ME 3250 (13335): Mechanics of Materials

Course Syllabus

Instructor: Dr. Lian X. Yang, Professor
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Office Hours: Monday and Wednesday 2:00PM to 3:00PM in EC 410 or by appointment

Class Time & Location: Jan. 3, 2018 – Apr. 25, 2018
Lecture: Monday and Wednesday, 3:30PM – 5:17PM, EC 254
Lab: Monday or Tuesday from 5:30 to 6:30PM, EC 454
TBD for the details for each group's time slot

Course Objectives:

The primary objective of this course is to teach the fundamental concepts, principles and engineering applications of the deformable body mechanics. The laboratory component is intended to reinforce these basic concepts, teach experimental design and principles, and improve teamwork and communication skills. By the end of the course, in corresponding to the outcomes (a) to (k) recorded at the end of the syllabus, the successful students will be able to:

1. Calculate normal, shear and bearing stress in deformable solid bodies. (a, e)
2. Apply stress and strain transformation equations and Mohr's circle to determine stress and strain on different planes in solid bodies. (a, e)
3. Interpret the generalized Hooke's law and apply to deformable solid body problems. (a, e)
4. Determine the critical load conditions for column structures. (a, e)
5. Calculate the stress states on thin walled pressure vessels. (a, b, e, g, k)
6. Calculate the stress and angular deformation of circular shafts under torsional load. (a, b, e, g, k)
7. Calculate normal and shearing stresses in beams under bending and transverse loads. (a, e)
8. Calculate deflection of beams under various transverse load systems. (a, b, e, g, k)
9. Apply energy methods to the solution of various structures. (a, e)
10. Apply the principle of superposition to deformable solid bodies. (a, e)
11. Perform experiments, analyze experimental data and write and/or present technical reports. (a, b, g, k)

Prerequisite: EGR 2800 **Corequisite:** ME 3200

Text Book: Mechanics of Materials by F.P. Beer, E.R. Johnston, Jr., J. T. Dewolf, and D. Mazurek, 7th Ed., McGraw Hill

Topics

1. Introduction, Force, Normal and Shear Stress
2. Deformation, Normal and Shear Strain
3. Stress-Strain Relation
4. Torsionally Loaded Members
5. Beams under Pure Bending, Beams under Eccentric Loadings, Elastic and Plastic Beams
6. Shear force and Bending Moment Diagrams – Section Method
7. Shear force and Bending Moment Diagrams – Graphical Method

8. Shear force and Bending Moment Diagram, Combined method
9. Stresses in Transversely Loaded Members
10. Torsionally Loaded Members
11. In-class excise, help session,
12. Moments in Transversely Loaded Members
13. Thin-walled Pressure Vessels
14. Stress and Strain Transformations Equations, principle stresses
15. Stress and Strain Transformations – Mohr's Circle
16. Thin-walled Pressure Vessels
17. Deflections in Transversely Loaded Members – Integration Method
18. Deflections in Transversely Loaded Members – Supper Position Method
19. Examples of deflections
20. Deflections in Transversely Loaded Members
21. Energy Methods – Theories
22. Energy Methods – Applications (1)
23. Energy Methods – Applications (2)

Homework:

The homework will include various textbook problems. The homework is due on every Wednesday, a week after the assignment.

Homework format: Use letter size paper, one side of each page, and box the final answers, late homework will not be accepted.

Laboratories:

Groups consisting of 7-8 students are given approximately 1 hour to conduct an experiment and submit a report for each laboratory project. **Attendance will be recorded, any unexcused absence will result in a zero grade for that individual.** There are totally 4 labs listed below

1. Lab #1: Stresses in thin walled pressure vessels
2. Lab #2: Stresses due to torsional and transverse loads
3. Lab #3: Bending moment in beams
4. Lab #4: Beams deflections

Lab Report

Laboratory reports are dues one weeks after the experiment is completed. Only one report is needed for each group. The student should follow the sample report outline shown below. The reports should be typed with 12-size front and be a maximum of six pages (not including the Appendix). Be precise, neat, compact and to-the-point.

I. Cover age (title, group member, date…)
II. Objectives
III. Procedures (use your own word)
IV. Theories and calculations (equation for theoretical and experimental calculations)
V. Results (tables and graphs, with description)
VI. Discussions (answer the question(s) in the lab instruction)
VII. Conclusions
VIII. Appendix

Individual Assessments for Teamwork:

All students will be asked to submit evaluations of how well they and their teammates performed as team members. These evaluations will be incorporated into the assignment of lab grades.

Examinations

The dates for mid and final exams will be discussed with students at the beginning of the class and be fixed in the first week. **Please note: No make-up exam will be offered,** Please arrange your work or travel schedule properly. Exceptions will be made only in extenuating circumstances and prior approval from the instructor will be necessary.

Grades:

The semester grade will be based on:

- Homework, discussions, attendance and participation in classes: 20%
- Laboratories and reports 15%
- Midterm exam 30%
- Final exams 35%

Academic Conduct

Students are expected to read, understand and comply with the Academic Conduct Poliy of Oakland University, as found in the current student catalog. If you cheat, you are not only hurting yourself, but you are also taking unfair advantage of the other students in the class, as such, I take active steps to monitor for cheating

Cell Phones/Labtops/iPads

It is required that all cell phone be put on silent or vibration during the class sessions. If you need to take a phone call, please excuse yourself quietly out of the classroom and take the call in the hallway.

Laptops/iPads are allowed in the class session for taking notes or presenting information to the class. Answering emails, working on assignments or viewing sites unrelated to the course are prohibited

Program Outcomes (ABET):

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environ., social, political, ethical, health, safety, manufactured ability, sustainability
(d) an ability to function on multi-disciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global economical, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice