MEEM 3501
Product Realization I
General Course Information
Summer 2006

Instructor
William J. Endres, Associate Professor
wjendres@mtu.edu
www.me.mtu.edu/~wjendres

Who am I? I grew up in the Northwest suburbs of Chicago (Park Ridge). I attended the University of Illinois at Urbana-Champaign where I received my B.S. (1988), M.S. (1990) and Ph.D. (1992) degrees, all in Mechanical Engineering. I spent 7 years at U. of Michigan before coming to MTU in 2001. Besides my work, I do have other interests, such as broomball, ice hockey, roller hockey, camping, and listening to music. I have three children.

Office: Location: 920 R. L. Smith
Phone: 487-2567
Regular Hours: 11:00 a.m. – 12:30 p.m. each day after class
Other Hours: By appointment, or anytime I am in my office and my door is open. But, not right before class from 9:00 – 9:35 a.m.; thanks.

Home: Phone: (906) 370-1442
Hours: 8 a.m. – 5 p.m. (7 p.m. – 10 p.m. if urgent)

Course Format

Lecture:
Time: MTWR, 9:35 – 10:50 a.m.

Homework:
6 assignments, about 1 every couple of days.

Quizzes:
Generally every few days (5 total).
(each answer which has something to do with the question’s topic will get credit)

Projects:
Quantity: Five (5)
Reports: Typed text with neat, hand- or computer-drawn sketches – as brief as possible.

Grading

HW Assignments (6) Total: 15%
Projects (5) Total: 65% (Distributed by number of weeks ea.)
Quizzes (best 4 of 5) Total: 0% (For borderline cases)
Written Final Exam: 20%

Course Goals, Focus and Approach

The goal of this course is: given help in structuring the problem and identifying sources of information, each student should be able to design and manufacture a simple system to meet a set of well-defined physical specifications. Sources of information include textbooks and catalogs. “Design” includes the following: configuring a simple system and defining component needs; selecting standard components from a catalog and designing (shape and size of) special components; interpreting and employment the required sizing/strength analyses presented in textbooks or specific to a particular catalog; and preparing instructions (drawings and text) for manufacture. “Manufacture” includes building components using hand tools, power tools and full-size machine tools in the student machine shop, and assembling and testing the product.

In this course, we will focus on three specific areas: (1) How things work, including conceptual understanding, application of basic physics, and hands-on investigation; (2) Simultaneous design for function and manufacture; and (3) Simple systems with primary attention placed on their components. The course goal will be achieved by building on students’
General Course Information

background knowledge while centering most of the learning experience on small projects of increasing complexity. Students addressing their questions to the instructors in the presence of all students, so that all can benefit, will drive much of the learning experience. I wish to emphasize that learning from each other is as important as learning from the instructors.

Project Teams

Teams and Responsibilities: Teams of three or four will be formed “on the spot” in the first class meeting for Project 1. By the time Project 2 is assigned, the instructional staff will assist as needed in rearranging teams, which will work together for the remainder of the projects. All members of a team are expected to share equally in the work. It is realistic, and necessary at times, to delegate primary responsibility for certain tasks to individual team members. In such situations, each team member who is solely responsible for a task should brief (i.e., teach) all other team members about the task; it is the responsibility of each team member to understand all aspects of a project.

Conflicts: It is expected that each team during the semester will experience some conflict. This is natural in a team setting and may prove to be one of the most educational aspects of the course. It is important that you work to deal with these conflicts in a positive and constructive manner. Teams having problems working together should make every effort to resolve the conflicts on their own. If that does not work, please see the course instructor.

Students who consistently fail to pull their weight can as a last resort be fired with permission of the instructor and a unanimous vote of the remaining team members. Firing a team member is a very serious action and should not be taken lightly. Please consult the course instructor for the procedure. On the other hand, students consistently carrying the bulk of the load for the entire team may as a last resort quit the team with permission of the instructor. Students who are either fired or quit must find another team unanimously willing to take them onto the team — no individual projects will be accepted.

Assignment Preparation, Submission and Re-grade Policy

Preparation: Assignments (homework, laboratory and projects) will be assigned either to each individual student or, in some cases such as laboratory reports, to a pre-defined team. All assignments are to be completed by the individual or team per the assignment. The term ‘You’ in the following refers to either an individual student or a team of students for team assignments.

You are allowed and encouraged to consult with other students in the current class during the solution of assignments; but all final written and computer work is to be generated by you working alone. You are not allowed to transcribe the work, either in scrap or final form, of another student; you are expected to work out the details of the assignments on your own when producing the final document to be submitted for grade. You are also not allowed to possess, look at, use, or in anyway derive advantage from the existence of solutions prepared in prior years, whether these solutions were former students’ work product or copies of solutions that had been made available by an instructor.

Violation of this policy is grounds for the instructor to initiate a disciplinary action. If you have any questions about this policy, please do not hesitate to contact me.

Submission: All assignments are due in class on the due date, unless otherwise stated. It is preferred that the assignment be submitted at the start of class. Assignments turned in after I leave lecture but before 8:00 a.m. the following morning will be accepted with a 25% penalty. Assignments submitted later than that but before the end of the next day will be graded if you want, but will not receive credit.

Re-grade: Any request for re-grade (homework assignments, quizzes, laboratory/project reports, exams, etc.) must be made/submitted within one (1) week of when the graded work is returned with the original grade, no exceptions.
General Course Information

The aforementioned policy may appear harsh; however, it is implemented for your benefit. First, by not permitting use of previous project write-ups or physical apparatus, past project assignments can be used. Previously used projects will run more smoothly, which results in less frustration for you, and much less nonproductive, non-educational effort on your part. Second, by not consulting homework solutions from past semesters assures that you do the problems yourself. That is the only way to learn how to solve the problems and, as a result, be able to perform to your potential on the exam. Collaboration on homework assignments is also good in that you should learn not only from the instructors, but also from each other. However, by doing all written work without assistance, there is a much better chance that you will truly know how to solve the problem, not just become proficient at copying another student’s solution.

Course Objectives
1. To teach students how to formulate the design and manufacturing problem for simple systems and mechanical components.
2. To teach students how to apply the general mechanical engineering sciences in analyses specific to the design of arbitrary mechanical components.
3. To teach students in a laboratory setting how to generate concepts, conduct analyses to size components, construct and assemble a prototype, and test its function.
4. To reinforce students’ team skills through team projects, including problem formulation, problem solution and written and oral reporting of results.
5. To reinforce students’ visualization and hands-on skills through project construction exercises.

Course Outcomes
1. Given functional and manufacturing requirements, brainstorm within a team setting to achieve a consensus for a product concept.
2. Weigh tradeoffs in concept and detail design from the perspectives of function, manufacture, design effort and available resources.
3. Apply basics of conservation and constitutive laws from the mechanical engineering sciences to understand the basic nature of a posed problem.
4. Compile reference (catalog, handbook and textbook) resources to formulate an analysis for an arbitrary mechanical component addressed within those resources.
5. Conduct failure analyses, including stiffness and static and fatigue strength, appropriate for sizing common components, such as belt drives, rolling element bearings, gears, and shafts.
6. Make decisions regarding buy or build for individual components of a design.
7. Use basic machines and hand tools to manufacture a simple part from wood and/or metal to reasonable tolerances sufficient for the part’s function.
8. Formulate, in a team setting or independently, a test plan that encompasses all failure modes that may be present per the analyses conducted during the design stage.
9. Translate, in a team setting or independently, test results to redesigns that will eliminate catastrophic failures and/or improve on marginal performance.