Course No.	Course Name	L-T-P – Credits	Year of Introduction
CE201	MECHANICS OF SOLIDS	3-1-0-4	2016

Pre requisite: BE 100 Engineering Mechanics

Course Objectives: To enable the students to calculate stresses and strains generated in material due to external loads for various types of loading conditions

Syllabus: Concept of stress. Concept of strain. Stress-strain relations. Calculating internal forces (Normal force, shear force and bending moment diagrams) Behavior of axially loaded members. Behavior of members subjected to bending moments. Behavior of circular members subjected to Torsion. Shear stresses in beams. Transformation of plane stresses. Mohr circle. Concept of design of beams. Buckling of columns. Indeterminacy.

Expected outcome .

1. Ability to calculate internal forces in members subject to axial loads, shear, torsion and bending and plot their distributions
2. Ability to calculate normal, shear, torsion and bending stresses and strains
3. Ability to transform the state of stress at a point and determine the principal and maximum shear stresses using equations as well as the Mohr's circle
4. Understanding of column buckling and ability to calculate critical load and stress

Text Books:

1. Timoshenko , Strength of Materials Vol. I & Vol. II , CBS Publishers & Distributers, New Delhi
2. Rattan, Strength of Materials 2e McGraw Hill Education India 2011

Data Book (Approved for use in the examination): Nil

References:

1. Crandall, An Introduction to Mechanics of Solids 3e McGraw Hill Education India 2014
2. Egor P Popov , Mechanics of solids, Prentice Hall of India, New Delhi
3. M.L. Gambhir, Fundamentals of structural Mechanics and analysis, Prentice Hall India
4. Stephen H Crandall, N C Dahi, Thomas J L, M S Sivakumar, an introduction to Mechanics of Solids , McGraw hill Education, 3rd edition
5. Cheng, Statics and Strength of Materials 2e McGraw Hill Education India 2013
6. Hearn E.J., *Mechanics of Materials*, Pergamon Press, Oxford
7. Nash W A, Strength of Materials (SIE) (Schaum's Outline Series) 5e McGraw Hill Education India 2010
8. Rajput R.K. Strength of Materials, S.Chand&company Ltd., New Delhi
9. James M Gere & Stephen P Timoshenko , Mechanics of Materials , CBS Publishers & Distributers, New Delhi
10. Punmia B. C., A. K. Jain and A. K. Jain, Mechanics of Materials, Laxmi Publications(P) Ltd, New Delhi

Course Plan			
Module	**Contents**	**Hours**	**Sem. Exam Marks**
I	**Review of Statics** Types of external loads - internal stresses - normal and shear stresses - strain - Hooke's law - working stress - stress strain diagrams - Poisson's ratio - relationship between elastic constants	9	15%
II	Elongation of bars of constant and varying sections – statically indeterminate problems in tension and compression –Temperature effects – strain energy and complementary energy-strain energy due to tension, compression and shear	9	15%
FIRST INTERNAL EXAMINATION			
III	**Bending Moment & Shear force:** Different types of beams- various types of loading –Relationship connecting intensity of loading , shearing force and bending moment- shear force and bending moment diagrams for cantilever beams and Simply supported beams for different types of loading.	9	15%
IV	**Stresses in beams of symmetrical cross sections:** Theory of simple bending –assumptions and limitations – Normal stresses in beams- Moment of resistance - beams of uniform strength - beams of two materials – strain energy due to bending - shearing stresses in beams.	9	15%
SECOND INTERNAL EXAMINATION			
V	**Analysis of stress and strain on oblique sections:** Stress on inclined planes for axial and biaxial stress fields - principal stresses - Mohr's circle of stress **Thin and Thick Cylinders:** Stresses in thin cylinders – thick cylinders - Lame's equation – stresses in thick cylinders due to internal and external pressures **Torsion:** Torsion of solid and hollow circular shafts.-Pure shear- strain energy in pure shear and torsion. **Springs**: Close coiled and open coiled helical springs.	9	20%
VI	**Deflection of statically determinate beams:** Differential equation of the elastic curve - Method of successive integration, Macaulay's method, Method of superposition, moment area method. **Theory of columns:** Direct and bending stresses in short columns- Kern of a section. Buckling and stability-Euler's buckling/crippling load for columns with different end conditions- Rankine's formula	11	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN (End semester exam)

Maximum Marks: 100 Exam Duration: 3 Hrs

The question paper shall have three parts.

Part A -Module I & II : Answer 2 questions out of 3 questions (15 marks each)

Part B - Module III & IV: Answer 2 questions out of 3 questions (15 marks each)

Part C - Module V & VI: Answer 2 questions out of 3 questions (20 marks each)

Note: 1.Each part should uniformly cover the two modules in that part.

2. Each question can have a maximum of 4 subdivisions (a,b,c,d), if needed.