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**EML 3500**  
**MECHANICAL DESIGN I**  
**ONLINE COURSE**

**Summer 2017**

**Instructor: Dr. Sabri Tosunoglu**  
**E-mail: [tosun@fiu.edu](mailto:tosun@fiu.edu)**

**Florida International University**  
**Department of Mechanical and Materials Engineering**  
**10555 West Flagler Street**  
**Miami, Florida 33174**

**[www.eng.fiu.edu/mme/robotics](http://www.eng.fiu.edu/mme/robotics)**

**Teaching Assistants**

Name	Ann Kayana Blanchard	Scott Jagolinzer
Email	<a href="mailto:ablan115@fiu.edu">ablan115@fiu.edu</a>	<a href="mailto:sjago001@fiu.edu">sjago001@fiu.edu</a>
Office Hours	M and W 5:00 – 6:00 PM	By appointment via email
Office	EC 3435 Robotics and Automation Laboratory	

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**ONLINE RESOURCES**

FIU Online Login: <http://online.fiu.edu/login>

McGraw Hill Connect: <http://connect.mheducation.com>

EML 3500: <https://connect.mheducation.com/class/s-tosunoglu-summer-2017-eml3500>

Supplemental Problems:

<http://www.eng.fiu.edu/mme/robotics/EML3500MechDesignI>

Correspondence: [tosun@fiu.edu](mailto:tosun@fiu.edu), [ablan115@fiu.edu](mailto:ablan115@fiu.edu), [sjago001@fiu.edu](mailto:sjago001@fiu.edu)

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**Course Description:**

Introduction to design process. Review of static and dynamic loading, resulting normal and shear stresses, principal stresses. Engineering materials, static and fatigue failure theories. Machine element design including screws, bolts, fasteners, welded joints. Open-ended design projects.

## Prerequisites:

EGN 3321 Dynamics  
EMA 3702 Mechanics and Materials Science  
EGN 3365 Materials in Engineering

## Textbook:

*Shigley's Mechanical Engineering Design*, Richard G. Budynas, and J. Keith Nisbett, 10th edition, McGraw-Hill, Inc., New York, 2015. ISBN 9781260243314.

**McGraw-Hill Connect and eBook:** The ISBN is provided for FIU's EML 3500 and 4501 Mechanical Design I and II courses which will provide access to McGraw-Hill Connect and eBook for 270 days.

## Online Lectures:

There are no on-campus lectures; however, the complete set of lecture video clips will be available on Blackboard throughout the semester. In general, each chapter will be online for a week until a new chapter is uploaded. Hence, timely review of video clips is extremely important to successfully complete this online course.

## Course Outline:

Part I Basics: Brief Review of Mechanics of Materials

1. Introduction to Design, Ethics, Standards
2. Materials
3. Load and Stress Analysis
4. Deflection and Stiffness

Part II Failure Prevention: Design Theories

5. Failures Resulting from Static Loading
6. Fatigue Failure Resulting from Variable Loading

Part III Design of Mechanical Elements

7. Design of Shafts
8. Screws, Fasteners, and the Design of Nonpermanent Joints
9. Welding, Brazing, Bonding and the Design of Permanent Joints

## Course Objectives:

- This course presents a review of the concepts on stress, strain, elastic and plastic ranges of material behavior, stress-strain relationship, and engineering materials.

- Stress calculations under axial loading, torsion, bending, and transverse loading. Brief review of deflection analysis.
- Static failure theories for ductile and brittle materials: Maximum shear stress theory, Maximum normal strain theory, Distortion energy (von Mises) theory; Maximum normal stress theory, Coulomb-Mohr theory, modified Coulomb-Mohr theory.
- Fatigue failure theories such as Goodman, modified Goodman, ASME elliptic curve, Gerber, and Soderberg for cyclic loading.
- Application of static and fatigue failure theories to mechanical design problems.
- Permanent and temporary joints. Welding, bolts and screws, welding groups and bolt groups.

### **ABET ME Student Outcomes Supported by the Course:**

ME departmental student outcomes that are supported by this course are as follows:

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (d) an ability to function on multidisciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

### **Note Regarding ABET MME Outcomes:**

ABET student outcomes are defined for the MME program that must be achieved by graduating students. Each course supports several of the outcomes incrementally but must not necessarily achieve them fully.

