Structural Mechanics

Discipline: Civil Engineering	**Semester: 3rd**		**Name of the teaching faculty: Er. Sangram Mishra**
Week	Period	**No of period available**	**Theory Topics**
1ST	1	1	**1.0 Review Of Basic Concepts** **1.1** Basic Principle of Mechanics: Force, Moment, support conditions,
	2,3	2	**1.1** Conditions of equilibrium, C.G & MI, Free body diagram
	4	1	**1.2** Review of CG and MI of different sections
	5	1	**2.0Simple And Complex Stress, Strain** **2.1 Simple Stresses and Strains** Introduction to stresses and strains: Mechanical properties of materials – Rigidity, Elasticity, Plasticity, Compressibility, Hardness, Toughness, Stiffness, Brittleness, Ductility, Malleability, Creep, Fatigue, Tenacity, Durability,
2nd	6	1	2.1 Types of stresses -Tensile, Compressive and Shear stresses, Types of strains - Tensile, Compressive and Shear strains,
	7,8	2	2.1 Complimentary shear stress - Diagonal tensile / compressive Stresses due to shear, Complimentary shear stress - Diagonal tensile / compressive Stresses due to shear, Elongation and Contraction, Longitudinal and Lateral strains, Poisson's Ratio, Volumetric strain, computation of stress, strain, Poisson's ratio, change in dimensions and volume etc,

	9	1	2.1Hooke's law - Elastic Constants, Derivation of relationship between the elastic constants.

	10	1	Monthly Class Test
3rd	10	1	**2.2 Application of simple stress and strain in engineering field:** Behaviour of ductile and brittle materials under direct loads, Stress Strain curve of a ductile material
	11,12	2	2.2 Limit of proportionality, Elastic limit, Yield stress, Ultimate stress, Breaking stress, Percentage elongation, Percentage reduction in area, Significance of percentage elongation and reduction in area of cross section
	13	1	2.2 Deformation of prismatic bars due to uniaxial load, Deformation of prismatic bars due to its self weight
	14	1	**2.3 Complex stress and strain** Principal stresses and strains: Occurrence of normal and tangential stresses, Concept of Principal stress and Principal Planes, major and minor principal stresses and their orientations
4th	15,16	2	2.3 Mohr's Circle and its application to solve problems of complex stresses
	17	1	**3.0Stresses In Beams and Shafts** **3.1 Stresses in beams due to bending:** Bending stress in beams – Theory of simple bending – Assumptions
	18	1	3.1 Moment of resistance – Equation for Flexure– Flexural stress distribution –

	19	1	3.1 Curvature of beam – Position of N.A. and Centroidal Axis – Flexural rigidity – Significance of Section modulus
5th	20,21	2	**3.2 Shear stresses in beams:** Shear stress distribution in beams of rectangular, circular and standard sections symmetrical about vertical axis.
	22	1	**3.3 Stresses in shafts due to torsion:** Concept of torsion, basic assumptions of pure torsion,
	23	1	3.3 torsion of solid and hollow circular sections, polar moment of inertia torsional shearing stresses, angle of twist, torsional rigidity, equation of torsion
	24	1	**3.4 Combined bending and direct stresses:** Combination of stresses, Combined direct and bending stresses, Maximum and Minimum stresses in Sections, Conditions for no tension,
6TH	25,26	2	3.4 Limit of eccentricity, Middle third/fourth rule, Core or Kern for square, rectangular and circular sections, chimneys, dams and retaining walls
	27	1	**4.0Columns and Struts** **4.1** Columns and Struts, Definition, Short and Long columns, End conditions, Equivalent length / Effective length, Slenderness ratio,
	28	1	4.1 Axially loaded short and long column, Euler's theory of long columns, Critical load for Columns with different end conditions
	30	1	Monthly Class Test
7th	31,32	2	**5.0 Shear Force and Bending Moment** **5.1 Types of loads and beams:** Types of Loads: Concentrated (or) Point load, Uniformly Distributed load (UDL), Types of

	33	1	Supports: Simple support, Roller support, Hinged support, Fixed support,
	34	1	Internal Assessment
	35	1	Internal Assessment
8TH	36	1	5.1Types of Reactions: Vertical reaction, Horizontal reaction, Moment reaction
	37,38	2	5.1Types of Beams based on support conditions: Calculation of support reactions using equations of static equilibrium.
	39	1	5.1 Shear Force and Bending Moment: Signs Convention for S.F. and B.M, S.F and B.M of general cases of determinate beams with concentrated loads and udl only
	40	1	5.1 S.F and B.M diagrams for Cantilevers, Simply supported beams and Over hanging beams, Position of maximum BM
9TH	41	1	5.1 Point of contra flexure, Relation between intensity of load, S.F and B.M.
	42,43	2	**6.0Slope and Deflection** **6.1 Introduction:** Shape and nature of elastic curve (deflection curve);
	44,45	2	6.1Relationship between slope deflection and curvature (No derivation), Importance of slope and deflection.

10th	46,47,48,49,50	5	**6.2** Slope and deflection of cantilever and simply supported beams under concentrated and uniformly distributed load (by Double Integration method, Macaulay's method).
11TH	51,52,53,54,55	5	**6.2** Slope and deflection of cantilever and simply supported beams under concentrated and uniformly distributed load (by Double Integration method, Macaulay's method).
12th	56,57,58	3	**7.0Indeterminate Beams** **7.1** Indeterminacy in beams, Principle of consistent deformation/compatibility
	58	1	7.1 Analysis of propped cantilever, fixed and two span continuous beams by principle of superposition
	59	1	7.1 SF and BM diagrams (point load and udl covering full span)
13TH	60,61	2	**8.0Trusses** **8.1 Introduction:** Types of trusses, statically determinate and indeterminate trusses
	62,63,64	3	**8.2 Analysis of trusses:** Analytical method (Method of joints, method of Section)
14th	65,66,67,68	4	8.2 degree of indeterminacy, stable and unstable trusses, advantages of trusses.
	69	1	Monthly Class Test
15TH	70	1	Revision
	71	1	Revision
	72	1	Revision
	73	1	Previous Year Questions Discussion
	74	1	Previous Year Questions Discussion