CEN 223 Mechanical System Design Fundamentals

Winter 2024

Course Credits: 4
Contact Hours: 56 hours
Instructor: TBA
Email:TBA

COURSE OBJECTIVES

This course is a comprehensive course that serves as a foundational exploration into the principles and methodologies of designing mechanical systems. It is designed to equip students with a solid understanding of the fundamental concepts and practices essential for designing effective and efficient mechanical systems. Through a blend of theoretical concepts and practical applications, students will gain a holistic understanding of the intricacies involved in designing mechanical systems that meet diverse engineering challenges.

Upon Completion of this Course, students will be able to:

1. Explore the core principles of mechanics, thermodynamics, and materials science, laying the groundwork for advanced system design;

2. Understand the systematic approach to designing mechanical systems, from problem definition and concept generation to analysis, optimization, and final implementation;

3. Delve into the selection of materials based on mechanical properties, considering factors like strength, durability, and thermal conductivity;

4. Gain hands-on experience in prototyping and testing mechanical systems, emphasizing the iterative nature of the design process and the importance of feedback loops for continuous improvement.

PREREQUISITES

CEN 202 Introduction to Mechanical Engineering Design

GRADING

Grades will be determined by accumulating points, with 100 points being the maximum, as follows:

ITEM	POINTS
3 Group Projects	30 Points
2 Labs	20 Points
Midterm	20 Points
Final Exam	30 Points
Total	100 Points

Late submissions will be graded at the end of the course. Grades will be assigned according to the following rule:

$A \geq 90 > B \geq 80 > C \geq 70 > D \geq 60 > F$.

We reserve the right to make adjustments to the overall grading policy.

COURSE MATERIALS

Required Texts:

Richard Budynas, ***Shigley's Mechanical Engineering Design***, 11th Edition, McGraw-Hill Higher Education, 2020.

Recommended (Optional) Texts or Other Materials:

None

COURSE TOPICS

MODULE	TASKS
Module 1	**Topics:** Topic 1: Phases and Interactions of the Design Process Topic 2: Design Tools and Resources Topic 3: The Design Engineer's Professional Responsibilities Topic 4: Safety and Product Liability **Assessments:** Group Project#1

Module 2	**Topics:** Topic 5: Material Strength and Stiffness Topic 6: The Statistical Significance of Material Properties Topic 7: Powder-Metallurgy Process Topic 8: Load and Stress Analysis **Assessments:** Lab#1: Linkage Mechanism Design
Module 3	**Topics:** Topic 9: Mohr's Circle for Plane Stress Topic 10: Elastic Strain Topic 11: Deflection and Stiffness Topic 12: Failures Resulting from Static Loading **Assessments:** Midterm Group Project#2
Module 4	**Topics:** Topic 13: Fatigue Failure Resulting from Variable Loading Topic 14: Shafts and Shaft Components Topic 15: Screws, Fasteners, and the Design of Nonpermanent Joints Topic 16: Welding, Bonding, and the Design of Permanent Joints **Assessments:** Group Project#3
Module 5	**Topics:** Topic 17: Mechanical Springs Topic 18: Gears–General: Nomenclature, Conjugate Action and Involute Properties Topic 19: Vibration Analysis Topic 20: GD&T in CAD Models **Assessments:** Final Exam Lab#2: CAD Modeling and Assembly

ATTENDANCE

1) Class attendance is required. Missing classes without permission will lead to decrease in overall grade.

Missing less than two classes: no penalty.

Missing more than two classes: 7% will be taken off from the overall grade.

If the instructor reports a student's frequent missing of class to the Soochow University Academic Administration Office, the student might get a written warning

and might be prohibited from attending final exam.

2) Participants in this course are expected to arrive in class promptly and adequately prepared. The primary objective of this course is to critically engage with the readings and the subject matter. Therefore, course participants are expected to have completed the reading prior to class and prepare thoughtful reflections/commentaries to share with fellow colleagues.

LEARNING REQUIREMENTS

1) Late assignments are not acceptable and are subjected to grade deductions.

2) Assignments submitted in the wrong format will be counted as not submitted.

3) Failure to submit or fulfill any required course component results in failure of the class.

4) Make-up for midterm and final exams only with valid excuses, as defined by the University.

5) In order to earn a Certificate of Completion, participants must thoughtfully complete all assignments by stated deadlines and earn an average quiz score of 50% or greater.

TECHNOLOGY POLICY

The use of electronic devices in class is distracting, both for the user and for the rest of the class. Only non-programmable calculators can be used in the tests and exam. Any attempts to use cell phones and other electronic communication devices will be seemed as cheating. Laptops are discouraged, unless you use them for activities DIRECTLY related to the course (eg., note taking, reading course documents).

ACEDEMIC INTEGRITY POLICY

Soochow University highly values the academic integrity and aims to promote the academic fairness, honesty and responsibility. Any academic dishonesty behaviors and any attempts to cheats and plagiarism will be reported to the university administration office. A written warning and the relevant penalties will be imposed. The record might be shown on the official university transcript.

DISABILITY ACCOMMODATION

Soochow University is committed to maintaining a barrier-free environment so that students with disabilities can fully access programs, courses, services, and activities at Soochow University. Students with disabilities who require accommodations for access to and/or participation in this course are welcome.

Note:

Please contact the University 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.