GOVERNMENT POLYTECHNIC, PURI
DEPARTMENT OF CIVIL ENGINEERING

Discipline: **CIVIL ENGG.**	Semester: 3RD	Name of the Teaching Faculty: - **Mr. Nityananda Behera**
Subject: **STRUCTURAL MECHANICS (TH 1)**	No. of days/per week class allotted: 05	Semester From date: 01.10.2021 To Date: 08.01.2022 No. of Weeks:15
PRE-REQUISITE	Basic knowledge about Engineering mechanics.	
COURSE OUTCOMES	CO1: Comprehend, define, compute and interpret major mechanical properties demonstrated by solid materials. CO2: Analyze solid states under uniaxial loading and plane stress conditions. CO3: Draw shear force and bending moment diagrams of simple statically determinate and statically indeterminate structural members subject to transverse loading. CO4: Obtain slope and deflection profiles of statically determinate simple structural members. CO5: Comprehend buckling as a failure mode in column and determine crippling loads for columns using Euler's theory. CO6: Compute forces in members of a truss.	

Week	Class day	Practical topics	Delivery Method
1ST	1ST	**1 Review Of Basic Concepts** 1.1 Basic Principle of Mechanics: Force, Moment, support conditions, Conditions of equilibrium, C.G & MI, Free body diagram	Whiteboard
	2ND	Basic Principle of Mechanics: Force, Moment, support conditions, Conditions of equilibrium, C.G & MI, Free body diagram.	Whiteboard
	3RD	Basic Principle of Mechanics: Force, Moment, support conditions, Conditions of equilibrium, C.G & MI, Free body diagram.	Whiteboard
	4TH	1.2 Review of CG and MI of different sections	Whiteboard
	5TH	Review of CG and MI of different sections	Whiteboard
2ND	1ST	**Quiz & Assignment**	
	2ND	**2 Simple And Complex Stress Strain** 2.1 Simple Stresses and Strains Introduction to stresses and strains:	Whiteboard
	3RD	Mechanical properties of materials – Rigidity, Elasticity, Plasticity, Compressibility, Hardness, Toughness, Stiffness, Brittleness, Ductility, Malleability, Creep, Fatigue, Tenacity, Durability	Whiteboard
	4TH	Types of stresses -Tensile, Compressive and Shear stresses, Types of strains - Tensile, Compressive and Shear strains, Complimentary shear stress - Diagonal tensile / compressive Stresses due to shear.	Whiteboard
	5TH	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.	Whiteboard
3RD	1ST	Hooke's law - Elastic Constants, Derivation of relationship between the elastic constants.	Whiteboard
	2ND	Problem solving	Whiteboard
	3RD	Problem solving	Whiteboard
	4TH	2.2 Application of simple stress and strain in engineering field: Behavior of ductile and brittle materials under direct loads.	Whiteboard
	5TH	Stress Strain curve of a ductile material, Limit of proportionality, Elastic limit, Yield stress, Ultimate stress, Breaking stress .	Whiteboard
4TH	1ST	Problem solving	Whiteboard
	2ND	Percentage elongation, Percentage reduction in area, Significance of percentage elongation and reduction in area of cross section	Whiteboard
	3RD	Deformation of prismatic bars due to uniaxial load .	Whiteboard