### **Grading:**

Activity	Percent	Comment
Online Participation and Assignments	10%	As monitored by FIU Online System & Connect: Online participation, practice problem assignments, reading assignments.
Online Quizzes	10%	<u>No make-ups will be offered for quizzes.</u> The lowest quiz grade will be dropped.
Project 1	15%	<u>Both projects require Senior Design Report format.</u> Project with individual and team involvement.
Project 2	15%	Team project. Structural mechanical design, professional engineering drawings, technical report. <u>Important: If Project 2 is not submitted, course grade will directly be F.</u>
On-Campus Midterm Exam	20%	E-book only. 1 page of formula sheet allowed.
On-Campus Final Exam	30%	E-book only. 2 pages of formula sheets allowed. Final is a comprehensive exam.

### On-Campus Exams and Online Quizzes:

One midterm exam and one final exam will be given on-campus.

Also, several online quizzes will be given.

Detailed information on quiz and exam dates, times and classroom information for exams are listed in the course activity table at the end.

### Proctored Off-Campus Exams:

The following university policy will be used in this online course:

- Students are responsible for scheduling and paying any extra costs if they are unable to attend the on-campus proctored exam and must arrange an alternative through one of the following options:
  - Students will locate a proctoring center. Proctoring centers can be located through the **National College Testing Association** site: <http://www.ncta-testing.org/cctc/find.php>. Refer to the “**Proctoring Center Agreement Form.**”

- Students will locate a virtual proctoring center such as Proctor U (<http://www.proctoru.com/>). Refer to the “**Proctoring Center Agreement Form.**”
- Students must select a proctoring center or virtual proctoring center no later than two weeks before the date of any scheduled proctored exam and notify the instructor of their choice and contact information.

### **Exam Policy:**

- One midterm and one final exam will be given on-campus and both will be paper-based exams.
- During the exams, a personal calculator may be used. See the calculator policy below.
- Use of personal laptops, tablets, computers, phones, mp3 players or any electronic device will strictly be prohibited.
- Lecture notes, PowerPoint files and problem solutions will not be allowed.
- No material or calculator may be shared by students.
- Individually-prepared one letter-size sheet of formulas will be allowed in the midterm exam, two sheets in the final exam.
- As necessary, access to eBook may be allowed during the exams on lockdown computers in EIC Computer Labs.

### **Calculator Policy:**

Allowable calculators are listed at NCEES site:

<http://ncees.org/exams/calculator-policy/>

Texas Instruments TI-36X Pro is currently the most advanced allowable TI calculator. HP 33s and HP 35s are allowed as well as Casio’s fx-115 MS, fx-115 MS Plus, fx-115 MS SR and fx-115 ES Plus. Check the NCEES site for policy changes.

Students can use only their own calculator. No calculator can be shared by students.

### **Correspondence via E-mail:**

Each student is required to provide a reliable “permanent” e-mail address for correspondence. Various announcements and reminders will be sent via e-mail throughout the semester.

Students are expected to check their e-mail regularly and make sure their inboxes are not full as the bounced mail messages will not be sent again.

### **Online Practice Problem Assignments and Online Quizzes:**

Online practice problem assignments will be posted at the course web site. Students are required to solve these problems to practice the theory introduced in lectures and textbook. Hence, these problems will prepare students for quizzes and midterms.

Online quizzes will also be given regularly. Timeframe allowed to solve the problem, permitted number of trials and hints provided will be more limited relative to the practice problem assignments.

At the end of the semester, the lowest quiz score and the lowest practice problem assignment score will be dropped.

Filling out and submission of online course evaluation forms that will be available at FIU Online towards the end of the semester will count as an extra quiz grade.

### **Reporting Problems Online to McGraw-Hill Connect Site:**

If a student detects an error in any of the problems on Connect, he/she is expected to report the problem directly to Connect. Note that Connect makes it possible to report problems online. You will receive a reference case number and will receive an explanation on the outcome of your reported error.

This is the only means to correct errors, and if the correspondence with Connect is provided to the instructor, and the TA, student's loss of points will be prevented by the instructor and TA.

### **Make-up Exams:**

Make-up exams will be allowed only after the student provides a medical doctor's original report describing the problem and a statement that it was an emergency. The report must include the doctor's address and phone number. The Department will contact and verify the situation before a test day is scheduled.

No make-up will be provided for missed quizzes under any circumstance. If a student misses a quiz, he/she should be prepared to receive a 0 score as a result.

### **Projects:**

All projects must use the *B.S. Thesis* format used for senior design projects. This requires the use of cover page, table of contents, and the sections as detailed in the related template developed for the B.S. Thesis report. Note that the template provided for B.S.

