

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

EDMM 4490: Advanced Product and System Design

- Catalog Description:

This course covers advanced concepts in engineering design and CAE for proper integration of components into final products or systems. Techniques and methodologies related to modeling, analysis, prototyping and improvement are presented in lecture, and will be integrated with topics from previous courses. Individual and team projects are undertaken during the course, in parallel with a final comprehensive design project.

Lecture/Lab (2 / 3 hours). Credits: 3 hrs.

- Prerequisites/Corequisite by Course:

Prerequisite - EDMM 3440: Product and Machine Design

- Textbook:

Machine Elements in Mechanical Design, by Robert L. Mott, 5th edition, Pearson & Prentice-Hall, Inc., 2014. (same textbook used for IME3440)

Engineering Analysis with SolidWorks Simulation 2015, Paul M. Kurowski, Schroff Publications, Mission, KS., 2015.

- References:

The Basics of FMEA, by Robin E. McDermott, Raymond J. Mikulak and Michael R. Beauregard, 2nd edition, Productivity Press, New York, NY, 2008.

The Mechanical Design Process, by David G. Ullman, 4th edition, McGraw-Hill, New York, 2009

Industrial Ecology and Sustainable Engineering, by T. E. Graedel and B. R. Allenby, 1st edition, Prentice-Hall, Inc., 2010.

Machinery's Handbook, 29th edition, Industrial Press, Inc., New York, 2012. (same textbook used for EDMM 3480)

- Course Coordinator:

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- Course Overview:

An advanced design course bringing together analysis and synthesis topics, and computer-aided tools for integrated design. Topics in concept generation and evaluation, as well as product/system generation and evaluation are included. Methodologies such as Design for Assembly/Manufacturing, Design for Sustainability, and Failure Mode and Effect Analysis are applied to final designs. Design projects are main component in the lab sessions. CAD use is required.

- Objectives/Performance Criteria:

Based on the above stated course description, at the conclusion of the semester the student should be able to:

- Topics:

The two lecture hours will be used to cover topics related to analysis and synthesis, and the 3-hour lab will be used to cover computer-based topics and work on the assigned projects.

Week	Lecture	Lab
1	Analysis of Components - Beams	Design Process – PLM, Problem Definition, Concept Generation
2	Power Transmission Components – Non-spur Gears	CAE – Concept Representation, Design Documentation
3	Power Transmission Components – Shaft Design	CAE – Engineering Design Changes
4	Synthesis: Beams and Shafts	CAE – Database Management (DBMS-PDM)
5	Friction Systems – Brakes and Clutches	CAE – Database Management (DBMS-PDM)
6	Hydraulic and Thermal Systems	CAE – Web-collaboration Tools and PLM
7	System Analysis – Energy Efficiency	CAE – Collaborative Design and PLM
8	Assembly Analysis –Contact and Welds	Rapid Prototyping
9	Material Selection – Metals and Plastics	Rapid Prototyping
10	Material Selection - Non-traditional Materials	Material Selection
11	DFX – Design for Manufacturing and Assembly	Design for Assembly/ Manufacturing
12	DFX – Design for Safety and Sustainability	Design for Safety/Sustainability
13	FMEA - Factors	FMEA
14	FMEA - Evaluation	FMEA
15	Final Exam	

- Evaluation:

Partial Exams	25 %
Quizzes	10 %
Homework	15 %
Final Exam	15 %
Projects	35 %

- 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, design, and 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 projects. Each report must include background and evaluation sections. Graphics must be included to show representative and important results. No handwritten submissions are accepted.
Presentations of lab assignments will take place during the semester. Use of MS PowerPoint (or similar) is required.
- Calculus Usage:
Basic understanding of differentials and integrals is beneficial, but not required, to follow some of the concepts covered.
- Library Usage:
Use of the Library is expected for proper references on all written reports.
- Academic Honesty
You must be familiarized with WMU's Academic Honesty Policy, which is published in the Undergraduate and Graduate Catalogs. Specific questions regarding this policy can be addressed by the Office of Student Conduct (OSC). This policy will be applied as needed.
- Comments:
 - Lecture quizzes are written ones. Lecture quizzes could be previously announced or not.
 - Lab quizzes/exams are written and/or hands-on.
 - There is at least one exam during the semester, and one final exam.
 - All homework assignments are due at the beginning of the following session of the same type (i.e., lecture or lab), unless otherwise indicated.
 - Textbook lab tutorials, exercises and homework will be given during lab sessions. The tutorials are due at the end of the lab session. Some exercises are due at the end of the lab session as well. Homework is due the following session.
 - Complete lab reports are required for all lab projects. There are individual and team projects.
 - Written evaluation of software used will be required. Software evaluation is your opinion (provide likes and dislikes) on the software.
 - A mid-semester course evaluation will be given, where you will be asked to provide feedback on what you would like to see changed and kept, and any recommendations or suggestions you might have to improve the course and the learning.

- Electronic submission (eLearning) of all lab work, and some lecture work, will be required.
- You must create proper directories and name your files in a sequential fashion according to the instruction that will be given during class/lab. The set of folder that need to be created in your account is as follows (suggested): ime4490> topic1 thru topic15; projects; quizzes; and reports.
- E-mail and eLearning will be used during the semester.

- All lecture work should be done individually, unless indicated otherwise.
- Presentation is important. Hand-written reports are not acceptable.
- Strict control of the due dates will be kept. Penalty applies to any late submission of work. The penalties are: 25% for submission during the same session, 50% for submission the same day, 75% next day, 100% after that.
- Some of the grading will take place during the lab sessions. No work will be accepted after the assignment has been graded.
- Make up exams and 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.

Grades: Based on average and standard deviation for the group. A good estimate of grade is that average score is a high CB, and each standard deviation is one letter grade, up and down. A minimum score of 50 is required to get a passing grade (i.e., D and above).

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 that is not indicated in this document.