
- Respondus Lockdown Browser will require that all internet tabs are closed prior to the start of the test.
- Respondus Monitor requires a webcam and microphone.
- You will be required to show the webcam your student ID prior to the start of the test.
- Your face should be completely visible during the test. Blocking the camera will disable the test.
- You should not have conversations with other people and/or leave and return to the area during the test.

### PLAGIARISM DETECTING SOFTWARE

Some of your course work and assessments may be submitted to SafeAssign, a plagiarism detecting software. SafeAssign is used to review assignment submissions for originality and will help you learn how to properly attribute sources rather than paraphrase.

### 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 the purpose of this course. They may not be further disseminated.

### COVID-19 PRECAUTIONS

You must **STAY AT HOME** and **REPORT** if you (1) have been diagnosed with COVID-19, (2) are experiencing COVID-19 symptoms, or (3) have had recent contact with a person who has received a positive coronavirus test. Reports should be made at [screening.utep.edu](https://screening.utep.edu). If you know of anyone who should report any of these three criteria, you should encourage them to report. If the individual cannot report, you can report on their behalf by sending an email to [COVIDaction@utep.edu](mailto:COVIDaction@utep.edu).

For each day that you attend campus—for any reason—you must complete the questions on the UTEP screening website ([screening.utep.edu](https://screening.utep.edu)) prior to arriving on campus. The website will verify if you are permitted to come to campus. Under no circumstances should anyone come to class when feeling ill or exhibiting any of the known COVID-19 symptoms. If you are feeling unwell, please let me know as soon as possible, and alternative instruction will be provided. Students are advised to minimize the number of encounters with others to avoid infection.

Wear face coverings when in common areas of campus or when others are present. You must wear a face-covering over your nose and mouth at all times in this class. If you choose not to wear a face covering, you may not enter the classroom. If you remove your face covering, you will be asked to put it on or leave the classroom. Students who refuse to wear a face covering and follow preventive COVID-19 guidelines will be dismissed from the class and will be subject to disciplinary action according to Section 1.2.3 *Health and Safety* and Section 1.2.2.5 *Disruptions* in the UTEP Handbook of Operating Procedures.

*(classes with on-campus meetings)* Please note that if COVID-19 conditions deteriorate in the City of El Paso, all course and lab activities may be transitioned to remote delivery.

**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 in 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 and 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 a variety of 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**

At the link, you can find tutor schedules, location of the ACES center, and the list of tutors available. For more information, send an email to [METutors@utep.edu](mailto: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.

KEY:

DB =Discussion Board

BB=Blackboard

Weeks	Topics	Readings Due	Assignments Due	Notes
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Week 1 8/24-8/30	*Class introduction *Syllabus, *Review of Statics	Review syllabus, Bb Lect. 1-3 Watch videos for week -1	*Syllabus Quiz due 8/30 *DB.* due 8/30 Both on B.B.	Blackboard Collaborate Ultra meeting, <b>[First Day Meeting]</b> from 1:30 to 2:50 pm. , Monday Aug.24 <sup>th</sup>
Week 2 8/31-9/6	*Introduction to Mechanical Design *Materials	* Chapter-1- *Chapter -2-	*Reading Quiz 1 due 9/6  H.W.#1 due 9/6	*Reading quiz will count towards the participation points
Week 3 9/7-9/13	*Load and Stress Analysis *Load Analysis by Using Singularity Method	*Chapter -3- part-1	*Quiz#1 due Friday, Sept.11 <sup>th</sup>	
Week 4 9/14-9/20	*Load Analysis by Using Singularity Method  * Mohr's Circle	*Chapter -3- part-1  *Chapter -3- part-2	*Reading Quiz_2 Due 9/20  H.W.#2 due 9/20	Blackboard Collaborative Ultra Due on Wednesday, Sep16 <sup>th</sup> at 1:30pm
Week 5 9/21-9/27	* Elastic Strains, Normal and Shear Stresses for 2D	<b>Test#1</b>  *Chapter -3- part-2	<b>Test #1 due 9/21</b>  *Reading Quiz_3 Due 9/27	
Week 6 9/28-10/4	*2 Plane Bending  *3D Structural Analysis and Stress Calculation	*Chapter -3- part-2	Quiz#2 due Friday, Oct.2 <sup>nd</sup>  H.W.#3 due 10/4	
Week 7 10/5-10/11	*Torsional Stress for 2D and 3D Structures. *Power, Speed, and Torque	*Chapter -3- part-3	*Reading Quiz_4 Due 10/11	
Week 8 10/12-10/18	*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 10/18  Quiz#3 due Friday, Oct.16 <sup>th</sup>	Blackboard Collaborative Ultra Due on Wednesday, Oct.14 <sup>th</sup> at 1:30pm



Week 9 10/19-10/25	* Deflections Calculations by Superposition Method and Using Tables	<b>Test#2</b>  *Chapter -4- part-1	<b>Test #2</b> <b>due 10/19</b>	
Week 10 10/26-11/01	* Buckling for Compression Members	*Chapter -4- part-2	H.W.# 5 due 11/01  *Reading Quiz_5 due 11/01	
Week 11 11/02-11/08	* Failure Resulting from Statics Loadings	*Chapter-5- part -1  *Chapter-5- part -2	*Quiz#4 due Friday, Nov.6 <sup>th</sup>	
Week 12 11/09-11/15	* Failure Criterion  * Introduction to Fracture Mechanism *	*Chapter-5- part -2  *Chapter-5- part -3	H.W.#6 due 11/15	Blackboard Collaborative Ultra Due on Wednesday, Nov.11 <sup>th</sup> at 1:30pm
Week 13 11/16-11/22	*Fatigue Failure Resulting from Variable Loads *Stress-Life Method and S-N Diagrams	Test#3  *Chapter-6- Part-1 Fatigue	<b>Test #3</b> <b>due 11/16<sup>th</sup></b>	
Week 14 11/23-11/29	*Fatigue Stress Concentration Factor	Chapter-6-part-1 Fatigue	H.W.#7 due 11/29  Thanksgiving Holiday	
Week 15 11/30-12/06	*Characterizing the Fluctuating Stress	Chapter-6- part-2 Fatigue	<b>Test #4</b> <b>due 12/02 (Online)</b> <b>Optional</b>	<b>End</b>

*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.*