

ME-475: Machine Design I Spring 2014

LECTURE: Hours: MWF, 12:00 P.M. – 12:50 P.M.
Room: EGRA 208
D2L and other software tools will also be used.

TEXTBOOK: Budynas, R. G. and Nisbett, K. J. 2011, *Shigley's Mechanical Engineering Design*, 9th edition, McGraw-Hill, NY. ISBN: 978-0-07-352928-8

REFERENCES: Norton, R. L. 2010, *Machine Design: An Integrated Approach*, 4th edition Prentice Hall. ISBN: 0-13-612370-8
Spotts, M. F., Shoup, T. E., and Hornberger, L. E. 2004, *Design of Machine Elements*, 4th edition Prentice Hall. ISBN: 0-13-048989-1

PREREQUISITES: Engineering 351 and Civil Engineering 350A or consent of instructor.

INSTRUCTOR: Anish Poudel
Email: anish@siu.edu
Office: EGRB 118
Phone: 618-453-7007
Lab: 618-453-7049
Hours: 10:00 A.M. – 11:00 A.M. (MWF) (or by appointment)

TEACHING ASSISTANT: Shashi Shrestha
Email: shashi@siu.edu
Office: Engr. A 221, Cubical # 11
Hours: 02:00 P.M. – 04:00 P.M. (TWR) (or by appointment)

COURSE DESCRIPTION:

This course introduces students to the process for selection, design and failure analysis of various common machine elements. This course will give students the foundation to design mechanical systems and the tools to design, select, or analyze machine components for practical applications necessary for their senior design projects and other mechanical engineering electives. Subjects include understanding of loads, stresses, deflections, material selection, fatigue failure, reliability, safety factors, and the design of machine elements including shafts, bearings, clutches, and brakes. Both static and cyclic loading are considered as part of the design and analysis process. Extensive use is made of material properties, design tables, figures and graphs to assist in the design and analysis process.

COURSE OBJECTIVE:

The main objective of this course is to provide students with the ability to execute a design with specific design tools representing empirical, semi-empirical and analytical approaches, and apply topics learned in Statics, Dynamics, and Mechanics of Materials to actual machine elements. Material learned will provide the basic knowledge necessary for professional practice in the design of machines.

COURSE GOALS:

1. Students will gain an understanding the fundamentals of machine design such as stress, deflection, static strength, and fatigue strength associated with engineering materials and application.
2. Students will be introduced to the design and selection of mechanical elements such as shafts, bearings, clutches, and brakes.
3. Student will gain the ability to analyze and design real world mechanical systems using the methodologies presented in class. Students will gain factual knowledge and learn fundamental principles and theories associated with the design of machine elements.
4. Student may enhance their use of computer packages such as MATLAB in analyzing mechanical systems.
5. Students will exercise their written and oral communication skills in the analysis and presentation of a mechanical design project.

COURSE OPERATION:

This course covers a lot of materials, some of which you may already know about and other things you will learn about for the first time. If you miss one class you may miss one important topic completely. You will be responsible on your own to make-up for the missed classes.

1. In Class Work and Quizzes (10%)
 - a. You are expected to be punctual and regular in your attendance. The class will begin promptly at its scheduled start time.
 - b. You are expected to be prepared for each class, having read the planned course topic and section(s) prior to coming to class. Lectures may contain supplemental materials not described in the course schedule, and the assigned course schedule may not be entirely covered in the lecture. Note that all materials described in the Course Schedule, as well as presented in the lectures shall be subject to testing.
 - c. Participation and engagement in class discussions is extremely encouraged.
 - d. The 10% grade assessment shall be based on the class activities and pop quizzes.
Missed class activities and pop-quizzes may not be made up.
2. Homework (15%)
 - a. Homeworks shall be due at the beginning of the class period that is due. **Late homework shall not be accepted, unless an extension has been granted by the instructor prior to the due date.**
 - b. Homeworks will be assigned on a weekly basis.
 - c. All problem work submittals (excluding computer printouts) shall be on one sided engineering pad paper with all computations made in pencil (not ink). Refer to the given sample homework handout.
 - d. The presentation of the work, as well as the content will be evaluated. Grades shall be reduced if format or submittal quality is not sufficient.
3. Examinations (20% each)
 - a. Two 50-minutes examination covering the material described in the Course Schedule will be administered at the beginning of the scheduled class period. **No make-up exams will be given for any reasons whatsoever. No exams will be given in advance, for any reason whatsoever. Missing examination will result in a zero grade.** Consideration to be excused from an examination must be discussed and approved by the instructor prior to the day of the examination, and exams missed due

