



# GOVERNMENT POLYTECHNIC, BOLANGIR

## DEPARTMENT OF CIVIL ENGINEERING

**Discipline:** CIVIL ENGG.      **Semester:** 3<sup>RD</sup>      **Name of the Teaching Faculty:** - Smt. Anupama Das [LECT. Stage-I, Civil Engg.]

**Subject:** MECHANICS OF MATERIAL(Th-3)      **No. of days/week class allotted:** 03      **Total contact Hours-45Hrs**  
**Total Marks-100**  
**Assessment: Internal Assessment -30, End term-70**

**COURSE OUTCOMES**

**CO1:** Describe the mechanical properties of important engineering materials and determine centroid and moment of inertia of different sections.

**CO2:** Determine stresses, strains and deformations in elastic bodies subjected to different loading conditions.

**CO3:** Analyze beams subjected to different loading conditions and determine shear force, bending moment, bending stress and shear stress.

**CO4:** Determine the load carrying capacity of columns using Euler's and Rankine's theories and calculate design load for engineering applications

Class Day	Main Topic	Sub-Topics	Teaching Aids / Activities	Course Outcome
1	Introduction to Strength of Materials	Scope, applications and importance in Civil Engineering	Real-life structural photographs, discussion on engineering applications	CO1
2	Centre of Gravity	Definition and significance of Centre of Gravity	Geometrical models, charts	CO1
3	Centre of Gravity of Standard Sections	Square, rectangle, circular and hollow sections	Numerical examples, section drawings	CO1
4	Centre of Gravity of Composite Sections	Built-up sections and composite areas	Worked examples, group activity	CO1

Class Day	Main Topic	Sub-Topics	Teaching Aids / Activities	Course Outcome
5	Moment of Inertia	Definition, significance and engineering applications	Section models, charts	CO1
6	Radius of Gyration and Section Modulus	Definitions and applications	Numerical illustrations, comparison charts	CO1
7	Parallel Axis Theorem	Statement and applications	Numerical examples, concept mapping	CO1
8	Perpendicular Axis Theorem	Statement and applications	Worked examples, diagrams	CO1
9	M.I. of Standard Sections	Rectangle, square and circular sections	Tutorial exercises	CO1
10	M.I. of Triangle, Semicircle and Quarter Circle	Calculations and applications	Numerical examples	CO1
11	M.I. of Symmetrical Sections	I-section and channel section	Section models, worked examples	CO1
12	M.I. of Unsymmetrical Sections	T-section and angle section	Numerical exercises	CO1
13	M.I. of Hollow and Built-up Sections	Composite and hollow sections	Section drawings, problem-solving	CO1
14	Polar Moment of Inertia	Solid circular sections and applications	Shaft models, numerical examples	CO1
15	Revision and Numerical Practice	Centre of Gravity and Moment of Inertia	Tutorial session, quiz	CO1
16	Introduction to Stress and Strain	Elastic, rigid and plastic bodies	Material specimens, demonstration	CO2
17	Stress and Strain	Definitions, units and classification	Charts, numerical examples	CO2
18	Hooke's Law	Elasticity, elastic limit and modulus	Stress-strain graphs	CO2

Class Day	Main Topic	Sub-Topics	Teaching Aids / Activities	Course Outcome
		of elasticity		
19	Types of Stresses	Tensile, compressive, shear and bending stresses	Structural component models	CO2
20	Stress-Strain Curve	Yield stress, proof stress, ultimate stress	Laboratory observations, charts	CO2
21	Axial Loading	Deformation under direct load	Numerical examples	CO2
22	Axial Loading with Intermediate Loads	Maximum and minimum stresses	Tutorial problems	CO2
23	Composite Sections under Axial Loading	Stress calculations in composite members	Worked examples	CO2
24	Temperature Stress and Strain	Thermal expansion and restraint	Practical case studies	CO2
25	Poisson's Ratio	Longitudinal and lateral strain	Demonstration using elastic materials	CO2
26	Elastic Constants	Modulus of rigidity and bulk modulus	Numerical illustrations	CO2
27	Volumetric Strain	Change in volume and applications	Worked examples	CO2
28	Complex Stress System	Normal and tangential stresses	Stress element models	CO2
29	Principal Stress and Principal Planes	Concept and determination	Numerical examples, diagrams	CO2
30	Stress on Inclined Plane	Normal and shear stress components	Tutorial problems	CO2
31	Mohr's Circle	Construction and applications	Graphical construction activity	CO2
32	Numerical on Mohr's Circle	Principal stresses and shear stresses	Tutorial session	CO2

Class Day	Main Topic	Sub-Topics	Teaching Aids / Activities	Course Outcome
33	Types of Supports and Beams	Roller, hinge, fixed supports and beam types	Beam models, support models	CO3
34	Types of Loads	Point load, UDL, UVL and couple	Load diagrams, structural photographs	CO3
35	Shear Force and Bending Moment	Definitions and sign conventions	Worked examples	CO3
36	SFD for Cantilever Beams	Point load and UDL cases	Numerical exercises	CO3
37	BMD for Cantilever Beams	Point load and UDL cases	Numerical exercises	CO3
38	SFD and BMD for Simply Supported Beams	Point load cases	Tutorial exercises	CO3
39	SFD and BMD for UDL and Combined Loads	UDL and combination loading cases	Problem-solving activity	CO3
40	Point of Contraflexure	Determination and significance	Numerical examples	CO3
41	Relationship between Load, SF and BM	Engineering applications	Graphical illustrations	CO3
42	Theory of Simple Bending	Assumptions and concept of pure bending	Beam models, section diagrams	CO3
43	Flexural Equation and Bending Stress	Flexural equation, stress distribution, moment of resistance	Numerical examples, stress distribution diagrams	CO3
44	Shear Stress in Beams	Shear stress equation, shear stress distribution in rectangular, circular, I, T and channel sections	Section models, numerical examples	CO3
45	Columns	Short and long columns, slenderness ratio, Euler's theory,	Column models, numerical problems,	CO4

Class Day	Main Topic	Sub-Topics	Teaching Aids / Activities	Course Outcome
		Rankine's formula, safe load, design load and factor of safety	revision quiz	

LEARNING RESOURCES

1. R.K. Rajput, Strength of Materials, S. Chand & Company Ltd.
2. R.S. Khurmi, Strength of Materials, S. Chand & Company Ltd.
3. S. Ramamrutham, Strength of Materials, Dhanpat Rai Publications.
4. Relevant BIS Codes and Strength of Materials Laboratory Manual.

*Adar*  
30/06/26

SIGNATURE OF CONCERNED FACULTY

*Prabhinde*  
20/6/26  
SIGNATURE OF HOD