ME302 Mechanical Systems II Sabanci University 2022-23 (Spring)

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Schedule	ME302 (Courses will be conducted online + physical)	
	TUESDAY 11:40 am - 13:30 pm FENS L056	
	THURSDAY 10:40 am - 11:30 am FENS L0302	
	ME302R (Recitations will be online)	
	WEDNESDAY 5:40 pm - 7:30 pm	
	ME302L (Labs will be online)	
	THURSDAY 4:40 pm - 6:30 pm	
Credits Prerequisite	3 SU Credit / 6.00 ECTS / 42 Teaching Hours ME301 – Mechanical Systems I	
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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.

Weeks & Lectures	Торіс
	BASICS OF MACHINE DESIGN
Week 1 – 28.02.2023 – 02.03.2023 Week 2 – 07.03.2023 – 09.03.2023	Introduction to mechanical design, Materials (Steels, plastics, composite materials), Load and Stress Analysis (review of torsion, bending, axial, shear strains & stress)
Week 3 – 14.03.2023 – 16.03.2023 Week 4 – 21.03.2023 – 23.03.2023	Beam deflection and stiffness, singularity functions, direct integration method

Course Content

Week 5 – 28.03.2023 – 30.03.2023	Buckling Analysis, Ideal column with various supports, Elastic
Week 6 – 04.04.2023 – 06.04.2023	stability, Critical buckling loads
(Quiz I)	
	FAILURE & FRACTURE ANALYSIS
Week 7 – 11.04.2023 – 13.04.2023	Failures resulting from static loading: Stress concentration,
	Failure envelopes, Brittle and Ductile fracture
Week 8 – 18.04.2023 – 20.04.2023	Crack Propagation, Fracture toughness, Fatigue failure resulting
Week 9 – 25.04.2023 – 27.04.2023	from variable loading: S-N diagrams, Paris equation
(Midterm)	
	DESIGN OF MECHANICAL ELEMENTS
Week 10 – 02.05.2023 – 04.05.2023	Tolerance analysis, Design of shafts: static design, design for
(Project Start)	cyclic loading, stress concentration, etc.
Week 11 – 09.05.2023 – 11.05.2023	Design of screws, fasteners, and nonpermanent joints,
Week 12 – 16.05.2023 – 18.05.2023	welding/permanent joints
Week 13 – 23.05.2023 – 25.05.2023	Design of mechanical springs, design of gears, and design of
(Quiz II)	rolling contact bearings
Week 14 – 30.05.2023 – 01.06.2023	-
(Project End)	
Final Exams Week	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 (<u>https://sucourse.sabanciuniv.edu/</u>).