MACHINE DESIGN I
COURSE OUTLINE
Spring 2020

Instructor: Dr. Judah Ari-Gur, Room F-246, Tel. 276-3419, (Fax: 276-3421),
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Office Hours: Mon. 3-3:50, Thurs. 1-1:50

BIBLIOGRAPHY
(Prentice-Hall), 2014.

Prerequisites: EDMM1420; ME2615; ME2500; ME2570; ME2580

OBJECTIVES
In previous studies the student learned to find exact solutions to model problems defined
within the various areas of mechanical engineering. The primary objective of the design course
is to convert the simple-model-minded student into a design-minded engineer, where optimal
solutions to real engineering problems replace the single "correct" answers. The secondary
objective is to interrelate and combine concepts and methods from the different areas of science
and engineering as deemed necessary in the design and analysis of machines.

DESCRIPTION
The class will meet in lectures and in laboratory sessions. Laboratories are for problem
solving, CAE tutorials and individual supervision on projects and assignments. Weekly
homework problems, which cover the lecture topics and prepare for the exams, will be assigned,
solved by the students and collected in the next lecture class. Late submissions are not
allowed! Students must come to the lab prepared with the lecture notes.

In addition to the weekly homework assignments there will be two design projects. The
handout for each project will include a description of the need together with the relevant
constraints. On the due date every team will submit a bound professional-style technical report.
Oral presentations will follow only for the first project, during the scheduled laboratory
sessions. The use of clearly explained graphics is essential for engineering communication.
High quality visual aids are required for effective oral presentation. For the second project, a
printout of an oral presentation will be submitted as an Appendix to the written report.

The course will emphasize the use of the computer as a powerful and productive tool.
The students are expected to be able to write their own programs, and use commercially available
software for analysis and graphics, as needed.

The course includes two major parts. One includes fundamental concepts of design and
its analysis. The other includes typical illustrative applications of common mechanical
components, covering their descriptions, design considerations and analytical procedures. The
lecture topics in both parts relate to design and analysis of present and future projects.
TOPICS (not in order of coverage)
Introduction - the design process.
Deformation analysis. Energy methods.
Failure analysis (yield, crack propagation, fatigue, buckling).
Shafts (combined loading, fatigue).
Clutches and brakes.
Gears (kinematics, power transmission, strength, safe-life).
Gear trains and gear-shaft systems.
Bearings. Hydrodynamic lubrication.

GRADING (and 2020 due dates):
Homework - 10%
Midterm exam 1 - 20% (Mon., 10 Feb.)
Midterm exam 2 - 20% (Mon., 23 Mar.)
First project - 15% (Fri., 21 Feb., 1:30 p.m.; presentations in the labs)
Second project - 15% (Fri., 17 Apr., 1:30 p.m.)
Final exam - 20% (Tue., 21 Apr., 12:30-2:30)

The grade for each project: 80% written report and design quality
20% (oral) presentation quality

Failure to submit any of the above means failure in the course ("E"), regardless of the cumulative average.

A=90%- ; BA=85%- ; B=80%- ; CB=75%- ; C=70%- ; DC=65%- ; D=60%- ; E

Note: Your grades are based on performance and achievement, not effort or time. However,
lack of effort usually results in a low level of accomplishment.

Additional information:
During the 3 tests all devices, such as cell phones, tablets, laptops, etc., must be turned off. The use of one calculator, from the list of calculators allowed in the FE exam, is allowed.
See: https://ncees.org/exams/calculator/
Also, hooded head covers are not allowed.

Familiarize yourself with expectations of academic conduct and academic integrity.
See: https://wmich.edu/conduct/honesty ; https://wmich.edu/conduct/code