Thesis is prepared for Senior Design Projects. It is the responsibility of student teams to revise the content to suit the project at hand. That is, the correct course number, appropriate project title, student names, and date are entered using the format in the template. Do not change the margins, fonts, and other styling given in the template.

Also, all reports must strictly adhere to the “*Style Guide for Technical Report Writing*” available at the course site. No grammatical mistakes and typos are expected in reports.

### **Late Projects:**

Project due dates will be strictly enforced. Late project submissions will not receive full credit, and the following policy will apply: Submissions after the class hour on due date or the following day will lose 10 points out of 100. Submissions on the second or third day after the due date will lose 10 additional points each day.

### **Ethics:**

All work prepared and submitted in this course in the form of projects, presentations, problem solutions in quizzes and exams are expected to be original and produced by the submitting student.

Any portion that may have been borrowed from a previous work must be clearly identified and referenced to indicate the original author along with the title of the work, and where and when it appeared. The origin of each figure, photograph, table as well as text used from other sources must be clearly identified.

It is extremely important to realize that not doing so may result in an accusation of plagiarism. Projects must contain the following statement and include student’s signature:

#### **Ethics Statement:**

The work submitted in this project is solely prepared by TEAM MEMBER 1, TEAM MEMBER 2, TEAM MEMBER 3, and it is original. Excerpts from others’ work have been clearly identified and listed in the list of references. All of the engineering drawings, computer programs, formulations and related files submitted on the accompanying CD and documented on paper are also original and prepared by the team.

*Signature1*

Team Member 1

*Signature2*

Team Member 2

*Signature3*

Team Member 3

### **Policy on Incomplete Grades:**

A grade of “incomplete” will not be assigned to replace an unwanted grade. In order to be eligible to receive “incomplete,” only a single component of the entire coursework needs to be missing.

### **Academic Misconduct:**

Academic dishonesty is a serious offense and will be treated according to the University policy as outlined below.

Florida International University is a community dedicated to generating and imparting knowledge through excellent teaching and research, rigorous and respectful exchange of ideas, and community service.

All students should respect the right of others to have an equitable opportunity to learn and honestly to demonstrate the quality of their learning. Therefore, all students are expected to adhere to a standard of academic conduct, which demonstrates respect for themselves, their fellow students, and the educational mission of the University.

All students are deemed by the University to understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the Student Handbook.



## SUMMARY OF EML 3500 ONLINE COURSE ACTIVITIES SUMMER 2017

The schedule of activities of the online course is summarized in the following table. Major components include lecture videos, practice problem assignments, quizzes, projects, midterm exams and final exam.

- **Lecture videos** for each chapter will remain online for one week; posted on Monday and removed the following Monday.
- **Practice problem assignments** will also be posted on the same day and time as the lecture videos. Multiple trials and hints will be allowed, and the activity monitored online.
- **Online quizzes** will cover the material posted earlier. This may include the latest chapter posted or the previous chapters posted earlier. Online quizzes must be completed between 9:30 am and 10:30 am on the days announced in the table below. The last quiz will last 2 hours as shown in the table and will be offered between 8:30 and 10:30 am. Number of trials in quizzes will be limited and no hints will be provided.
- **On-campus midterm exam and the final exam** will span 2 hours each between 8:30 am and 10:30 am on the exam days listed below. Note that the midterm and the final exam will be on-campus.
  - Midterm exam will cover Chapters 1 through 5 (included).
  - Final exam will be comprehensive and include Chapters 1 through 9.
- **Projects 1 and 2** are team based. Assignment and due dates are as listed in the course activity table.

**Project 1.** The first project is a survey, and requires technical report and PowerPoint file preparation as well as a team presentation which will be recorded and the movie file will be submitted. The report will use the *B.S. Thesis* (Senior Design Report) format and follow the *Style Guide for Technical Writing* recommendations. The Style Guide, and B.S. Thesis (Senior Design Report) template are available at the Blackboard course site.

**Project 2.** The second project involves structural design and analysis, and the use of static and fatigue failure theories for a realistic mechanical design problem. The design will be submitted in formal *B.S. Thesis* (Senior Design Report) format. Teams that do not turn in this project will directly be assigned F for the course.

