

GUJARAT TECHNOLOGICAL UNIVERSITY

BE-4 SEMESTER – OLD PAPER – S22 TO W25 – QUESTION BANK

Subject Name & Code: Structural Analysis-I (3140603)

Unit 1: Fundamentals of Statically Determinate Structures

(Basics, Framed Structures, Arches & Cables, Thin Cylinders)

Repeated Questions:

1. **Define statically determinate and indeterminate structures.**
 - Appeared in: S24 (Q1a, 03 marks), W25 (Q1a, 03 marks)
 2. **State and explain the principle of superposition.**
 - Appeared in: S23 (Q1a, 03 marks), W22 (Q1b, 04 marks), W25 (Q1b, 04 marks)
 3. **Explain Maxwell's reciprocal theorem / theorem of reciprocal deflections.**
 - Appeared in: S22 (Q2b, 04 marks), W22 (Q2a, 03 marks), W24 (Q1b, 04 marks), S23 (Q5a, 03 marks)
 4. **State Moment Area Theorems I and II.**
 - Appeared in: S22 (Q1b, 04 marks), S22 (Q3a, 03 marks), W22 (Q1a, 03 marks), W25 (Q3b, 04 marks)
 5. **Calculate static and kinematic indeterminacy for given structures.**
 - Appeared in: S24 (Q1b, 04 marks), W23 (Q1b, 04 marks)
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Other Important Questions:

1. **Explain external and internal stability of structures.**
 - Appeared in: W24 (Q1a, 03 marks)
 2. **Differentiate between plane frame and grid.**
 - Appeared in: S23 (Q1b(i), 03 marks)
 3. **Differentiate between conjugate beam and real beam.**
 - Appeared in: S23 (Q1b(ii), 03 marks), S22 (Q1b, 04 marks), W25 (Q3b, 04 marks)
 4. **Draw shear force, bending moment, and axial force diagrams for a given rigid frame.**
 - Appeared in: W25 (Q1c, 07 marks), W24 (Q1c, 07 marks)
 5. **Analyze a three-hinged parabolic/circular arch under point loads / UDL.**
 - Appeared in: S24 (Q1c, 07 marks), W23 (Q1c, 07 marks), S22 (Q3c, 07 marks)
 6. **Derive equations for circumferential and longitudinal stresses in thin cylindrical shells under internal pressure.**
 - Appeared in: S23 (Q2a, 03 marks), W23 (Q2a, 03 marks)
 7. **Calculate stresses in thin cylindrical/spherical shells under internal pressure.**
 - Appeared in: S24 (Q2b, 04 marks), W23 (Q2b, 04 marks), W25 (Q5b, 04 marks)
 8. **Find change in dimensions/volume of thin cylinders/spheres under pressure.**
 - Appeared in: S23 (Q5b, 04 marks), W22 (Q4b, 04 marks), W23 (Q2c, 07 marks)
 9. **A three-hinged circular arch with given span and rise carries a point load. Find BM, thrust, shear.**
 - Appeared in: S22 (Q3c, 07 marks), W22 (Q2c, 07 marks)
 10. **A cable with UDL or point loads—find tension, reactions, or dip.**
 - Appeared in: S22 (Q3b, 04 marks)
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Unit 2: Strain Energy & Displacement of Statically Determinate Structures

(Strain Energy, Deflection Methods)

Repeated Questions:

