ME-475: Machine Design I
FALL 2013

LECTURE: Hours: MWF, 08:00 AM – 08:50 AM
Room: Neckers 218
Desire to Learn 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: Engr. 351 (Numerical Methods) and Engr. 350A (Mechanics of Materials) or consent of instructor.

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

TEACHING ASSISTANTS:

Name:	Shashi Shrestha	Anuroop Naarumanchi
Email:	shashi@siu.edu	anuroop@siu.edu
Office:	TBA	TBA
Hours:	MWF 11:00 A.M – 01:00 P.M	TRF 11:00 A.M – 01:00 P.M

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. You are responsible for lecture notes and class handouts. The instructor will not distribute class materials if you miss a scheduled class, unless previous arrangements have been discussed with the instructor prior to class. Classroom etiquette is extremely important. Respect for your fellow students by remaining orderly and quiet during class is expected and shall be enforced. No cell phones, text messaging, music, ear buds, or other non-class related communication device is allowed to be used during class.

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 (20%)
    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. Homework assignments with applicable due dates can be found in the Course Schedule, although the homework assignments may be modified occasionally to reflect course direction, interest, or content change.
    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 (15% each)
    a. Three 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. Unexcused absences from the examination will result in a zero grade for that particular examination.
    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.
    b. The examinations shall be open book, open note.

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 (15%)
    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. Unexcused absences from the examination will result in a zero grade for the final examination. 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.
    b. The examination shall be open book, open note.

GRADE DISTRIBUTION:

3 Tests – 15% each	45%
Final Exam, comprehensive	15%
Homework Assignments	20%
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 reason. 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.*

COURSE SCHEDULE:

	Class Date:	Topics:	Section:	HW Assigned:	HW Due Date:
1	M, Aug. 19	Intro to Mec. Engineering Design	1.1 - 1.16		
2	W, Aug. 21	Materials: Strength, Cold Work, Heat Treat, Composites	2.1 - 2.6, 2.14 - 2.21		
3	F, Aug. 23	Load & Stress Analysis: Shear & Moment Diagrams	3.1 - 3.2		
4	M, Aug. 26	Load & Stress Analysis: Type of stresses, Principal Stresses, Mohr's circle for Plane Stress, General 3D Stress	3.4 - 3.9		
5	W, Aug. 28	Load & Stress Analysis: Stresses for Beams in Bending, Tortion, Stress Concentration	3.10 - 3.13		
6	F, Aug. 30	Load & Stress Analysis: Press & Shrink Fits, Curved member in Flexure	3.14 - 3.20		
LABOR DAY HOLIDAY					
7	W, Sept. 4	Beam Deflection: Superposition	4.1 - 4.5		
8	F, Sept. 6	Beam Deflection: Superposition	4.1 - 4.5		
9	M, Sept. 9	Deflection: Castigliano's Theorem	4.8		
10	W, Sept. 11	Deflection of Curved Members	4.9		
11	F, Sept. 13	**Term Project & Exam 1 Review**			
12	M, Sept. 16	**EXAMINATION 1: Chap 1, 2, 3, and 4**			
13	W, Sept. 18	Failure: Yield Criteria	5.1 - 5.7		
14	F, Sept. 20	Failure: Yield Criteria	5.1 - 5.7		
15	M, Sept. 23	Failure: Fracture Criteria	5.8 - 5.10		
16	W, Sept. 25	Failure: Fracture Mechanics ***Project Design Team Formation and Identification of Topics for Project Due***	5.11 - 5.12		
17	F, Sept. 27	Fatigue: Introduction, Fatigue Life Methods	6.1 - 6.6		
18	M, Sept. 30	Fatigue: Endurance Limit, Fatigue Strength	6.7 - 6.8		
19	W, Oct. 2	Fatigue: Endurance Limit Modifying Factors	6.9		
20	F, Oct. 4	Fatigue: Stress concentration and Notch Sensitivity ***Design Project Proposal Due***	6.10		
21	M, Oct. 7	Fatigue: Fluctuating Stress and Fatigue Criteria	6.11 - 6.12		
22	W, Oct. 9	Fatigue: Combined loading	6.13- 6.14		
23	F, Oct. 11	*Practice Problems on Chapter 5 and 6*			
FALL BREAK					

24	W, Oct. 16	Shaft Design: Stress Considerations	7.1 - 7.4		
25	F, Oct. 18	Shaft Design: Stress Considerations	7.1 - 7.4		
26	M, Oct. 21	Shaft Design: Deflection Considerations	7.5 - 7.6		
27	W, Oct. 23	Shaft Design: Components and Fits	7.7 - 7.8		
28	F, Oct. 25	Rolling-Contact Bearing: Bearing Types, Life, Reliability	11.1 – 11.5		
29	M, Oct. 28	Rolling-Contact Bearing: Combined Radial & Thrust Loading	11.6 – 11.7		
30	W, Oct. 30	Rolling-Contact Bearing: Selection of Bearings	11.8 – 11.9		
31	F, Nov. 1	*Practice Problems on Chapter 7 and 11*			
32	M, Nov. 4	**Exam 2 Review**			
33	W, Nov. 6	**EXAMINATION 2: Chap 5, 6, and 7**			
34	F, Nov. 8	Journal Bearings: Lubrication and it's types	12.1 - 12.6		
VETERANS DAY HOLIDAY					
35	W, Nov. 13	Journal Bearings: Design Considerations	12.7		
36	F, Nov. 15	Journal Bearings: Design Curves	12.8 - 12.9		
37	M, Nov. 18	Journal Bearings: Design Curves	12.8 - 12.9		
38	W, Nov. 20	**Final Exam Review**			
39	F, Nov. 22	**Exam 3 Review**			
40	M, Nov. 25	**EXAMINATION 3: Chap 11 and 12**			
THANKSGIVING BREAK					
41	M, Dec. 2	**PROJECT PRESENTATIONS, Final Design Report Due**			
42	W, Dec. 4	**PROJECT PRESENTATIONS**			
43	F, Dec. 6	**PROJECT PRESENTATIONS**			
44	**M, Dec. 9**	**Final Examination 07:50 A.M. – 09:50 A.M.**			