**EML 3500 ONLINE COURSE SUMMER 2017**  
**COURSE ACTIVITY TABLE**

**Two on-campus exams shown below will be given on Thursdays 8:30 – 10:30 am.**

**Online quizzes 1-5 shown below must be taken on Thursdays 9:30 – 10:30 am.**

**Online quiz 6 shown below must be taken on Thursday 8:30 – 10:30 am.**

**Mondays are shown below to indicate the beginning of weeks.**

Week	Date	Activity	Begin	End
1	Monday, May 8	Chapter 1: Intro to Design Chapter 2: Materials	5/8 (Section 1 video)	5/15
	Monday, May 8	Project 1 Assigned	5/8	
	Thursday, May 11	Reading Assignment: Chapter 1 Problem Assignment 1	5/11	5/20
2	Monday, May 15	Chapter 3: Stress Analysis: Axial Loads, Torsion Project 1 Part 1 (Individual) Due	5/15 5/8	5/22 5/15 – 5:00 pm
	Thursday, May 17	<b>Online Quiz 1</b>	5/17 – 9:30 am	5/17 – 10:30 am
3	Monday, May 22	Chapter 3 (continued): Stress Analysis: Bending Moment, Shear Force, and Principal Stresses	5/22	5/29
	Thursday, May 25	Project 1 Part 2 (Team) Due	5/8	5/25 – 5:00 pm
	Thursday, May 25	Project 2 Assigned Reading Assignment: Chapter 3 Problem Assignment 2	5/25 5/25 5/25	6/5 6/5
4	Monday, May 29 Memorial Day	Memorial Day Chapter 4: Deflection Analysis	5/29	6/5
	Thursday, June 1	<b>Online Quiz 2</b> Project 1 Part 3 (Individual) Teamwork Evaluation by Peers Form Due	6/1 – 9:30 am 5/8	6/1 – 10:30 am 6/1 – 5:00 pm
5	Monday, June 5	Chapter 5: Static Failure Theories – Brittle Materials	6/5	6/12
	Thursday, June 8	<b>Online Quiz 3</b>	6/8 – 9:30 am	6/8 – 10:30 am
	Thursday, June 8	Reading Assignment: Chapter 5 Problem Assignment 3	6/8 6/8	6/15 6/15
6	Monday, June 12	Chapter 5: Static Failure Theories – Ductile Materials	6/15	6/22
	Thursday, June 15	<b>Online Quiz 4</b>	6/15 – 9:30 am	6/15 – 10:30 am
7	Monday, June 19	Chapter 6: Fatigue Failure Theories	6/19	7/3
	Thursday, June 22	<b>On-Campus Midterm Exam</b> (Chapters 1, 2, 3, 4 and 5) Room: EC 2840 (Computer Lab with 31 cap) Not online exam; eBook may be used on lockdown computers	6/22 – 8:30 am	6/22 – 10:30 am

<b>8</b>	Monday, June 26	Chapter 7: Design of Shafts	6/26	7/3
	Monday, June 26	Reading Assignment: Chapter 6 Problem Assignment 4	6/26	7/3
<b>9</b>	Monday, July 3	Chapter 8: Nonpermanent Joints: Screws and Fasteners	7/3	7/10
	Thursday, July 6	Reading assignment: Chapter 7 Problem Assignment 5	7/6 7/6	7/13 7/13
<b>10</b>	Monday, July 10	Chapter 8: Nonpermanent Joints: Screws and Fasteners	7/10	7/17
	Thursday, July 13	<b>Online Quiz 5</b>	7/13 – 9:30 am	7/13 – 10:30 am
<b>11</b>	Monday, July 17	Chapter 9: Permanent Joints: Welding	7/17	7/27
	Monday, July 17	Project 2 Due Review of Chapters 1 through 9 begins	5/25 7/17	7/20 – 5:00 pm 7/27
	July 17 – 24	Submit Online Course Evaluations on Blackboard (and earn a full extra assignment grade)	7/17	7/24
	Thursday, July 20	<b>Online Quiz 6</b> (Online Practice Comprehensive Final Exam; Chapters 1 through 9)	7/20 – 8:30 am	7/20 – 10:30 am
<b>12</b>	Monday, July 24	Review Chapters 1 through 9	7/17	7/27
	Thursday, July 27	<b>On-Campus Comprehensive Final Exam</b> (Chapters 1 through 9) Room: EC 2840 (Computer Lab with 31 cap) Not online exam; eBook may be used on lockdown computers	7/27 – 8:30 am	7/27 – 10:30 am

**Notes:**

**Reading Assignments** are prepared on McGraw-Hill Connect's LearnSmart platform. These assignments are accessible through Blackboard, which is integrated into Connect.

**Problem Assignments** are McGraw-Hill Connect based and are accessible through Blackboard.

**Online Quizzes** are also prepared on McGraw-Hill Connect which are accessible through Blackboard. Quizzes may be directly accessed by signing on to Connect since they are available for a limited period as listed above.