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Mechanics of Material — Complete Syllabus

BTEUP Diploma in Civil Engineering • 3rd Semester • Session 2026-27

Subject 3.4 (Theory) + 3.5 (Lab) • Total 200 Marks • 3 Credits

About this document: Mechanics of Material appears twice in the 3rd semester — as a theory paper (3.4) and as a lab (3.5). Both are covered here, completely, in the official order.

Examination Scheme

Code	Paper	Type	L - P	Credits	Internal	External	Total
3.4	Mechanics of Material	Theory	2 - 0	2	Theory 40	Theory 60 (3 hrs)	100
3.5	Mechanics of Material Lab.	Practical	0 - 2	1	Practical 60	Practical 40 (3 hrs)	100
Mechanics of Material Total				3	100	100	200

What This Subject Aims To Do

To learn properties of area and structural material properties, understand stress and strain, calculate shear force and bending moment for different shapes of structural elements and the corresponding stresses, and understand buckling loads for short and long columns.

Unit-Wise Complete Topic List

Unit	Topic	Periods	Marks Share
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1	Simple Stresses and Strains	6	20%
2	Moment of Inertia	6	20%
3	Shear Force and Bending Moment	6	20%
4	Bending and Shear Stresses in Beams	6	20%
5	Columns	4	20%

Unit 1 — Simple Stresses and Strains (6 Periods, 20%)

Topics: Properties of materials, classification of materials, elastic materials, plastic materials, ductile materials, brittle materials; introduction to tensile test, compressive test, impact test, fatigue test, torsion test on metals; concept of stress, normal and shear stresses; concept of strain and deformation, longitudinal and transverse strain, Poisson's ratio, volumetric strain, Hooke's law, moduli of elasticity and rigidity, bulk modulus of elasticity, relationship between the elastic constants; stresses and strains in bars subjected to tension and compression; extension of uniform bar under its own weight, stress produced in compound and tapering bars due to axial load; stress-strain diagram for mild steel and HYSD steel, proof stress, mechanical properties, factor of safety; temperature stresses and strains.

Unit 2 — Moment of Inertia (6 Periods, 20%)

Topics: Concept of moment of inertia and second moment of area and radius of gyration, theorems of parallel and perpendicular axis, second moment of area of common geometrical sections: rectangle, triangle, circle (without derivations); second moment of area for L, T and I sections, section modulus.

Unit 3 — Shear Force and Bending Moment (6 Periods, 20%)

Topics: Concept of a beam and supports (hinges, roller and fixed), types of beams: simply supported, cantilever, propped, overhang, fixed and continuous beams (only concept); types of loads (dead load, live load, snow load, wind load, seismic load as per IS Codes etc.) and types of loading (point, uniformly distributed and uniformly varying loads); concept of bending moment and shear force, sign conventions, bending moment and shear force diagrams for cantilever, simply supported and overhanging beams subjected to concentrated, uniformly distributed and varying loads; relationship between load, shear force and bending moment, point of maximum bending moment, and point of contraflexure; fixed and continuous beams — simple numerical problems.

Unit 4 — Bending and Shear Stresses in Beams (6 Periods, 20%)

Topics: Bending stresses in beams, concept of pure/simple bending, assumptions made in the theory of simple bending, derivation and application of bending equation to circular cross-section, I section, T and L sections only, moment of resistance, calculations of bending stresses; shear stresses in beams, concept of shear stresses in beams, shear stress distribution in rectangular, circular, I, T, L sections for beams.

Unit 5 — Columns (4 Periods, 20%)

Topics: Theory of columns — long and short columns, slenderness ratio, problem solving using Euler's and Rankine formula.

Practical Work

- Study and understand the use and components of Universal Testing Machine (UTM).
- Perform tension test on mild steel as per IS:432(1) and compute value of Young's modulus.
- Perform tension test on Tor steel as per IS:1608, IS:1139.
- Conduct compression test on sample test piece using Compression Testing Machine.
- Conduct Izod Impact test on three metals, e.g. mild steel / brass / aluminum / copper / cast iron etc. as per IS:1598.
- Conduct Charpy Impact test on three metals, e.g. mild steel / brass / aluminum / copper / cast iron etc. as per IS:1757.
- Plot shear force and bending moment diagrams for cantilever, simply supported beams.
- Plot shear force and bending moment diagrams for overhanging beams for different types of loads including moment loading.
- Conduct flexural test on timber beam on rectangular section in both orientation as per IS: 1708, IS:2408.

Reference Books (as listed in the syllabus)

- Bedi D.S., Strength of Materials, Khanna Publishing House, Delhi, Ed. 2018.
- Timoshenko, S., Strength of Materials, Vol. I, CBS, New Delhi.
- Khurmi, R.S., Strength of Materials, S Chand and Co. Ltd., New Delhi.
- Ramamurtham, S, Strength of Materials, Dhanpat Rai and sons, New Delhi.
- Punmia B C, Strength of Materials, Laxmi Publications (p) Ltd., New Delhi.
- Rattan S.S., Strength of Materials, McGraw Hill Education, New Delhi.
- Bansal R K, Strength of Materials, Laxmi Publications.
- Subramaniam R, Strength of Materials, Oxford University Press.

Source: BTEUP 2nd Year curriculum (folder2627), approved in C.D.C. meeting held on 16.07.2026. Topic lists follow the official syllabus; short explanations are the author's own plain-English summaries, not syllabus text.

Please confirm with your own polytechnic for any local changes.

