

**Western Michigan University**  
**College of Engineering and Applied Sciences**  
**Engineering Design, Manufacturing, and Management Systems (EDMMS)**

EDMM 3440: Product and Machine Design

- Catalog Description:

Analysis of parts and components under combined loads. Failure criteria, design factors and fatigue considerations. Selection and analysis of mechanical components to meet design requirements for applied motion and force transmission projects. CAD will be utilized to report concepts and products. Lecture/Lab (2 & 3 hours). Credits: 3 hrs.

- Prerequisites by Course:

EDMM 1430: Product Design Fundamentals (EDT)

EDMM 2810: Statics and Strength of Materials

- Textbook:

Machine Elements in Mechanical Design, by Robert L. Mott, 5<sup>th</sup> edition, Pearson & Prentice-Hall, Inc., 2014.

- References:

Machinery's Handbook, 27th edition, Industrial Press, Inc., New York, 2004.

Applied Statics and Strength of Materials, L. Spiegel and G. F. Limbrunner, 5<sup>th</sup> edition, Prentice-Hall, Inc., 2009.

Design of Machine Elements, M. F. Spotts, T.E. Shoup, and L. E. Hornberger, 8<sup>th</sup> edition, Prentice Hall, Inc. 2004.

- Course Coordinator:

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- Objectives:

A design course bringing into play the application of statics, strength of materials and applied CAD for components and systems design. Theoretical basis for analysis, evaluation, improvement and communication of engineering developments will be covered. Application of covered concepts in the context of design projects.

### Performance Criteria:

- Objective 1:
  - a) Establish the topological models that adequately represent existing components
- Objective 2:
  - a) Determine the appropriate loading and support conditions for topological models of real life components
  - b) Formulate standard equilibrium conditions in a parametric fashion
  - c) Apply standard solution techniques for static, linear conditions
- Objective 3:
  - a) Apply brainstorming techniques for creative solutions
  - b) Utilize evaluation techniques for proper identification of valid solution(s)
- Objective 4:
  - a) Follow standard procedure for complete stress and deformation evaluation of existing or proposed mechanical and structural components
  - b) Understand the issues relevant to defining various different parameters for design, and apply modified analysis procedure
- Objective 5:
  - a) Efficiently and effectively communicate followed methodologies and obtained results while performing analyses
  - b) Provide accurate description of solutions and conclusions
  - c) Present the complete sequence followed for solution of solid mechanic's problems

- a) Lectures: The two lecture hours will be used to cover design principles and their application. Homework will be assigned.

### Tentative list of topics:

- Mechanical Design (Chapter 1)
- Engineering Materials (Chapter 2)
- Stress Analysis and Deformation (Chapter 3)
- Combined Stresses (2-D, 3-D) (Chapter 4)
- Fatigue and Failure Criteria (Chapter 5)
- Columns (Chapter 6)
- Components: Belt Drives (Chapter 7)
- Chain Drives (Chapter 7)
- Contact Elements (Gears) (Chapter 8, 9)
- Bearings (Journal, Rolling), Keys and Couplings

- b) Laboratories: The following activities will be taking place during the lab times:

- Reviews and/or examination of lectures material
- Discussion and work on the assigned projects.
  - For the projects consideration of manufacturing processes, assembly techniques, maintenance considerations and installation procedures will be considered.
  - CAD application and usage will be expected.
  - The projects will require full documentation, including cost, strength and function analysis.

- Plant visits/Speakers (tentative)  
Plant visits and tours will be used to acquaint us with past and advanced applied design and manufacturing technology.

□ Grading (tentative):

Partial Exams (~2)	25 pts
Quizzes (~8)	15 pts
Homework	15 pts
Final Exam	15 pts
Projects (~4)	30 pts
Attendance, Participation	x pts

- Computer Usage:

Use of computer hardware and software is required in this course. All lab sessions take place at the CAE Lab. Some of the lectures will take place at the lab as well, for demonstration purposes.

- Laboratory Projects:

There will be analysis and design-redesign projects during the lab sessions. A complete written report is required in all lab assignments.

- Oral and Written Communications:

Written reports are required for all lab exercises and for the projects are required. Each report must include theory and evaluation sections. Graphics must be included to show representative and important results. No handwritten submissions are accepted.

Five minute presentations of assignments will take place during the semester. Use of MS PowerPoint (or similar) is required.

- Calculus Usage:

Basic use and understanding of differentials and integrals is required to follow the theory on Finite Element Analysis.

- Library Usage:

Use of the Library is expected for proper references on all written reports.

- Comments:

- E-mail and eLearning will be used during the semester.
- Lecture quizzes are written ones. Lecture quizzes could be previously announced or not.
- Quizzes/exams during lab time are written and/or hands-on.
- All homework is due at the beginning of the following lecture of the same type (i.e., lecture or lab), unless indicated otherwise.

- Electronic submission of some work will be required.
- You must create proper directories and name your files in a fashion that organizes them, some specific instructions might be given during class/lab.
- All work should be done individually. Presentation is important. Hand-written work or work by hand – when it can be done with standard software - is not acceptable.
- Strict control of the due dates will be kept. Penalty applies to any late submission of work. The penalties are: 20% for submission during the same session, additional 20% for submission the same day, and additional 20% for each subsequent day. No work will be accepted after the assignment has been graded.
- No work will be accepted after the assignment has been graded
- Make up exams and lab quizzes will be allowed only for verified extreme circumstances.
- Use of personal computer/laptops/device is permitted during lectures/lab only for class-related activities. No use of any other personal electronic devices is allowed during lecture/lab.
- Student must comply with the Academic Honesty Policy in WMU's Student Code.

Grades: Based on average and standard deviation for the group. A very good estimate of your grade at any time during the semester is that the average score corresponds to a CB. Information on average and standard deviation will be provided in class, usually after quizzes/exams.

Note: These are basic guidelines. If you have any questions or doubts about something, please ask about it. I will be more than willing to explain or clarify your doubts. Do not assume or expect anything.