Strength of Materials
BEG256CI

Year: II **Semester: I**

Teaching Schedule Hours/week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory	Practical	
L	T	P	Duration	Marks	Duration	Marks			
3	3	2/2	3	80	-	-	20	25	125

Course Objective:

Course Contents:

1.0 Introduction (2 hrs)

1.1 Types of loads - static, dynamic, dead, live, wind and seismic loads.
1.2 Types of supports
1.3 Statically determinate and indeterminate structures
1.4 Degree of static indeterminacy

2.0 Shear Forces and Bending Moment (7 hrs)

2.1 Revision of previous works
2.2 The concept of superposition of internal forces
2.3 Maximum bending moments and shearing forces and their positions for statically determinate beams and frames.
2.4 Calculation of applied load from given bending moment and shear force diagram.

3.0 Moment of Inertia (4 hrs)

3.1 Review of previous work
3.2 Moment of inertia of standard and built-up sections
3.3 Polar moment of inertia
3.4 Radius of gyration
3.5 Principal moment of inertia

4.0 Direct Stresses and Strains (7 hrs)

4.1 Stresses and strains - normal stress-strain, shear stress-strain, Hook's law, Poisson's ratio, modulus of elasticity, modulus of rigidity, bulk modulus and their relationship.
4.2 Stress-strain diagrams for steel, timber, masonry, concrete and RCC
4.3 Ultimate stress, allowable stress, factor of safety and stress concentration
4.4 Elongation of bars: varying cross-sections, tapered section, principle of superposition
4.5 Compound bars subjected to axial tension and compression
4.6 Thermal stresses: single bar, compound / composite bars

5.0 Principal Stresses (5 hrs)

5.1 Introduction
5.2 Stresses on an inclined plane subjected to two mutually perpendicular normal stresses
5.3 Stresses on an inclined plane subjected to two mutually perpendicular normal and shear stresses
5.4 Principal stresses and principal strains
5.5 Mohr's circle diagram for stress

6.0 Theory of Flexure (7 hrs)

6.1 Coplanar and pure bending, assumptions, derivation of bending equation.

6.2 Introduction to elastic and plastic bending
6.3 Radius of curvature, flexural stiffness
6.4 Analysis of beams of symmetric cross-section
6.5 Shear stress variation in rectangular and thin walled I beam
6.6 Analysis of composite beams
6.7 Concept of deflection in beams

7.0 Torsion (3 hrs)

7.1 Introduction
7.2 Assumptions and derivation of torsional equation
7.3 Calculation of torsional moments in series and parallel combination of shafts
7.4 Calculation of torsional stresses

8.0 Thin-Walled Pressure Vessels (3 hrs)

8.1 Definition and characteristics of thin-walled vessels
8.2 Types of stresses in thin-walled vessels
8.3 Calculation of stresses and strains in thin-walled vessels

9.0 Compound Stresses Failure Theories (4 hrs)

9.1 Introduction
9.2 Load acting eccentrically to one and both axes
9.3 Condition for no tension in the section
9.4 Introduction to failure theories

10.0 Introduction to Buckling (3 hrs)

10.1 Definition of buckling
10.2 Buckling of columns
10.3 Effective length

Laboratories:

(i) Tensile test of steel
(ii) Simple bending test on steel or timber beam
(iii) Torsion test on simple shaft
(iv) Test on column behavior and buckling

References:

- S. P. Timoshenko & D. H. Young, Elements of Strength of Materials, 5th Edition, East-West Press Pvt. Ltd., 1987
- G. H. Ryder, Strength of Materials, 3rd Edition, Macmilliam, ELBS, 1985
- E. P. Popov, Mechanics of Materials, 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 1989
- R. K Bansal, A text book of strength of materials, Laxmi publication, New Delhi
- S. S. Vavikatti, Strength of Materials, Vikas Publication, New Delhi
- B.C. Punmia, Strength of Materials – Mechanics of Structures, Standard Publication Distributors, New Delhi
- R. K. Rajput, Strength of Materials (Mechanics of Solids), S. Chand, New Delhi