

ME302 Mechanical Systems II

Sabanci University 2021-22 (Spring)

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Schedule	<p>► ME302 (Courses will be conducted hybrid: Physical + Zoom) Tuesday at 9:40 am – 11:30 am (Adnan Kefal) – FASS 1008-1010 Friday at 9:40 am – 10:30 am (Adnan Kefal) – FASS G062</p> <p>► ME302R (Recitations will be online: 2 simultaneous sessions) Thursday 10:40 am – 12:30 pm</p> <p>► ME302L (Labs will be physical: 2 simultaneous sessions) Tuesday 5:40 pm – 7:30 pm (FENS G035 & L056)</p>
Credits	3 SU Credit / 6.00 ECTS / 42 Teaching Hours
Prerequisite	ME301 – Mechanical Systems I

Objectives

This course is designed for undergraduate students to (i) develop an understanding of standards, safety, reliability, importance of dimensional parameters and manufacturing aspects in mechanical design, (ii) develop an understanding of different design criteria, and (iii) gain the ability to design different mechanical elements such as shafts, joints, springs, etc.

Learning Outcomes

At the conclusion of this course, students should be able to:

1. Formulate and analyze stresses and strains in machine elements and structures in 3-D subjected to various loads including tension, shearing, torsion, bending, and buckling.
2. Be able to do tolerance analysis and specify appropriate tolerances for machine design applications
3. Understand and apply multi-dimensional static/fatigue failure criteria in the analysis and design of mechanical components.
4. Be able to analyze and design structural joints and power transmission shafts carrying various elements with geometrical features
5. Ability to solve basic engineering problems with the use of a commercially available software

Course Content

Weeks & Lectures	Topic
BASICS OF MACHINE DESIGN	
Week 1 – 01.03.2022 – 04.03.2022 Week 2 – 08.03.2022 – 11.03.2022	Introduction to mechanical design, Materials (Steels, plastics, composite materials), Load and Stress Analysis (review of torsion, bending, axial, shear strains & stress)
Week 3 – 15.03.2022 – 18.03.2022 Week 4 – 22.03.2022 – 25.03.2022	Beam deflection and stiffness, singularity functions, direct integration method

Week 5 – 29.03.2022 – 01.04.2022 Week 6 – 05.04.2022 – 08.04.2022 (Quiz I)	Buckling Analysis, Ideal column with various supports, Elastic stability, Critical buckling loads
FAILURE & FRACTURE ANALYSIS	
Week 7 – 12.04.2022 – 15.04.2022	Failures resulting from static loading: Stress concentration, Failure envelopes, Brittle and Ductile fracture
Week 8 – 19.04.2022 – 22.04.2022 Week 9 – 26.04.2022 – 29.04.2022 (Midterm)	Crack Propagation, Fracture toughness, Fatigue failure resulting from variable loading: S-N diagrams, Paris equation
Spring Break (02.05.2022-08.05.2022)	
DESIGN OF MECHANICAL ELEMENTS	
Week 10 – 10.05.2022 – 13.05.2022 (Project Start)	Tolerance analysis, Design of shafts: static design, design for cyclic loading, stress concentration, etc.
Week 11 – 17.05.2022 – Holiday Week 12 – 24.05.2022 – 27.05.2022	Design of screws, fasteners, and nonpermanent joints, welding/permanent joints
Week 13 – 31.05.2022 – 03.06.2022 (Quiz II) Week 14 – 07.06.2022 – 10.06.2022 (Project End)	Design of mechanical springs, design of gears, and design of rolling contact bearings
Final Exams Week 11.06.2021 – 23.06.2021	FINAL EXAM

Books and References

Main Textbook:

1. Budynas, R., Nisbett, K., 2019. Shigley's Mechanical Engineering Design, McGraw-Hill Education.

Other References:

1. Norton, R.L., 2014. Machine Design an Integrated Approach, Third Edition, Prentice Hall, New Jersey, USA.
2. Juvinall, R.J., Marshek, K.M., 2011. Fundamentals of Machine Component Design, Fifth Edition, John Wiley & Sons.
3. Hibbeler, R.C., 2014. Mechanics of Materials, Ninth Edition, Prentice Hall, New Jersey, USA
4. Beer, Jr., E., Johnston, R., DeWolf, J., Mazurek, D., 2014. Mechanics of Materials, Seventh Edition, McGraw-Hill Education.

Assessment Criteria

Group Project (15%), Midterm Exam (35%), Quizzes I-II (2×5%), Final Exam (40%)

- ▶ Quizzes will be conducted during recitation sessions.
- ▶ There will be a semester-project and groups of four will be formed to work on the projects.

Course Material

The outline of lecture notes, project guidelines, and other course-related material will be posted at the SUCourse site (<https://sucourse.sabanciuniv.edu/>).