University of Science and Technology of Hanoi
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COURSE SYLLABUS

Subject: Mechanics of Materials
Lecturer:
Phone:

Academic field: Aerospace Engineering and Application
E-mail :

Academic year: 2013-2014

COURSE DESCRIPTION

Credit points		
Level	Undergraduate	
Teaching time **Location**		
Time Commitment	Lecture	**26_hrs**
	Tutorial	0_hrs
	Practice + In-class assignments	**12_hrs**
	Lab-work	**0_hrs**
	Total	38_hrs
Prerequisites	Statics	
Recommended background knowledge	Maths, Physics	
Subject description:	This course is designed for the first course in mechanics of materials offered to the 2nd engineering students. It deals with the internal effects (primarily stresses and strains) in a deformable solid boy due to external loads acting on it. The subject is also known as "Mechanics of Materials" or "Solid Mechanics." It is useful in a variety of engineering areas including aerospace, mechanical and civil engineering and biomechanics. It provides theory and formulas that are directly applicable in the modeling, analysis, design, and testing of engineering devices and structures such as automobiles, airplanes, robots, machine tools, engines, ships, bridges, elevated guideways, and buildings. Materials in this course are based on the understanding of a few basic concepts and on the use of simplified models. This approach makes it possible to develop all the necessary formulas in a rational and logical manner, and to clearly indicate the conditions under which they can be safely applied to the analysis and design of actual engineering structures and machine components. Free-body diagrams are used extensively throughout the text to	

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	determine external or internal forces. The use of "picture equations" will also help the students understand the superposition of loadings and the resulting stresses and deformations. It is expected that students using this text will have completed a course in statics. However, lectures are also designed to provide students with an opportunity to review the concepts learned in that course. The course consists of lectures, quizzes, class exercises, homework assignments, an intermediate examination, and a final examination.
Objectives & Outcome	This 'Mechanics of Materials' course is a very important and fundamental course designed for the engineering student and help them the ability to analyze a given problem in a simple and logical manner and to apply to its solution a few fundamental and well-understood principles. The main objective of the course is to study the behavior or "internal effects" of structures caused by external loads, and provide the future engineer with the means of analyzing and designing various machines and load bearing structures.
Assessment/ Evaluation	Attendance/Attitude: 10% Class exercise(s): 20% Assignment(s): 20% Mid-term test: 20% Final exam: 30%
Prescribed Textbook(s)	[1] Bear FP., Johnston ER., DeWolf JT., Mazureck DF., Mechanics of Materials. 5th edition, Mc Graw Hill, 2008. [2] Hibbeler RC., Mechanics of Materials. 5th edition, Prentice Hall, 2011.

COURSE CONTENTS & SCHEDULE

Class	Contents	Hours			Ref./Resources	Assignment(s)
		Lect.	Exr.	Prc.		
1	Chapter 1: Introduction –Concept of Stress • Stress Definition • Statics Review • Stress Analysis • Normal and Shear Stress	2			Chapter 1 [1]	Assignment-1

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	• Stress on an Oblique Plane • Maximum Stress • Stress under General Loadings, State of Stress					
2	Chapter 2: Stress and Strain – Axial Loading • Normal Strain • Stress-Strain Test • Stress-Strain Diagram • Hooke's Law • Saint-Venant's Principle • Stress Concentration • Thermal and Residual Stresses • Examples	3	1		Chapter 2 [1]	Assignment-2
3	Chapter 3: Torsion • Torsional Loads on Circular Shafts • Torque due to Internal Stresses • Axial Shear Components • Shear Strain • Stresses in Elastic Range • Torsional Failure Modes • Angle of Twist in Elastic Range • Torsion of Noncircular Members • Thin-Walled Hollow Shafts • Examples	2	1		Chapter 3 [1]	Assignment-3
4	Chapter 4: Pure Bending • Other Loading Types • Symmetric Member in Pure Bending • Bending Deformations • Strain Due to Bending • Beam Section Properties • Deformations in a Transverse Cross Section • Plastic Deformations • Eccentric Axial Loading in a Plane of Symmetry • Unsymmetric Bending • General Case of Eccentric Axial	3	2		Chapter 4 [1]	Assignment-4

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	Loading • Examples					
5	Chapter 5: Analysis and Design of Beams for Bending • Shear and Bending Moment Diagrams • Relations among Load, Shear, and Bending Moment • Design of Prismatic Beams for Bending • Examples	2	1		Chapter 5 [1]	Assignment-5
6	Chapter 6: Shearing Stresses in Beams and Thin-Walled Members • Shear on the Horizontal Face of a Beam Element • Determination of the Shearing Stress in a Beam • Shearing Stresses txy in Common Types of Beams • Further Discussion of the Distribution of Stresses • Longitudinal Shear on a Beam Element of Arbitrary Shape • Shearing Stresses in Thin-Walled Members • Unsymmetric Loading of Thin-Walled Members • Examples	2	1		Chapter 6 [1]	Assignment-6
7	Chapter 7: Transformations of Stress and Strain • Transformation of Plane Stress • Principal Stresses • Maximum Shearing Stress • Mohr's Circle for Plane Stress • General State of Stress • Application of Mohr's Circle to the Three- Dimensional Analysis of Stress • Yield Criteria for Ductile Materials Under Plane Stress • Fracture Criteria for Brittle Materials Under Plane Stress • Stresses in Thin-Walled Pressure Vessels	3	1		Chapter 7 [1]	Assignment-7
8	Chapter 8: Principal Stresses Under a Given	2	1		Chapter 8 [1]	Assignment-8

	Loading • Principle Stresses in a Beam • Design of a Transmission Shaft • Stresses Under Combined Loadings					
9	Chapter 9: Deflection of Beams • Deformation of a Beam Under Transverse Loading • Equation of the Elastic Curve • Direct Determination of the Elastic Curve • Statically Indeterminate Beams • Method of Superposition • Application of Superposition • Moment-Area Theorems • Application to Cantilever Beams • Bending Moment Diagrams by Parts • Application of Moment-Area Theorems to Beams • Maximum Deflection • Use of Moment-Area Theorems	2	1		Chapter 9 [1]	Assignment-9
10	Chapter 10: Columns • Stability of Structures • Euler's Formula for Pin-Ended Beams • Extension of Euler's Formula • Eccentric Loading; The Secant Formula • Design of Columns Under Centric Load • Design of Columns Under an Eccentric	2	1		Chapter 10 [1]	Assignment-10
11	Chapter 11: Energy Methods • Strain Energy • Strain Energy Density • Elastic Strain Energy for Normal Stresses • Strain Energy For Shearing Stresses • Strain Energy for a General State of Stress • Impact Loading • Design for Impact Loads • Work and Energy Under a Single Load • Deflection Under a Single Load • Work and Energy Under Several Loads • Castigliano's Theorem • Deflections by Castigliano's Theorem	3	2		Chapter 11 [1]	Assignment-11

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Notes:

- *Abbreviation: Lect. (lecture), Exr. (Exercise), Prc. (Practice).*
- *Assignments may include assignments, practical work, reports, exercises ...for each class sessions*

Reference Literature:

[1] Bear FP., Johnston ER., DeWolf JT., Mazureck DF., Mechanics of Materials. 5th edition, Mc Graw Hill, 2008.

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