WORCESTER POLYTECHNIC INSTITUTE
MECHANICAL & MATERIAL ENGINEERING DEPARTMENT

STRESS ANALYSIS

COURSE No.:	ES–2502, D'2025
TEXT:	*Mechanics of Materials*, 10th ed. R. C. Hibbeler, Pearson, 2016
WEB PAGE:	http://users.wpi.edu/~cfurlong/es2502.html
LECTURES:	M, Tu, Th, F @ 4:00 PM, SL 115 Kinnicutt Hall
CONF. MTGs:	W @ 4:00 PM, SL 115 Kinnicutt Hall
SUBJECT:	Course Outline
DATE:	20 March 2025

INSTRUCTOR: *Cosme Furlong*
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HOMEWORK

PLACE **ALL** OF THE ASSIGNED **AUTHOR's EXAMPLES** AND **SOLVED PROBLEMS** INTO A THREE-RING NOTEBOOK and/or save in ELECTRONIC VERSION. Instructor will ask you to submit several of those problems (randomly chosen) for grading at each exam: *homework problems are part of the exams.*

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.

EXAMS

THERE WILL BE SEVEN (7) EXAMS. Exams are given on Fridays. *Exams include all the materials covered until Wednesday (inclusive) the week of the exam.*

Note:

- Exams are solved individually during the assigned times.
- Laptop computers can be brought into the exams should electronic solutions are submitted.

HELP SESSIONS (attendance is recorded)

There are two sessions per week. We strongly recommend that you attend at least one of the two weekly sessions.

Times and locations to be communicated to the class in advance.

GRADING

THE GRADE FOR THE COURSE WILL BE BASED ON THE EXAMS, with homework problems (randomly chosen) being part of the exams.

- To ensure fairness in your evaluation, the lowest exam score will be dropped.
- *Participation in course discussions, demonstrated engagement in the course materials, demonstrated effort, and other positive contributions made to the course will strongly be taken into consideration for grading.*

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 CLEARLY AND ORGANIZED, while writing your results only on one side of the sheet(s) of paper; start each problem on a new sheet.

LIST OF TOPICS

Unit 1: Introduction
Unit 2: Stress: Find internal forces first
Unit 3: Stress: Definition of normal stress and shear stress
Unit 4: Stress: Designing a connector based on stress criteria

Unit 5: Strain: Definition of normal strain and shear strain

Unit 6: Stress-strain relationship – Hook's law

Unit 7: Tension/compression of slender longitudinal bars: General
Unit 8: Tension/compression of slender longitudinal bars/Advanced: Statically indeterminate
Unit 9: Tension/compression of slender longitudinal bars/Advanced: Thermal stress
Unit 10: Tension/compression of slender longitudinal bars/Advanced: Stress Concentrations
Unit 11: Tension/compression of slender longitudinal bars/Advanced: Nonlinear deformations

Unit 12: Torsion of Shafts: Circular cross section
Unit 13: Torsion of Shafts /Advanced: Statically indeterminate
Unit 14: Torsion of Shafts /Advanced: Non-circular cross-sections

Unit 15: Bending of beams: MV Diagrams
Unit 16: Bending of beams: MV General relationship
Unit 17: Bending of beams: Classical beam theory: Normal stress
Unit 18: Bending of beams/Advanced: Shear stress
Unit 19: Bending of beams: Calculation of section properties
Unit 20: Bending of beams/Advanced: Non-symmetrical bending

Unit 21: Bending of beams: Deflection analysis
Unit 21B: Bending of beams: Deflection analysis by discontinuity functions
Unit 22: Bending of beams: Statically indeterminate beams

Unit 23: Buckling of columns

Unit 24: Stress transformation: Principal stresses and principal directions
Unit 25: Stress transformation by Mohr's circle

Unit 26: Failure theory

Unit 27: Designing structural longitudinal members under combined loading

Unit 28: Summary

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