



**Course** MECH 3351.001  
**Course Title** Design of Mechanical Systems  
**Professor** Rodrigo Bernal  
**Term** Spring 2021  
**Meetings** Tue. & Thurs. 8:30-9:45 AM, Blackboard Collaborate

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## 1 Professor's Contact Information

**Office** N/A  
**Email** [bernal@utdallas.edu](mailto:bernal@utdallas.edu)  
Please use "MECH 3351.001 S21" in the subject line, otherwise I might miss your email  
**Office Hours** Tuesdays 4-5 pm. Blackboard Collaborate. Other hours by appointment (send me an email)

**Teaching Assistant** Mr. Mohammad Waliullah  
**Email** [mxw180003@utdallas.edu](mailto:mxw180003@utdallas.edu)  
**Office Hours** Mondays 1-2 pm. Blackboard Collaborate. Other hours by appointment (send him an email.)

## 2 Course Information

### 2.1 Course Modality and Expectations

<b>Instructional Mode</b>	<b>Remote/Virtual:</b> <a href="https://covid.utdallas.edu/students-families-info/spring-2021-registration/">https://covid.utdallas.edu/students-families-info/spring-2021-registration/</a> "Synchronous online learning at the day and time of the class. The instructor delivers the instruction from home or the office. Students complete the course at a distance."
<b>Course Platform</b>	<ul style="list-style-type: none"><li>eLearning and Blackboard Collaborate</li><li>Recordings available within eLearning. Captioned recordings available in MS Teams (General/Lectures tab) or MS Stream (<a href="https://dox.utdallas.edu/instruction1159">https://dox.utdallas.edu/instruction1159</a>).</li></ul>
<b>Expectations</b>	I encourage synchronous attendance so that you can participate in live discussions. However, attendance is not mandatory; asynchronous recordings are provided and discussion participation through eLearning forums is also possible. Homeworks will be handed in advance of the due date and exams will have a day-long window with a generous time limit. Grading standards are the same as in a traditional class.
<b>Asynchronous Learning Guidelines</b>	If you choose asynchronous learning, know that no graded activities will be done live. You will be able to watch all recordings and access all lecture and class materials through eLearning. <a href="https://covid.utdallas.edu/response/faq/">https://covid.utdallas.edu/response/faq/</a> Search for "Asynchronous Access for Spring 2021"

## 2.2 Prerequisites and Co-requisites

Prerequisites:

- MECH 2320: Mechanics of Materials
- ENGR 3300: Advanced Engineering Mathematics

Co-requisites:

- MECH 3350: Kinematics and Dynamics of Mechanical Systems

## 2.3 Course description

This course will focus on the design, synthesis and analysis of mechanical components and systems using strength of materials techniques. Specific design criteria based on reliability and functionality will be introduced. Students will also exercise problem-solving, communication and teamwork skills through a team project.

## 2.4 Student Learning Objectives/ Outcomes

1. Apply knowledge of the working principles of mechanical components and systems.
2. Analyze and select basic mechanical components, such as shaft and shaft accessories, bearings, gears, fasteners, etc., for the design of a mechanical system.
3. Formulate existing solutions to open-ended problems, and conceive possible future solutions.
4. Interpret a design problem and model it as a solvable engineering problem.
5. Understand and synthesize engineering analysis results.
6. Operate in a team-oriented design project.

## 2.5 Textbooks

**Main textbook (not required):**

- Budynas, R. G. and Nisbett, J. K., *Shigley's Mechanical Engineering Design*, 11<sup>th</sup> Ed., McGraw-Hill. It is a good investment to have this book for your ME career, but I will not use verbatim problems or access codes from it; hence, not owning it, or owning a previous edition, or a used book will be fine for our course.

**Suggested textbooks that might be useful:**

- Hibbeler, R. C., *Mechanics of Materials*, 9<sup>th</sup> Ed. (or previous), Prentice Hall.
- Callister W.D., and Rethwisch D.G, *Materials Science and Engineering: An introduction*. 9<sup>th</sup> Ed. (or previous), Wiley.

## 3 Course policies

### 3.1 Grading percentages

Homework/Quizzes: 35%  
Midterm exam: 20%  
Final exam: 25%  
Team project: 20%

### 3.2 Grading Policy

Everything will be graded on a 0-100 scale. Total grade on a scale of 0-100 will be computed using the percentages outlined above. A letter grade will be assigned according to UTD policy: <https://catalog.utdallas.edu/2020/undergraduate/policies/academic>  
Use the table to the right as a reference.