- to a serious illness or a family emergency (these must be documented) will be dealt with on a case by case basis. **Valid documentation must be provided in these cases.**
- b. The examinations shall be open book, open note. **Electronic medias such as tablets, laptops, notebooks are not allowed during the exam period.**
4. Term Project (10%)
 - a. The course includes a comprehensive project that incorporates several of the topics covered in the course in the design of a mechanical system. The goal of the project is for students to learn how various machine components and procedures are used in the Machine Design process as well as giving them further experience in teamwork and presentation skills.
 - b. A formal report, as well as a short presentation will be the basis of evaluation. Project requirements and report guidelines shall be presented in class.
 5. Final Examination, comprehensive (25%)
 - a. A 2-hour examination covering the cumulative course material described in the Course Schedule will be administered at the beginning of the scheduled class period. **No make-up exams will be given for any reasons whatsoever. No exams will be given in advance, for any reason whatsoever. Missing examination will result in a zero grade.** Consideration to be excused from an examination must be discussed and approved by the instructor prior to the day of the examination, and exams missed due to a serious illness or a family emergency (these must be documented) will be dealt with on a case by case basis. **Valid documentation must be provided in these cases.**
 - b. The examination shall be open book, open note. **Electronic medias such as tablets, laptops, notebooks are not allowed during the exam period.**

GRADE DISTRIBUTION:

2 Tests – 20% each	40%
Final Exam, comprehensive	25%
Homework Assignments	15%
Term Project	10%
In Class Work and Quizzes	10%
TOTAL	100%

GRADING SCALE: 90% - 100% = A, 80% - 89% = B, 70% - 79% = C, 60% - 69% = D,
Below 60% = F

INCOMPLETE: No incomplete will be given for any reasons! If you have any problems, let me know as soon as possible.

Honor Code: Southern Illinois University Carbondale expects each and every student to maintain the highest principles of academic honesty and integrity. Violations of academic honesty represent a breach of the University's expectations and will be regarded as a serious matter. Violations include, but are not limited to, plagiarism, cheating, lying, and stealing.

All work on tests and assignments must be your own. For group assignments, the policy is as follows: within your own group, collaborative discussions and preparation of assignment solutions are expected. However, discussions across groups are discouraged. That is, you are expected to come up with group-prepared solutions for your assignments as long as you keep the work within your own group. If it becomes obvious that the above policies are violated, then it will be considered plagiarism, which is not tolerated. If I deem that such an event has occurred, all students involved will at minimum receive zero credit for the assignment and may receive a zero credit (failing grade) for the class. I advise you to protect your work.

Emergency Procedures. Southern Illinois University Carbondale is committed to providing a safe and healthy environment for study and work. Because some health and safety circumstances are beyond our control, we ask that you become familiar with the SIUC Emergency Response Plan and Building Emergency Response Team (BERT) program. Emergency response information is available on posters in buildings on campus, available on BERT's website at www.bert.siu.edu, Department of Safety's website www.dps.siu.edu (disaster drop down) and in Emergency Response Guideline pamphlet. Know how to respond to each type of emergency.

*Instructors will provide guidance and direction to students in the classroom in the event of an emergency affecting your location. **It is important that you follow these instructions and stay with your instructor during an evacuation or sheltering emergency.** The Building Emergency Response Team will provide assistance to your instructor in evacuating the building or sheltering within the facility.*

"We emphasize student achievement and success because achievement and success are essential if we are to shape future leaders and transform lives." 1

IMPORTANT DATES

Semester Class Begins.....01/13/2014
Last day to add a class (without instructor permission):01/24/2014
Last day to withdraw completely and receive a 100% refund:01/26/2014
Last day to drop a course using SalukiNet:.....03/23/2014
Last day to file diploma application (for name to appear in Fall Commencement program):03/28/2014
Final examinations:.....5/5 – 5/9/2014

Note: For outreach, internet, and short course drop/add dates, visit Registrar's Academic webpage <http://registrar.siu.edu/>

SPRING SEMESTER HOLIDAYS

Martin Luther King, Jr.'s Birthday 01/20/2014
Spring Vacation 03/08—03/16/2014

For more information, visit
http://pvcaa.siu.edu/_common/documents/syllabus-attachment-spring14.pdf

TENTATIVE COURSE SCHEDULE:

