1151CE201 (VTUR15)	STRENGTH OF MATERIALS	L	T	P	C
		2	2	2	4

Course Category: Integrated Course

A. Preamble:

This course is useful for a detailed study of forces and their effects along with some suitable protective measures for the safe working condition. This knowledge is very essential for an engineer to enable him in designing all types of structures and machines.

B. Prerequisites:

- Engineering Mechanics
- Mechanics of Solids

C. Links to other Courses:

- Structural Analysis-I
- Design of RC Elements

D. Course Educational Objectives:

- On completion of this course the student will gain knowledge in analyze and design structural members subjected to tension, compression, torsion, bending and combined stresses using the fundamental concepts of stress, strain and elastic behavior of materials.
- Utilize appropriate materials in design considering engineering properties, sustainability, cost and weight. Perform engineering work in accordance with ethical and economic constraints related to the design of structures and machine parts.

E. Course Outcomes:

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's)
CO1	Describe the concepts of stress and strain , their use in the analysis and design of machine members and structures	K2
CO2	Solve the methods of analysis used in treating statically indeterminate loading conditions.	K2
CO3	Solve the analytic methods used in connection with the structural design of columns, long mechanical members under compression.	K2
CO4	Determine the principal stresses, principal planes and maximum shear stress under various combinations of bending, torsion and axial loads on machine and structural	K3
CO5	Developing the models and understanding the procedures used in the analysis of transversely loaded beams and shafts with various support conditions.	K3

F. Correlation of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M	H	M							M	
CO2	H	M	H	M							M	
CO3	H	M	H	M							M	
CO4	H	M	H	M							M	
CO5	H	M	H	M							M	

G. Course Content:

UNIT I ENERGY PRINCIPLES 6+6

Strain energy and strain energy density – Strain energy in traction, shear in flexure and torsion – Castigliano's theorems – Principle of virtual work – Application of energy theorems for computing deflections in beams and trusses – Maxwell's reciprocal theorems

UNIT II INDETERMINATE BEAMS 6+6

Propped cantilever and fixed beams-fixed end moments and reactions for concentrated load central, non-central, uniformly distributed load maximum at centre and maximum at end – Theorem of three moments – Analysis of continuous beams – Shear force and bending moment diagrams for continuous beams.

UNIT III COLUMNS 6+6

Eccentrically loaded short columns – Middle third rule – Core section – Columns of unsymmetrical sections (angle and channel sections) – Euler's theory of long columns – Critical loads for prismatic columns with different end conditions; Rankine-Gordon's formula for eccentrically loaded columns – Thick cylinders – Compound cylinders.

UNIT IV STATE OF STRESS IN THREE DIMENSIONS 6+6

Spherical and deviatory components of stress tensor - Determination of principal stresses and principal planes – Volumetric strain – Dilatation and distortion – Theories of failure – Principal stress dilatation – Principal strain – Shear stress – Strain energy and distortion energy theories – Application in analysis of stress, load carrying capacity and design of members – Residual stresses

UNIT V ADVANCED TOPICS IN BENDING OF BEAMS 6+6

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections – Curved beams – Winkler-Bach formula – Stress concentration.

LIST OF EXPERIMENTS

1. Tension Test on steel bars
2. Double shear test on mild steel
3. Torsion test on mild steel
4. Brinell, Rockwell Hardness tests
5. Charpy and Izod Impact tests mild steel rod
6. Compression (Parallel as well as perpendicular to the grains) and shear tests on timber specimens
7. Test on springs (Both closed coil and open coiled springs)
8. Deflection Tests on steel beams

TOTAL30+30+30: 90 Periods

H. **Learning Resources:**

a) TEXT BOOKS

1. Bansal R.K., Strength of Materials, Laxmi Publications, New Delhi – 2010
2. Rajput R.K., "Strength of Materials (Mechanics of Solids)", S.Chand & Company Ltd., New Delhi, 2010.

b) REFERENCES

1. Kazimi S.M.A, Solid Mechanics, Tata McGraw-Hill Publishing Co., New Delhi, 2010
2. William Nash, Theory and Problems of Strength of Materials, Schaum's Outline Series, McGraw-Hill International Edition.2008
3. Khurmi R.S, Strength of Materials, S. Chand & Company Ltd, New Delhi, 2010
4. Subramanian R., Strength of materials, Oxford Institute Press, New Delhi – 2005