Grade	Grade Points	0-100 threshold
A	4.000	95
A-	3.670	87.5
B+	3.330	79.1
B	3.000	70.9
B-	2.670	62.5
C+	2.330	54.1
C	2.000	45.9

### 3.3 Homework and Quizzes

There will be one homework due every 1.5 weeks starting on week 3 (see schedule at the end). Next homework will be posted when the previous one is due. There will be a link in e-learning to upload a **pdf** of your handwritten assignment.

In certain weeks, homework might be replaced by a quiz due the same due date. This will be announced at the latest the class before the quiz.

### 3.4 Appeals Policy

Homework, quiz and exam grade appeals shall be submitted within one week of the return date for the assignment or exams and must be submitted in writing. The reason for requesting a re-grade must be clearly stated. **Requests submitted later than one week after the return date or not in writing will not be processed.**

### 3.5 Academic integrity

Academic integrity is a serious matter. Students can discuss assignments but are expected to complete their individual work. Direct copying from someone else or from a solution manual is not permitted. Any violation of the academic conduct policy will be dealt with according to the University Policy.

### 3.6 Other policies

- **Make up exams:** No make-up exams will be given with the only exception of an emergency. Advance notice and/or justification must be given in such a case.
- **Late work:** Late work without a documented excuse (homework and project) will be graded if turned-in the next day after it is due. However, a penalty of 40% will be imposed. Any late work must be delivered to Prof. Bernal or the TA according to the policies in Section 3.2. Work turned-in after the next day will not be graded.
- **Email usage:** Please note that all email communication with regard to the course must be handled through your UT Dallas email address according to University policy.

### 3.7 UT Dallas Syllabus Policies and Procedures, COVID-19 Guidelines and Resources

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus. Please make sure to go to <http://go.utdallas.edu/syllabus-policies> and read these policies.

#### Class Recordings

The instructor may record meetings of this course. Any recordings will be available to all students registered for this class as they are intended to supplement the classroom experience. Students are expected to follow appropriate University policies and maintain the security of passwords used to access recorded lectures. Unless the Office of Student AccessAbility has approved the student to record the instruction, students are expressly prohibited from recording any part of this course. Recordings may not be published, reproduced, or shared with those not in the class, or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. If the instructor or a UTD school/department/office plans any other uses for the recordings, consent of the students identifiable in the recordings is required prior to such use unless an exception is allowed by law. Failure to comply with these University requirements is a violation of the [Student Code of Conduct](#).

### **Class Materials**

The Instructor may provide class materials that will be made available to all students registered for this class as they are intended to supplement the classroom experience. These materials may be downloaded during the course, however, these materials are for registered students' use only. Classroom materials may not be reproduced or shared with those not in class, or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. Failure to comply with these University requirements is a violation of the [Student Code of Conduct](#).

### **Technical Requirements**

In addition to a confident level of computer and Internet literacy, certain minimum technical requirements must be met to enable a successful learning experience. Please review the important technical requirements on the [Getting Started with eLearning](#) webpage.

### **Course Access and Navigation**

This course can be accessed using your UT Dallas NetID account on the [eLearning](#) website.

Please see the course access and navigation section of the [Getting Started with eLearning](#) webpage for more information.

To become familiar with the eLearning tool, please see the [Student eLearning Tutorials](#) webpage.

UT Dallas provides eLearning technical support 24 hours a day, 7 days a week. The [eLearning Support Center](#) includes a toll-free telephone number for immediate assistance (1-866-588-3192), email request service, and an online chat service.

### **Communication**

This course utilizes online tools for interaction and communication. Some external communication tools such as regular email and a web conferencing tool may also be used during the semester. For more details, please visit the [Student eLearning Tutorials](#) webpage for video demonstrations on eLearning tools.

Student emails and discussion board messages will be answered within 3 working days under normal circumstances.

### **Distance Learning Student Resources**

Online students have access to resources including the McDermott Library, Academic Advising, The Office of Student AccessAbility, and many others. Please see the [eLearning Current Students](#) webpage for more information.

### **Server Unavailability or Other Technical Difficulties**

The University is committed to providing a reliable learning management system to all users. However, in the event of any unexpected server outage or any unusual technical difficulty which prevents students from completing a time sensitive assessment activity, the instructor will provide an appropriate accommodation based on the situation. Students should immediately report any problems to the instructor and also contact the online [eLearning Help Desk](#). The instructor and the eLearning Help Desk will work with the student to resolve any issues at the earliest possible time.

