

DEPARTMENT OF CIVIL ENGINEERING

Course Code & Name : **23CET03-Mechanics of Materials**

Course Faculty : **Ms.Anurekha G S**

Question Bank

UNIT I – ENERGY PRINCIPLES

(Strain energy and strain energy density – strain energy due to axial load (gradual, sudden and impact loadings), shear, flexure and torsion – Castiligiano’s theorem- Maxwell’s reciprocal theorem - Principle of virtual work – Application of energy theorems for computing deflections in determinate beams, plane frames and plane trusses

2 Marks

S.No	Question	CO	Bloom's Level	Industry Reference
1	Define strain energy.	CO1	Remember	L&T / High-rise & bridge structures
2	What is strain energy density?	CO1	Understand	Sobha residential projects
3	Define impact loading.	CO1	Remember	Aarbee industrial structures
4	State the difference between gradual and sudden loading.	CO1	Understand	Timberwoods / High-rise cantilever frames
5	Define total potential energy of a structure.	CO1	Remember	L&T / Sobha high-rise buildings
6	What is the principle of virtual work?	CO1	Understand	Pinnacle Infotech / BIM structural projects

S.No	Question	CO	Bloom's Level	Industry Reference
7	Mention two assumptions of Castigliano's theorem.	CO1	Understand	L&T bridges & industrial beams
8	Define maximum strain in axial member.	CO1	Remember	Aarbee / Industrial structures
9	Write the general expression for strain energy due to bending.	CO1	Remember	Sobha / Timberwoods building projects
10	Define torsional strain energy.	CO1	Remember	L&T / Mechanical shaft design
11	What is Maxwell's reciprocal theorem?	CO1	Understand	Pinnacle Infotech / Structural analysis
12	State the applications of energy methods in beams and frames.	CO1	Understand	Aarbee / High-rise and industrial beams
13	What is the significance of strain energy in structural safety?	CO1	Understand	L&T bridges / Crane structures
14	Define elastic potential energy.	CO1	Remember	Sobha / Timberwoods residential structures
15	Mention one industrial application of Castigliano's theorem.	CO1	Understand	Pinnacle Infotech / L&T industrial projects

16 m

S.No	Question	CO	Bloom's Level	Industry Reference
1	A simply supported beam of span L carries a central point load P. Using strain energy concept, derive an expression for the deflection at the point of load.	CO1	Apply/Analyze	L&T / Sobha bridges & building projects

S.No	Question	CO	Bloom's Level	Industry Reference
2	Derive the expression for strain energy in bending of a cantilever beam subjected to uniformly distributed load w .	CO1	Apply/Analyze	Timberwoods / Residential cantilever frames
3	A truss joint is subjected to axial loads. Show how deflection at the loaded joint can be computed using Castigliano's theorem.	CO1	Apply/Analyze	Aarbee / Industrial truss structures
4	Using the principle of virtual work, determine the deflection at the free end of a cantilever subjected to a tip load.	CO1	Apply/Analyze	L&T / High-rise cantilever structures
5	A shaft of circular cross-section is subjected to torsion T . Derive an expression for the angle of twist using strain energy in torsion.	CO1	Apply/Analyze	L&T / Mechanical shaft & crane structures
6	Explain how total potential energy of a beam under axial and bending loads is used to estimate deflection. Derive a simple expression.	CO1	Analyze	Pinnacle Infotech / BIM beam projects
7	Using Maxwell's reciprocal theorem, show how deflection at a point in a two-span simply supported beam with uniform load can be verified.	CO1	Apply/Analyze	Sobha / Residential & industrial beams
8	A plane frame with fixed joints is loaded at a joint. Derive the procedure to compute deflection at a specific joint using Castigliano's theorem.	CO1	Apply/Analyze	Aarbee / Industrial frame design

S.No	Question	CO	Bloom's Level	Industry Reference
9	For a prismatic bar subjected to impact axial load, derive the expression for strain energy and explain its effect on structural safety.	CO1	Analyze	L&T / Crane & industrial structures
10	A simply supported beam with axial and bending loads: derive deflection at midspan using energy methods and discuss the effect of axial load on deflection.	CO1	Apply/Analyze	Pinnacle Infotech / Industrial projects