

# MAE 3242-001: Mechanical Design I

Summer 2016

**Instructor(s):** Sheikh Fahad Ferdous

**Office Number:** 323H Woolf Hall

**Office Telephone Number:** (817) 272-2561 (voice)

**Email Address:** sheikh@uta.edu

**Office Hours:** 1:00 pm – 3:00 pm; Monday (or, by appointment)

**Time and Place of Class Meetings:** WH 308, Woolf Hall (WH)

**MW 3:00 pm – 4:20 pm**

**Course Website:** <https://elearn.uta.edu/>

**Description of Course Content:** This overall nature of design as a process is presented along with various models, methods, techniques, and tools for the various phases of the process provide the student with an excellent understanding of how to design. Students learn to design mechanical components based on stress/deflection and the associated failure theories.

**Course Prerequisites:** MAE C or better in each of the following, MAE 2312, MAE 2323, and MAE 3324.

**Textbooks:** Robert L. Norton, Machine Design-An Integrated Approach, 4th Edition,  
*The text book will be used as reference, and for some reading and homework assignments.*

## Student Learning Outcomes:

The student will learn about:

- Design process
- Use the various techniques, tools and methods that can be used at each stage
- Understand how solid mechanics and materials theory are used in the design process
- Appropriate safety factors for different design situations
- Failure theories for mechanical parts.

## Course Grading Policy:

Homework	40 (10%)
Quiz	60 (15%)
**Key Assignment	40 (10%)
Midterm	120 (30%)
Final Exam	140 (35%)
<hr/>	
Semester Total points	400 (100%)

**\*\*In order to pass this class, students must submit and pass this key assignment. If the key assignment is not submitted and passed, the student will not pass the class even if he/she scores perfectly on all exams and other assignments. Details about key assignment will be discussed in class.**

<b>Tentative Grading Scale</b>	<b>Letter Grade</b>
340 or above ( $\geq 85\%$ )	A
300 – 339 (75% to $\leq 85\%$ )	B
260 – 299 (65% to $\leq 75\%$ )	C
220 – 259 (55% to $\leq 65\%$ )	D
000 – 220 ( $\leq 55\%$ )	F

**Important Dates:**

**Midterm: Monday, July 18, 2016, 3:00 pm – 4:20 pm.**

Syllabus: All class materials, solved problems, homework and reading assignments that are covered to date.

**Homework:** Assigned weekly during the **Monday** class and due before the next **Monday** class unless otherwise stated.

**Final Exam: On the date scheduled by the University during the Final Exam Period.** Covers all class materials including homework, solved problems, reading assignments and midterm exams.

**Note:**

- All students **MUST** check blackboard and UTA email periodically. All HWs, announcements and course related information will be made available to Blackboard only.
- **NOT CHECKING MAVMAIL OR BLACKBOARD NOTICES IS NOT AN EXCUSE FOR “I WAS NOT INFORMED”**
- All homework assignments should be prepared on instructor-approved papers and turned in with a coversheet. The template for the coversheet will be uploaded to Blackboard before the 1<sup>st</sup> HW assignment is due.
- Homework turned in **LATE** will receive a 20% penalty per day until solution for that Homework is posted. Solutions to HWs will be posted within one week from the due date.
- No **LATE** home work will be accepted after the solution is made available to students. [NO EXCEPTIONS]
- UTA regulations permitting, missed midterms and/or final exams can only be rescheduled when missed due to major health problems or circumstances beyond the student’s control.
- With instructor’s discretion, students will be required to reschedule the missed exams at the earliest time possible.

First Class: June 06, 2016  
Census Date: June 23, 2016  
Last day to drop class: July 21, 2016  
Last day of class: August 10, 2016  
Final Exam: August 15, 2016

**Attendance Policy:** Students are strongly recommended to attend each class.

**Drop Policy:** Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://wweb.uta.edu/aao/fao/>).

**Americans with Disabilities Act:** The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the *Americans with Disabilities Act (ADA)*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at [www.uta.edu/disability](http://www.uta.edu/disability) or by calling the Office for Students with Disabilities at (817) 272-3364.

**Academic Integrity:** Students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

*I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*

*I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work

submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

**Student Support Services:** UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to [resources@uta.edu](mailto:resources@uta.edu), or view the information at [www.uta.edu/resources](http://www.uta.edu/resources).

**Electronic Communication:** UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

**Student Feedback Survey:** At the end of each term, students enrolled in classes categorized as "lecture," "seminar," or "laboratory" shall be directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit <http://www.uta.edu/sfs>.

**Final Review Week:** A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

**Emergency Exit Procedures:** Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist handicapped individuals.

**Woolf Hall 406 Computer Teaching Lab Policies:**

1. WH 406 must be officially reserved for all events including classroom instructions due to the limited classroom space equipped with computers and scheduling logistics. Please see Lanie or Janet for reservation.
2. WH 406 is a computer teaching lab. Faculty and Instructors must be present while students occupy this room. When an instructor leaves the room, students are to leave WH 406 as well. Instructors should encourage students to use WH 320 if needed after class is over. The computer lab in WH 320 is available for MAE student access 24/7.
3. WH 406 doors are not to be propped open. Propped doors are considered a security breach by the UTA Police Department and a hazard violation by the Fire Inspector.
4. Food, drink, and tobacco products are prohibited in WH 406.

