

ME302 Mechanical Systems II

Sabanci University 2023-24 (Spring)

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Teaching Asst.	Andisheh Choupani (achoupani@sabanciuniv.edu) M. Yavuz Belur (yavuz.belur@sabanciuniv.edu)
Schedule	▶ ME302 Thursday 10:40 am - 11:30 am FENS L030 Friday 12:40 pm - 2:30 pm FENS L048 ▶ ME302R Wednesday 5:40 pm-7:30 pm FENS L063 ▶ ME302L Thursday 5:40 pm-7:30 pm FENS L061
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.
2. Be able to do tolerance analysis and specify appropriate tolerances for machine design application
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
5. Be able to analyze and design power transmission shafts carrying various elements with geometrical feature.

Course Content

Weeks & Lectures	Topic
	BASICS OF MACHINE DESIGN
Week 1 – 12.02.2024 – 16.02.2024	Introduction to mechanical design, Load and Stress Analysis (review of torsion, bending, axial, shear strains & stress)
Week 2 – 19.02.2024 – 23.02.2024 Week 3 – 26.02.2024 – 01.03.2024	Beam deflection and stiffness, singularity functions, direct integration method
Week 4 – 04.03.2024 – 08.03.2024 Week 5 – 11.03.2024 – 15.03.2024 (Quiz I)	Buckling Analysis, Ideal column with various supports, Elastic stability, Critical buckling loads

FAILURE & FRACTURE ANALYSIS	
Week 6 – 18.03.2024 – 22.03.2024 Week 7 – 25.03.2024 – 29.03.2024	Failures resulting from static loading: Stress concentration, Failure envelopes, Brittle and Ductile fracture
Week 8 – 01.04.2024 – 05.04.2024 (Midterm) Week 9 – 15.04.2024 – 19.04.2024	Crack Propagation, Fracture toughness, Fatigue failure resulting from variable loading: S-N diagrams, Paris equation
DESIGN OF MECHANICAL ELEMENTS	
Week 10 – 22.04.2024 – 26.04.2024 (Project Start)	Tolerance analysis, Design of shafts: static design, design for cyclic loading, stress concentration, etc.
Week 11 – 29.04.2024 – 03.05.2024 Week 12 – 06.05.2024 – 10.05.2024 (Quiz II)	Design of screws, fasteners, and nonpermanent joints, welding/permanent joints
Week 13 – 13.05.2024 – 17.05.2024 Week 14 – 20.05.2024 – 24.05.2024 (Project End)	Design of mechanical springs, design of gears, and design of rolling contact bearings

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 (35%), Quizzes (2×5%), Final (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 SU Course site (<https://sucourse.sabanciuniv.edu/>).