	4TH	Deformation of, prismatic bars due to its self weight.	Whiteb
	5TH	Problem solving	Whiteb
5TH	1ST	Problem solving	Whiteb
	2ND	2.3 Complex stress and strain Principal stresses and strains: Occurrence of normal and tangential stresses	Whiteb
	3RD	Concept of Principal stress and Principal Planes.	Whiteboa
	4TH	Major and minor principal stresses and their orientations.	Whiteboa
	5TH	Mohr's Circle and its application to solve problems of complex stresses	Whiteboa
6TH	1ST	Problem solving	Whiteboard
	2ND	Problem solving	Whiteboard
	3RD	Problem solving	Whiteboard
	4TH	**Quiz & Assignment**	
	5TH	**3 Stresses In Beams and Shafts** 3.1 Stresses in beams due to bending: Bending stress in beams – Theory of simple bending – Assumptions, Moment of resistance	Whiteboard
7TH	1ST	Equation for Flexure– Flexural stress distribution – Curvature of beam – Position of N.A. and Centroidal Axis.	Whiteboard
	2ND	Flexural rigidity – Significance of Section modulus.	Whiteboard
	3RD	Problem solving	Whiteboard
	4TH	Problem solving	Whiteboard
	5TH	3.2 Shear stresses in beams: Shear stress distribution in beams of rectangular, circular and standard sections symmetrical about vertical axis.	Whiteboard
8TH	1ST	Shear stresses in beams: Shear stress distribution in beams of rectangular, circular and standard sections symmetrical about vertical axis.	Whiteboard
	2ND	Problem solving	Whiteboard
	3RD	Problem solving	Whiteboard
	4TH	3.3 Stresses in shafts due to torsion: Concept of torsion, basic assumptions of pure torsion	Whiteboard
	5TH	Torsion of solid and hollow circular sections, polar moment of inertia, torsional shearing stresses, angle of twist, torsional rigidity, equation of torsion	Whiteboard
9TH	1ST	Problem solving	Whiteboard
	2ND	Problem solving	Whiteboard
	3RD	3.4 Combined bending and direct stresses: Combination of stresses, Combined direct and bending stresses.	Whiteboard
	4TH	Maximum and Minimum stresses in Sections, Conditions for no tension, Limit of eccentricity, Middle third/fourth rule	Whiteboard
	5TH	Core or Kern for square, rectangular and circular sections, chimneys, dams and retaining walls.	Whiteboard
10TH	1ST	Problem solving	Whiteboard
	2ND	Problem solving	Whiteboard
	3RD	**Quiz & Assignment**	
	4TH	4 Columns and Struts 4.1 Columns and Struts, Definition, Short and Long columns, End conditions, Equivalent length / Effective length, Slenderness ratio	Whiteboard
	5TH	Axially loaded short and long column, Euler's theory of long columns, Critical load for Columns with different end conditions.	Whiteboard
11TH	1ST	Problem solving	Whiteboard
	2ND	**5 Shear Force and Bending Moment** 5.1 Types of loads and beams: Types of Loads: Concentrated (or) Point load, Uniformly Distributed load (UDL).	Whiteboard
	3RD	Types of Supports: Simple support, Roller support, Hinged support, Fixed support.	Whiteboard
	4TH	Types of Reactions: Vertical reaction, Horizontal reaction, Moment reaction.	Whiteboard

	5TH	Types of Beams based on support conditions: Calculation of support reactions using equations of static equilibrium.	Whiteboard
	1ST	5.2 Shear force and bending moment in beams: 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.	Whiteboard
	2ND	S.F and B.M diagrams for Cantilevers, Simply supported beams and Over hanging beams, Position of maximum BM, Point of contra flexure.	Whiteboard
	3RD	Relation between intensity of load, S.F and B.M.	Whiteboard
	4TH	Problem solving	Whiteboard
	5TH	Problem solving	Whiteboard
13TH	1ST	**6 Slope and Deflection** 6.1 Introduction: Shape and nature of elastic curve (deflection curve).	Whiteboard
	2ND	Relationship between slope, deflection and curvature (No derivation), Importance of slope and deflection.	Whiteboard
	3RD	6.2 Slope and deflection of cantilever and simply supported beams under concentrated and uniformly distributed load (by Double Integration method, Macaulay's method).	Whiteboard
	4TH	Problem solving	Whiteboard
	5TH	Problem solving	Whiteboard
14TH	1ST	**7 Indeterminate Beams** 7.1 Indeterminacy in beams, Principle of consistent deformation/compatibility,	Whiteboard
	2ND	Analysis of propped cantilever, fixed and two span continuous beams by principle of superposition.	Whiteboard
	3RD	SF and BM diagrams (point load and udl covering full span).	Whiteboard
	4TH	Problem solving	Whiteboard
	5TH	**Quiz & Assignment**	
15TH	1ST	**8 Trusses** 8.1 Introduction: Types of trusses, statically determinate and indeterminate trusses.	Whiteboard
	2ND	Degree of indeterminacy, stable and unstable trusses, advantages of trusses.	Whiteboard
	3RD	8.2 Analysis of trusses: Analytical method (Method of joints, method of Section).	Whiteboard
	4TH	Problem solving	Whiteboard
	5TH	**Quiz & Assignment**	

LEARNING RESOUCES:

01. Strength of Materials:- R.Subramanian
02. Theory of structure :- S.Rammrutham
03. Analysis of structure (vol-I&II):- V.N.Vazirani&M.M. Rathwani

WEBSITE RESOUCES:

1. https://youtu.be/GkFgvsZC4Vc (NPTEL)

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