Mechanical Engineering and Mechanics

MEM431, MACHINE DESIGN

Fall 2006/2007

Course (catalog) description

Covers fundamentals of machine design such as general design rules, load analysis, materials selection, stress analysis, failure theories and safety factors. Introduces design guidelines, mathematical models and equations for: fasteners and power screws, springs, bearings, gears, shafts, clutches and brakes, and chain drives. Students will have an opportunity to do a comprehensive design project using learned knowledge.

Prerequisite(s)

MEM202 Statics, MEM 230 Mechanics of Materials, MEM238 Dynamics

Textbook(s) and/or other required material

Required: "Fundamentals of Machine Element Design," R. C. Juvinall & K. M. Marshek, Fourth Edition, Wiley, 2005

Reference Texts: "Machine Elements in Mechanical Design," R. L. Mott, Fourth Edition, Pearson Prentice Hall 2004.

Course Objectives

- 1. Apply the knowledge learned from mechanics and materials to deal with machine design problems.
- 2. Use stress analysis theory to design machine components and find their dimensions.
- 3. Determine mechanical spring parameters and further to design mechanical springs.
- 4. Use terminologies, gear teeth stress analysis and design procedures for gears to design a simple spur gear and conduct gear train ratio calculation.
- 5. Apply the concepts, design principles and equations for bearings, fasteners, clutches & brakes, to solve various design problems.
- 6. Conduct a real world problem to design a gear box for various applications.

Topics Covered

- 1. Mechanical Engineering Design considerations, Materials and Stress Analysis
- 2. Failure theories, Safety Factors and others
- 3. fasteners and Power Screws
- 4. Springs
- 5. Spur Gears, Gear Trains and other Gears
- 6. Clutches and Brakes
- 7. Journal Bearings and Lubrication
- 8. Rolling Element Bearings
- 9. Shafts and Associated Parts
- 10. Case Study

Class/laboratory schedule, i.e., number of sessions each week and duration of each session

One and a half hours lectures, twice a week, 3 credits.

Contribution to Professional Component

The course builds upon the knowledge learned in MEM202 Statics, MEM 230 Mechanics of Materials, MEM238 Dynamics towards professional development. The principles taught in MEM 431 can be used by students in their capstone senior design projects and their future engineering career.

Relationship to Program Outcomes:

$0 = No \ content; \ 1 = Some \ content; \ 2 = Significant \ content$

Outcomes a - k	Cont.	Explanation	Evidence
a. An ability to apply knowledge of mathematics, science and engineering	2	The course needs students to have good knowledge of math, mechanics and physics to conduct various machine component design	Home work, team project and Exams
b . An ability to design and conduct experiments as well as to analyzed and interpret data	1	This is a design course, students need to do stress analysis and dimension calculation.	Two project reports; Classroom examples and homework problems on each machine component selection and design.
c. An ability to design a system, component or process to meet desired needs	2	That is the key of this course, students need to design machine components and systems to meet course requirement.	Home work, project report and Exams
d. An ability to function on multidisciplinary teams	0	N/A	N/A
e. An ability to identify, formulate and solve engineering problems	2	Students need to identify and use equations to conduct their design and solve real engineering problem	Home work, team project and Exams
f. An understanding of professional and ethical responsibility	1	. This is emphasized as part of the engineer's overall responsibility	Classroom discussion Lecture and text book
g. An ability to communicate effectively	1	Students need to answer questions in the class, write project reports, discussion in the team projects	Lecture, Team project discussion and report
h. The broad education necessary to understand the impact of engineering solutions in a global or societal context	1	The impact of engineering design on the environment (pollution, greenhouse effect, etc.) and society are covered.	Classroom discussion of environmental issues Text book
i. A recognition of the need for and an ability to engage in lifelong learning	0	.N/A	N/A
j. A knowledge of contemporary issues	0	N/A	N/A
k. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice	2	Students can use computer aided design and analysis software to solve design and engineering analysis problems.	Home work, team project

Prepared by: Jack Zhou 11/15/2006