ME 025: Mechanics of Materials

Term: 2020 Winter Session Instructor: Staff Language of Instruction: English Classroom: TBA Office Hours: TBA
Class Sessions Per Week: 6 Total Weeks: 4 Total Class Sessions: 25 Class Session Length (minutes): 145 Credit Hours: 4

Course Description:

This course is a combination of Statics and Mechanics of Materials I & II. It aims to help students develop an understanding of solid mechanics and the ability to analyze engineering problems in a simple and logical manner. We will introduce the fundamentals of statics using vector analysis and concepts of engineering, based on forces in equilibrium and the concepts of stress and strain. Topics include stress analysis, materials' behavior, constitutive relationship, Hookes law, stress concentration, St. Venant principle, transformation equations, and Mohr's circle; also axially loaded members, torsion, change of length, angle of twist, transmission of power by shafts, and statically indeterminate structures. Other important topics include bending, shear and moment diagrams; flexure formula; differential equation of deflection curve, method of superposition, and Castigliano's theorem.

Prerequisites: MATH 021 Calculus II and PHYS 021 General Physics II.

Course Materials:

Mechanics of Materials, Ferdinand P. Beer; J. E. Russell Johnston; John T. DeWolf, and David F. Mazurek, McGraw-Hill, 10th edition, 2016

Course Format and Requirements:

Class time will be used for a combination of lectures and class discussions. Attendance at lectures is vital to get a thorough understanding of the material. Good attendance will be rewarded since all quiz questions and most exam questions will be drawn from the lectures.

Grading Scale:

A+: 98%-100%
A: 93%-97%
A-: 90%-92%
B+: 88%-89%
B: 83%-87%
B-: 80%-82%
C+: 78%-79%
C: 73%-77%
C-: 70%-72%
D+: 68%-69%
D: 63%-67%
D-: 60%-62%
F: Below 60%

Course Assignments:

Quizzes

Quizzes will usually consist of True-False, multiple choices and short answers. Quizzes will be based on the lectures, and will be given on the beginning of class. There will be 6 quizzes during the semester and the lowest scores will be dropped, but if you miss a quiz without prior arrangement, you will be given a zero.

Exams

There are two mid-term exams (in class) and one final exam (location TBA). All exams are closed-book and without notes but all required formulae will be provided. Students are only allowed to use the formula sheet handed out by the instructor before the exam.

Course Assessment:

Quizzes	15%
Midterm Exams 1	25%
Midterm Exams 2	25%
Final Exam	35%
Total	**100%**

Course Schedule:

Week 1- Class 1	Week 1- Class 2
Overview of the course; Go through syllabus; Introduction	Forces and vectors; Free body diagrams for particles; Static equilibrium of particles;
Week 1- Class 3	Week 1- Class 4
Moments and vectors Statically equivalent forces and force-couples; Free body diagrams for rigid bodies;	***Quiz 1*** Static equilibrium of rigid bodies; Friction Center of mass;
Week 1- Class 5	Week 1- Class 6
Distributed loading; Frames and machines Introduction to normal stress and constitutive behavior;	Shearing stress, 3D stress, and design; Shearing strain, and statically indeterminate problems
Week 2- Class 7	Week 2- Class 8
Quiz 2 Stress transformation; Mohr's Circle	Bolts, connectors, bearings; Pressure vessels Review for midterm 1
Week 2- Class 9	Week 2- Class 10
Midterm Exam 1	Pressure vessels (cont.) Hooke's Law: stress-strain behavior;
Week 2- Class 11	Week 2- Class 12

Temperature changes, Poisson's ratio, and strain energy; Saint-Venant's principle, stress concentration, and plastic deformation	***Quiz 3*** Torsion of shafts; Statically indeterminate shafts, design of transmission shafts, and strain energy for shearing stress
Week 3- Class 13	Week 3- Class 14
Torsion of shafts (Cont.); Statically indeterminate shafts, design of transmission shafts, and strain energy for shearing stress (Cont.)	Deformation and axial loading; General case of axial loading, and beams made of several materials;
Week 3- Class 15	Week 3- Class 16
Quiz 4 Shear and bending moment diagrams; Beam theory and bending stresses;	Torsion of circular shafts Review for Midterm 2
Week 3- Class 17	Week 3- Class 18
Midterm Exam 2	Areal moment of inertia; Deformation and twisting
Week 4- Class 19	Week 4- Class 20
Deformation and twisting (Cont.) Shear stresses in beam bending	***Quiz 5*** Shear stresses in beam bending (Cont.) Superposition and combined loading; Transformations of stress and strain;
Week 4- Class 21	Week 4- Class 22
Stress in thin-walled pressure vessels Principal stresses;	Statically indeterminate systems; Castigliano's theorem
Week 4- Class 23	Week 4- Class 24
Quiz 6 Statically indeterminate systems (Cont.); Castigliano's theorem (Cont.); Design criteria and failure analysis	Fatigue and creep; Buckling theory and instabilities;
Week 4- Class 25	***Final Exam (Cumulative): TBA***
Miscellaneous applications	

Wrap-up; Review for final exam	

Academic Integrity:

Students are encouraged to study together, and to discuss lecture topics with one another, but all other work should be completed independently.

Students are expected to adhere to the standards of academic honesty and integrity that are described in the Shanghai Normal University's *Academic Conduct Code*. Any work suspected of violating the standards of the *Academic Conduct Code* will be reported to the Dean's Office. Penalties for violating the *Academic Conduct Code* may include dismissal from the program. All students have an individual responsibility to know and understand the provisions of the *Academic Conduct Code*.

Special Needs or Assistance:

Please contact the Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material. Our goal is to help you learn, not to penalize you for issues which mask your learning.