	Class Date:	Topics:	Section:	HW Assigned:	HW Due Date:
1	M, Jan 13	Intro to Mech. Engineering Design	1.1 - 1.16		
2	W, Jan 15	Materials: Strength, Cold Work, Heat Treat, Composites	2.1 - 2.6		
3	F, Jan 17	Materials: Strength, Cold Work, Heat Treat, Composites	2.14 - 2.21	HW 1	F, Jan 24
	M, Jan 20	Martin Luther King, Jr.'s Birthday			
4	W, Jan 22	Load & Stress Analysis: Shear & Moment Diagrams	3.1 - 3.2		
5	F, Jan 24	Load & Stress Analysis: Type of stresses, Principal Stresses	3.4 - 3.5	HW 2	F, Jan 31
6	M, Jan 27	Load & Stress Analysis: Mohr's circle for Plane Stress	3.6		
7	W, Jan 29	Load & Stress Analysis: General 3D Stress, Elastic Strain, Uniformly Distributed Stress	3.7 - 3.9		
8	F, Jan 31	Load & Stress Analysis: Stresses for Beams in Bending, Tortion	3.10 - 3.12	HW 3	F, Feb 07
9	M, Feb 03	Load & Stress Analysis: Stress Concentration	3.13		
10	W, Feb 05	Load & Stress Analysis: Press & Shrink Fits, Thermal Stress	3.14 - 3.16		
11	F, Feb 07	Beam Deflection: Superposition	4.1 - 4.5	HW 4	F, Feb 14
12	M, Feb 10	Beam Deflection: Superposition	4.1 - 4.5		
13	W, Feb 12	Deflection: Castigliano's Theorem	4.8		
14	F, Feb 14	Deflection of Curved Members	4.9	HW 5	F, Feb 21
15	M, Feb 17	Failure: Yield Criteria	5.1 - 5.7		
16	W, Feb 19	Failure: Yield Criteria	5.1 - 5.7		
17	F, Feb 21	Failure: Fracture Criteria	5.8 - 5.10	HW 6	F, Feb 28
18	M, Feb 24	Failure: Fracture Criteria	5.8 - 5.10		
19	W, Feb 26	Failure: Fracture Mechanics	5.11 - 5.12		
20	F, Feb 28	Fatigue: Introduction, Fatigue Life Methods	6.1 - 6.6	HW 7	F, Mar 07
21	M, Mar 03	Fatigue: Endurance Limit, Fatigue Strength	6.7 - 6.8		

22	W, Mar 05	Fatigue: Endurance Limit Modifying Factors	6.9		
23	F, Mar 07	Fatigue: Stress concentration and Notch Sensitivity	6.10	HW 8	F, Mar 21
	M, Mar 10	SPRING BREAK			
	W, Mar 12				
	F, Mar 14				
24	M, Mar 17	Fatigue: Fluctuating Stress and Fatigue Criteria	6.11 - 6.12		
25	W, Mar 19	Fatigue: Combined loading	6.13- 6.14	HW 9	W, Mar 26
26	F, Mar 21	<i>Practice Problems on Chapter 5 and 6</i>		Project Description Handout	
27	M, Mar 24	Exam I Review			
	W, Mar 26	No Class			
28	F, Mar 28	Exam I			
29	M, Mar 31	Shaft Design: Stress Considerations	7.1 - 7.4		
30	W, Apr 02	Shaft Design: Deflection Considerations	7.5 - 7.6		
31	F, Apr 04	Shaft Design: Components and Fits	7.7 - 7.8	HW 10	F, Apr 11
32	M, Apr 07	Journal Bearings: Lubrication and it's types	12.1 - 12.6		
33	W, Apr 09	Journal Bearings: Design Considerations	12.7		
34	F, Apr 11	Journal Bearings: Design Curves	12.8 - 12.9	HW 11	F, Apr 18
35	M, Apr 14	Journal Bearings: Design Curves	12.8 - 12.9		
36	W, Apr 16	Rolling-Contact Bearing: Bearing Types, Life, Reliability	11.1 – 11.5		
37	F, Apr 18	Rolling-Contact Bearing: Combined Radial & Thrust Loading	11.6 – 11.7	HW 12	W, Apr 23
38	M, Apr 21	Rolling-Contact Bearing: Selection of Bearings	11.8 – 11.9		
39	W, Apr 23	Exam II Review			
40	F, Apr 25	Exam II			
41	M, Apr 28	Project Presentation			
42	W, Apr 30	Project Presentation, Final Design Report Due			
43	F, May 02	Final Exam Review			
44	W, May 07	Final Examination 12:50 P.M. – 02:50 P.M.			