### **Academic Support Resources**

The information contained in the following link lists the University's academic support resources for all students. Please go to [Academic Support Resources](#) webpage for these policies.

*The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.*

## 4 Program

*The descriptions and timelines contained in this program are subject to change at the discretion of the Professor*

For extra reading, C means the book by Callister, H means the book by Hibbeler

Part	Week	Class	Date	Topic	Req. reading Shigley's		Extra reading
					10 <sup>th</sup> Ed.	11 <sup>th</sup> Ed.	
Part 1: Review	1	1	1/19	Class survey Introduction to the class	1.1-1-9	1.1-1-9	
		2	1/21	Materials: Stress-strain curve	2.1, 2.3	2.1, 2.3	C: Ch 6.
	2	3	1/26	Materials: Classification and microstructure	2.4-2.21	2.5-2.22	C:Ch1, Ch3
		4	1/28	Materials: Metals and Steels	2.4-2.21	2.5-2.22	C: 7.8-7.10
	3	5	2/2	Load and stress analysis: Free-body and shear moment diagrams in beams <b>Homework 1 Due</b>	3.1-3.2	3.1-3.2	H: 6.1-6.4
		6	2/4	Load and stress analysis: Bending and shear stresses in beams	3.9-3.11	3.9-3.11	H: Ch6-Ch7
	4	7	2/9	Load and stress analysis: Torsion	3.12	3.12	H: Ch 5.
		8	2/11	Deflection and stiffness: Superposition <b>Homework 2 Due</b>	4.1-4.5	4.1-4.5	
	5	9	2/16	Deflection and stiffness: Singularity functions	3.3	3.3	H: 12.3
		10	2/18	Deflection and stiffness: Singularity functions	4.6	4.6	
	6	11	2/23	Deflection and stiffness: Compression members and buckling <b>Homework 3 Due</b>	4.10-4.15	4.10-4.15	
		12	2/25	Failure from static loading: Stress concentrations, Principal stresses	5.1,5.2, 3.13	5.1,5.2, 3.13	
Part 2: Failure prevention	7	13	3/2	Failure from static loading: Principal stresses	3.4-3.7	3.4-3.7	H: 9.4
		14	3/04	Failure from static loading: Theories for Ductile materials – Maximum shear stress theory <b>Homework 4 Due</b>	5.3-5.7	5.3-5.7	
	8	15	<b>3/9</b>	<b>Midterm</b>			
		16	3/11	Failure from static loading: Theories for Ductile materials. Maximum Deflection energy theory. Theories for Brittle Materials	5.8-5-11	5.8-5-11	

	9	17	3/16	<b>Spring Break. No classes</b>			
		18	3/18	<b>Spring Break. No classes</b>			
	10		<b>3/23</b>	Failure from variable loading: Fracture toughness, crack growth and fatigue	5.12, 6.1 – 6.6	5.12, 6.1-6.5	
			<b>3/25</b>	Failure from variable loading: Fatigue and S-N Curve <b>Homework 5 Due</b>	6.7-6.11	6.7-6.11	
	11	19	3/30	Failure from variable loading: Fatigue failure criteria	6.12-6-17	6.12 -6.19	
		20	4/1	Design of shafts <b>Project: Deliverable 1 Due</b>	7.5-7.8	7.5 -7.8	
Part 3: Mechanical Elements and systems	12	21	4/6	Welding, bonding & permanent joints <b>Homework 6 Due</b>	Ch 9	Ch 9	
		22	4/8	Screws, Fasteners & non-permanent joints	8.1-8.3, 8-6	8.1-8.3, 8-6	
	13	23	4/13	Screws, Fasteners & non-permanent joints	8.4-8.12	8.4-8.12	
		24	4/15	Screws, Fasteners & non-permanent joints <b>Homework 7 Due</b>	8.4-8.12	8.4-8.12	
	14	25	4/20	Springs	10.1-10.6,	10.1-10.6,	
		26	4/22	Springs	10.7-10.9	10.7-10.9	
	15	27	4/27	Bearings and journal bearings <b>Homework 8 Due</b>	Ch. 12	Ch. 12	
		28	4/29	Bearings and journal bearings	Ch. 12	Ch. 12	
	16	29	5/4	Rolling-element bearings	Ch. 11	Ch. 11	
		30	5/6	Rolling-element bearings <b>Homework 9 Due</b>	Ch. 11	Ch. 11	
			5/7	<b>Project: Deliverable 2 Due</b>			
			5/10-5/15	<b>Final Exam Week. Date TBA by the Registrar.</b>			