Strength of Materials

Course Code:

ME 246

Course Period:

Spring

Course Type:

Core

Credits:

3

Theoric:

2

Practice:

2

Laboratory Hour:

0

ECTS:

6

Prerequisite Courses:

Statics [1]
Course Language:

English

Course Objectives:

The aim of this course is to enable students to relate the notion of internal load and deformation to stress and strain, namely, to teach students the concepts of stress and strain and the relations between them, in particular, to teach stress and strain analysis in slender (1-D) structural elements under various types of external loads and in thin-walled

cylinders and spheres under pressure; furthermore, to teach deformation analysis in statically determinate and indeterminate axially and torsionally loaded systems, and to teach the concepts of stress and strain transformation.

Course Content:

Analysis of stress and strain. Axially loaded bars. Torsion. Transverse loading of beams; stresses in beams, deflection of beams. Stresses in combined bending, torsion, shear and axial loading. Mohr's circle. Design of shafts and beams under combined loading. Statically indeterminate problems. Introduction to the energy methods.

Course Methodology:

1: Lecture, 2: Problem session, 3: Homework.

Course Evaluation Methods:

A: Written exam,, C: Homework, H: Attendance record.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) A good understanding of stress and strain and their relation to internal loads and deformations, respectively.	1	1,2,3	A,C,H
2) Adequate knowledge of material behavior in terms of stress-strain relations.	1	1,2,3	A,C,H
3) Ability to perform stress and strain analyses in slender structural elements under various types of external loading and in thin-walled cylinders and spheres under pressure.	1,2	1,2,3	A,C,H
4) Ability to perform deformation analysis for simple staticaly determinate and indeterminate slender systems.	1,2	1,2,3	A,C,H
5) Ability to transform stresses and strains between different coordinate systems.	1,2	1,2,3	A,C,H

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Introductıon, internal load resultants, normal and shear stress.	Textbook
2	Allowable stress, simple design examples, strain.	Textbook

3	Mechanical properties of materials, ductile and brittle materials, Hooke's law, strain energy, Poisson's ratio.	Textbook
4	Axial loading, statically indeterminate bars, stress concentrations.	Textbook
5	Thermal stress; midterm exam 1.	Textbook
6	Torsional loading, the torsion formula, power transmission.	Textbook
7	Statically indeterminate torsion bars, stress concentrations; bending	Textbook
8	Bending, shear and moment diagrams, bending deformations, strain, the flexure formula, stress concentrations	Textbook
9	Unsymmetric bending; midterm exam 2.	Textbook
10	Transverse loading of beams, shear formula, shear flow	Textbook
11	Combined loading, thin-walled pressure vessels, stress analysis of beams under combined loading.	Textbook
12	Stress transformations; midterm exam 3	Textbook
13	Stress and strain transformations, column buckling.	Textbook
14	Column buckling, design of beams.	Textbook

RECOMMENDED SOURCES	
Textbook	Mechanics of Materials, R. C. Hibbeler, McGraw Hill.
Additional Resources	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
In-term exams	2	50
Assignment	10	20
Attendance	56 class hrs	0
Final exam	1	30
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		70

Total		**100**

COURSE'S CONTRIBUTION TO PROGRAM								
No	Program Learning Outcomes		Contribution					
		NA	1	2	3	4	5	
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied knowledge in these areas in complex engineering problems.	**X**						
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.	**X**						
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.	**X**						
4	Ability to devise, select, and use modern techniques and tools needed for analyzing and solving complex problems encountered in engineering practice; ability to employ information technologies effectively.	**X**						
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating complex engineering problems or discipline specific research questions.	**X**						
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.	**X**						
7	Ability to communicate effectively in Turkish, both orally and in writing; knowledge of a minimum of one foreign language; ability to write effective reports and comprehend written reports, prepare design and production reports, make effective presentations, and give and receive clear and intelligible instructions.	**X**						
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.	**X**						
9	Consciousness to behave according to ethical principles and professional and ethical responsibility; knowledge on standards used in engineering practice.	**X**						

10	Knowledge about business life practices such as project management, risk management, and change management; awareness in entrepreneurship, innovation; knowledge about sustainable development.	**X**						
11	Knowledge about the global and social effects of engineering practices on health, environment, and safety, and contemporary issues of the century reflected into the field of engineering; awareness of the legal consequences of engineering solutions.	**X**						
12	Ability to work professionally in both thermal and mechanical systems areas, including design and realization.	**X**						
13	Ability to verify and validate numerical solutions to engineering problems.	**X**						

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Hrs per Quantity	Total Workload (Hour)
Course Duration (12.5 weeks excluding 1.5 weeks for exams)	12.5	4	50
Off-the-classroom study (pre-study, practice for 14 weeks)	14	5	70
In-term exams	3	2	6
Homework	5	2	10
Final examination	1	3	3
Total Work Load			139
Total Work Load / 25 (h)			5.6
ECTS Credit of the Course			6