## Course Schedule

Date	Day	Lecture	Topic	Note
06-Jun-16	Monday	Lecture 1	<b>Chapter 1</b> <ul style="list-style-type: none"> <li>• Introduction.</li> <li>• Design</li> <li>• A Design Process</li> </ul>	
08-Jun-16	Wednesday	Lecture 2	<ul style="list-style-type: none"> <li>• Problem Formulation and Calculation</li> <li>• The Engineering Model</li> <li>• Computer Aided Design and Engineering</li> <li>• The Engineering Report</li> <li>• Factor of Safety and Design Codes</li> <li>• Statistical Considerations</li> <li>• Units</li> </ul>	
13-Jun-16	Monday	Lecture 3	<b>Chapter 2</b> <ul style="list-style-type: none"> <li>• Material Property Definitions</li> <li>• The Statistical Nature of Material Properties</li> <li>• Homogeneity and isotropy</li> </ul>	HW 1 Assigned
15-Jun-16	Wednesday	Lecture 4	<ul style="list-style-type: none"> <li>• Hardness</li> <li>• Coatings and Surface Treatments</li> </ul>	
20-Jun-16	Monday	Lecture 5	<ul style="list-style-type: none"> <li>• General Properties of Metals</li> <li>• General Properties of Nonmetals</li> <li>• Selecting Materials</li> </ul>	HW 1 Due HW 2 Assigned
22-Jun-16	Wednesday	Lecture 6	<b>Chapter 3</b> <ul style="list-style-type: none"> <li>• Introduction.</li> <li>• Degree of Freedom</li> <li>• Mechanisms</li> <li>• Calculating Degree of Freedom (Mobility)</li> </ul>	
27-Jun-16	Monday	Lecture 7	<ul style="list-style-type: none"> <li>• Common 1-DOF Mechanisms</li> <li>• Analyzing Linkage Motion</li> <li>• Analyzing the Fourbar Linkage</li> </ul>	HW 2 Due HW 3 Assigned
29-Jun-16	Wednesday	Lecture 8	<ul style="list-style-type: none"> <li>• Analyzing the Fourbar Crank-Slider</li> <li>• Cam Design and Analysis</li> <li>• Loading Classes for Force Analysis</li> </ul>	
06-Jul-16	Wednesday	Lecture 9	<ul style="list-style-type: none"> <li>• Free-body Diagrams</li> <li>• Load Analysis</li> <li>• Two-Dimensional, Static Loading Case Studies</li> </ul>	HW 3 Due HW 4 Assigned
11-Jul-16	Monday	Lecture 10	<ul style="list-style-type: none"> <li>• Three-Dimensional, Static Loading Case Study</li> <li>• Dynamic Loading Case Study</li> <li>• Vibration Loading</li> </ul>	
13-Jul-16	Wednesday	Lecture 11	<ul style="list-style-type: none"> <li>• Impact Loading</li> <li>• Beam Loading</li> <li>• Summary</li> </ul>	HW 4 Due

18-Jul-16	Monday	<b>Mid-Term</b>	<b>*** EXAM ***</b>	
20-Jul-16	Wednesday	Lecture 12	<b>Chapter 4</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Stress and Strain</li> <li>• Principal Stresses</li> <li>• Plane Stress and Plane Strain</li> <li>• Mohr's Circle</li> <li>• Applied versus Principal Stresses</li> <li>• Axial Tension</li> </ul>	
25-Jul-16	Monday	Lecture 13	<ul style="list-style-type: none"> <li>• Direct Shear Stress, Bearing Stress, and Tearout</li> <li>• Beams and Bending Stresses</li> <li>• Deflection in Beams</li> <li>• Castigliano's Method</li> <li>• Torsion</li> </ul>	HW 5 Assigned
27-Jul-16	Wednesday	Lecture 14	<ul style="list-style-type: none"> <li>• Combined Stresses</li> <li>• Spring Rates</li> <li>• Stress Concentration</li> <li>• Axial Compression-Columns</li> <li>• Stresses in Cylinders</li> </ul>	
01-Aug-16	Monday	Lecture 15	<b>Chapter 5</b> <ul style="list-style-type: none"> <li>• Failure of Ductile Materials Under Static Loadings</li> <li>• Failure of Brittle Materials Under Static Loadings</li> <li>• Fracture Mechanics</li> <li>• Using the Static Loading Failure Theories</li> <li>• Case Studies in Static Failure Analysis</li> </ul>	HW 5 Due HW 6 Assigned
03-Aug-16	Wednesday	Lecture 16	<b>Chapter 6</b> <ul style="list-style-type: none"> <li>• Mechanism of Fatigue Failure</li> <li>• Fatigue-Failure Models</li> <li>• Machine-Design Considerations</li> <li>• Fatigue Loads</li> <li>• Measuring Fatigue Failure Criteria</li> </ul>	
08-Aug-16	Monday	Lecture 17	<ul style="list-style-type: none"> <li>• Estimating Fatigue Failure Criteria</li> <li>• Notches and Stress Concentrations</li> <li>• Residual Stresses</li> <li>• Designing for High Cycle Fatigue</li> <li>• Designing for Fully Reversed Uniaxial Stresses</li> </ul>	HW 6 Due
10-Aug-16	Wednesday	Lecture 18	<b>Chapter 7</b> <ul style="list-style-type: none"> <li>• Surface Geometry</li> <li>• Mating Surfaces</li> <li>• Friction</li> <li>• Adhesion, Abrasive, and Corrosion Wear</li> <li>• Spherical Contact</li> </ul>	

			• Cylindrical Contact	
15-Aug-16	Monday		<b>***FINAL EXAM***</b>	

*As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course. –Sheikh F Ferdous*