# WORCESTER POLYTECHNIC INSTITUTE
## MECHANICAL & MATERIAL ENGINEERING DEPARTMENT

## DESIGN OF MACHINE ELEMENTS

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| COURSE No.: | ME-3320, B'2026 | INSTRUCTOR: | Cosme Furlong |
| TEXT: | *Machine Design. An Integrated Approach*, 6th ed. | | HL-152 |
| | R. L. Norton, Pearson, 2020 | | (508) 831-5126 |
| | | | cfurlong@wpi.edu |
| WEB PAGE: | http://users.wpi.edu/~cfurlong/me3320.html and CANVAS | | |
| LECTURES: | M, Tu, Th @ 9:00 AM, HL-202 | GA: | Pascale Michaud |
| SECTION MTG: | F @ 9:00 -10:50 AM, HL-031 | | HL-145 |
| SUBJECT: | Course Outline | | pmichaud@wpi.edu |
| DATE: | 19 October 2026 | | |

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### DESIGN PROJECT

**THERE IS ONE DESIGN PROJECT**, which benefits from the application of computer program solvers (e.g., Matlab, MathCad, ANSYS). Details provided during lectures.

- Project is developed in teams of 3-4 students
- Project is developed throughout the entire term in parallel with course lectures on related topics
- Each team will be evaluated based on individual member efforts *and* on overall team outcomes and collaboration

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### HOMEWORK

PLACE **ALL** OF THE ASSIGNED **AUTHOR's EXAMPLES** AND **SOLVED PROBLEMS** INTO A THREE-RING NOTEBOOK and save in ELECTRONIC VERSION, when applicable. *Instructor will ask you to submit several of those problems (randomly chosen) for grading*.

- Homework is done individually
- There are 6 sets of randomly chosen homework problems submitted in the entire term
- Randomly chosen homework problems are collected weekly. Normally collected on Mondays, except for the last weeks of the term when homework is collected on Tuesdays
- Collected homework includes all the materials covered till Friday (*inclusive*) the week before homework is due
- First homework is due on Monday, October 26

*Good faith collaboration on the homework assignments is encouraged. In good faith collaboration, students should first make serious attempts to solve the problems on their own, and only then discuss the problems with one another to clarify difficulties they may have had. If the collaboration is done properly then, even though students have worked together, the details of their solutions should still be quite different.*

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### GRADING

THE GRADE FOR THE COURSE WILL BE BASED 60% ON THE HOMEWORK and 40% ON THE DESIGN PROJECT. *Participation in course discussions will strongly be taken into consideration.*

**NOTE**: In all your work, state explicitly every assumption and/or approximation made, explain every procedure, and justify its use. Dimensional analyses are absolutely necessary. All results must be expressed in appropriate units. PLEASE, ALWAYS SHOW ALL WORK, while writing your results only on one side of the sheet(s) of paper; start each problem on a new sheet.

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## LIST OF TOPICS

Subjected to changes based on class requirements

For specifics, consult:

Website of our course: *http://users.wpi.edu/~cfurlong/me3320.html*

and Canvas of our course

Part I: Introduction

Unit 1: Introduction. Course organization.
Unit 2: Review of material properties. Stress-strain diagrams.
Unit 3: Review: force analysis; free-body diagrams.
Unit 4: Force analysis. Location of critical section.
Unit 5: Introduction to symbolic math solver: MathCad software.

Part II: Fundamentals

Unit 6: Normal, shear, torsion, bending and principal stresses. Mohr's circles.
Unit 7: Stresses distribution in cross-sections under load: *combined and multi-axis loads*.
Unit 8: Idealization of structures: Beams.
Unit 9: Analysis of selected structures: Columns. Torsion Bars. Cylinders.

Part III: Failure Theories

Unit 10: Static failure theories: *ductile materials*.
Unit 11: Static failure theories: *brittle materials*.

Unit 12: Fatigue failure theories.
Unit 13: Fatigue strength: residual stresses.
Unit 14: Fatigue design: fully reversed and fluctuating loads.

Part IV: Design of Selected Machine Components

Unit 15: Shaft design.
Unit 16: Bearings and lubrication.
Unit 17: Fastener design.
Unit 18: Spur gears.
Unit 19: Helical, bevel, and worm gears.
Unit 20: Spring design.
Unit 21: Surface fatigue.

Unit 22: Review and Summary

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