ACADEMIC SESSION: WINTER-2024

Discipline : Civil engg	Semester: 3rd	Name of the Teaching Faculty : Padma Lochan Behera, Sr. Lect. (Civil)
Subject: structural mechanics	No. of Days / Week class allotted: 5	Semester Duration: 01/07/2024 to 08/11/2024 No. of Weeks : 19
Week	**Class day**	**Theory/Practical Topics:**
1st	1st	Basic Principle of Mechanics: Force, Moment, support conditions
	2nd	Conditions of equilibrium, C.G & MI , Free body diagram
	3rd	Review of CG and MI of different sections
	4th	Problems on CG & MI
	5th	Problems on CG & MI
2nd	1st	Introduction to stresses and strains: Mechanical properties of materials – Rigidity, Elasticity, Plasticity
	2nd	Compressibility, Hardness, Toughness, Stiffness, Brittleness, Ductility, Malleability, Creep, Fatigue, Tenacity, Durability
	3rd	Types of stresses -Tensile, Compressive and Shear stresses, Types of strains - Tensile, Compressive and Shear strains
	4th	Complimentary shear stress - Diagonal tensile / compressive Stresses due to shear, Elongation and Contraction, Longitudinal and Lateral strains, Poisson's Ratio
	5th	Volumetric strain, computation of stress, strain, Poisson's ratio, change in dimensions and volume etc,
3rd	1st	Hooke's law - Elastic Constants, Derivation of relationship between the elastic constants
	2nd	Problems
	3rd	Behaviour of ductile and brittle materials under direct loads, Stress Strain curve of a ductile material
	4th	Limit of proportionality, Elastic limit, Yield stress, Ultimate stress
	5th	Breaking stress, Percentage elongation, Percentage reduction in area,
4th	1st	Significance of percentage elongation and reduction in area of cross section
	2nd	Deformation of prismatic bars due to uniaxial load, Deformation of prismatic bars due to its self weight
	3rd	Principal stresses and strains: Occurrence of normal and tangential stresses,
	4th	Concept of Principal stress and Principal Planes
	5th	major and minor principal stresses and their orientations
5th	1st	Mohr's Circle and its application to solve problems of complex stresses
	2nd	Problems
	3rd	Stresses in beams due to bending: Bending stress in beams
	4th	Theory of simple bending – Assumptions – Moment of resistance – Equation for Flexure– Flexural stress distribution – Curvature of beam
	5th	Problems on simple bending
6th	1st	Position of N.A. and Centroidal Axis – Flexural rigidity – Significance of Section modulus
	2nd	Shear stresses in beams: Shear stress distribution in beams of rectangular, circular and standard sections symmetrical about vertical axis.
	3rd	Stresses in shafts due to torsion: Concept of torsion, basic assumptions of pure torsion
	4th	torsion of solid and hollow circular sections, polar moment of inertia
	5th	torsional shearing stresses, angle of twist, torsional rigidity, equation of torsion

7th	1st	Combined bending and direct stresses: Combination of stresses, Combined direct and bending stresses
	2nd	Maximum and Minimum stresses in Sections, Conditions for no tension,
	3rd	Limit of eccentricity, Middle third/fourth rule, Core or Kern for square, rectangular and circular sections, chimneys, dams and retaining walls
	4th	Columns and Struts: Definition, Short and Long columns
	5th	End conditions, Equivalent length / Effective length, Slenderness ratio,
8th	1st	Axially loaded short and long column, Euler's theory of long columns,
	2nd	Critical load for Columns with different end conditions
	3rd	Problems to determine critical load
	4th	Types of Loads: Concentrated (or) Point load, Uniformly Distributed load (UDL)
	5th	Types of Supports: Simple support, Roller support, Hinged support, Fixed support,
9th	1st	Types of Reactions: Vertical reaction, Horizontal reaction, Moment reaction,
	2nd	Types of Beams based on support conditions: Calculation of support reactions using equations of static equilibrium
	3rd	Shear Force and Bending Moment: Signs Convention for S.F. and B.M
	4th	S.F and B.M of general cases of determinate beams with concentrated loads and udl only
	5th	S.F and B.M diagrams for Cantilever beam with Point Load
10th	1st	Problems
	2nd	S.F and B.M diagrams for Cantilever beam with UDL
	3rd	Problems
	4th	S.F and B.M diagrams for Simply Supported beam with Point Load
	5th	Problems
11th	1st	S.F and B.M diagrams for Simply Supported beam with UDL
	2nd	Simply supported beams and Over hanging beams
	3rd	Problems
	4th	Position of maximum BM, Point of contra flexure, Relation between intensity of load, S.F and B.M
	5th	Problems on S.F & B.M.
12th	1st	Slope and deflection Introduction: Shape and nature of elastic curve (deflection curve);
	2nd	Relationship between slope, deflection and curvature (No derivation), Importance of slope and deflection.
	3rd	Slope and deflection of cantilever and simply supported beams under concentrated and uniformly distributed load (by Double Integration method, Macaulay's method).
	4th	Problems
	5th	Problems
13th	1st	Durgapuja Holiday
	2nd	
	3rd	
	4th	
	5th	
14th	1st	Class test
	2nd	Indeterminacy in beams
	3rd	Problems on indeterminacy
	4th	Principle of consistent deformation/compatibility
	5th	Analysis of propped cantilever and fixed beam

15th	1st	problems
	2nd	Analysis of two span continuous beams by principle of superposition,
	3rd	problems
	4th	SF and BM diagrams (point load and udl covering full span)
	5th	problems
16th	1st	Trusses- Introduction: Types of trusses, statically determinate and indeterminate trusses
	2nd	degree of indeterminacy
	3rd	Problems on degree of indeterminacy
	4th	stable and unstable trusses
	5th	advantages of trusses.
17th	1st	Analysis of trusses: Analytical method : Method of joints
	2nd	Problems on method of joint
	3rd	Problems on method of joint
	4th	Method of Section
	5th	Problems on Method of section
18th	1st	Problems on Method of section
	2nd	Problems on Method of section
	3rd	Doubt Clearing Class
	4th	Doubt Clearing Class
	5th	Doubt Clearing Class
19th	1st	Previous year question discussion
	2nd	Previous year question discussion
	3rd	Previous year question discussion
	4th	Previous year question discussion
	5th	Previous year question discussion

Prepared By :

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Approved By:

11/7/24

HOD(Civil)