1. **Define resilience, proof resilience, and modulus of resilience.**
 - Appeared in: S22 (Q1a, 03 marks), S24 (Q2a, 03 marks), W25 (Q2a, 03 marks), W22 (Q5a, 03 marks)
2. **Derive expression for strain energy due to impact / sudden loading.**
 - Appeared in: S23 (Q4b, 04 marks), W24 (Q2a, 03 marks)
3. **Find slope/deflection using Macaulay's method.**
 - Appeared in: S23 (Q3b, 04 marks), W22 (Q1c, 07 marks), W23 (Q2c, 07 marks), S24 (Q3c, 07 marks)
4. **Use Moment Area Method to find slope/deflection.**
 - Appeared in: S22 (Q2c, 07 marks), W25 (Q3c, 07 marks), W22 (Q4c, 07 marks), S23 (Q3c, 07 marks)
5. **Use Conjugate Beam Method to find slope/deflection.**
 - Appeared in: S22 (Q2c, 07 marks), W22 (Q2c, 07 marks), S23 (Q3c, 07 marks), W24 (Q4b, 04 marks)

Other Important Questions:

1. **Derive relation between slope, deflection, and radius of curvature.**
 - Appeared in: S22 (Q3b, 04 marks), W25 (Q3a, 03 marks)
 2. **Find strain energy stored in a bar under axial load / beam under bending.**
 - Appeared in: S22 (Q2c, 07 marks), W25 (Q2c, 07 marks)
 3. **Calculate instantaneous stress/elongation due to impact loading.**
 - Appeared in: S22 (Q2c, 07 marks), S24 (Q2c, 07 marks), W25 (Q2c, 07 marks), W23 (Q3c, 07 marks)
 4. **Explain gradual, sudden, and impact loads.**
 - Appeared in: W25 (Q2b, 04 marks)
 5. **Find deflection under point loads/UDL for simply supported/fixed beams.**
 - Appeared in: S22 (Q5c, 07 marks), W25 (Q3c, 07 marks)
 6. **Derive expression for strain energy due to flexure in beams.**
 - Appeared in: W22 (Q5b, 04 marks)
 7. **Prove max strain energy stored = $(\sigma^2/2E) \times \text{Volume}$.**
 - Appeared in: S22 (Q5a, 03 marks)
 8. **A cantilever beam with UDL/point load—find slope/deflection using double integration/Macaulay's method.**
 - Appeared in: S24 (Q3b, 04 marks), W23 (Q3b, 04 marks)
 9. **A simply supported beam with UDL/point loads—find slope at supports, deflection at center.**
 - Appeared in: S24 (Q3c, 07 marks), W23 (Q1c, 07 marks)
 10. **A beam with varying EI—find slope/deflection using moment area/conjugate beam method.**
 - Appeared in: S23 (Q3c, 07 marks), W25 (Q3c, 07 marks)
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Unit 3: Direct & Bending Stresses + Columns & Struts

(Eccentric Loading, Dams, Retaining Walls, Columns)

Repeated Questions:

1. **Define core/kernel of a section. Find kernel for rectangular/circular sections.**
 - Appeared in: S22 (Q4a, 03 marks), S24 (Q3a, 03 marks), W22 (Q4a, 03 marks), W24 (Q4a, 03 marks)
2. **Find max/min stresses in a short column under eccentric load.**
 - Appeared in: S24 (Q4c, 07 marks), S22 (Q1c, 07 marks), W23 (Q4c, 07 marks)
3. **Derive Euler's formula for crippling load for column with both ends hinged.**
 - Appeared in: S22 (Q2a, 03 marks), W25 (Q4b, 04 marks)
4. **State assumptions and limitations of Euler's formula.**
 - Appeared in: S22 (Q5a, 03 marks), W22 (Q4b, 04 marks), W24 (Q4b, 04 marks)
5. **Calculate crippling load using Rankine's formula.**
 - Appeared in: S22 (Q5c, 07 marks), W22 (Q3c, 07 marks), S24 (Q4c, 07 marks)

Other Important Questions:

1. **Differentiate between direct stress and bending stress.**
 - Appeared in: S22 (Q1a, 03 marks), W23 (Q5b, 04 marks)
 2. **Explain middle third rule and its importance in dam design.**
 - Appeared in: S23 (Q4a, 03 marks)
 3. **Discuss stability checks for a dam / retaining wall.**
 - Appeared in: S22 (Q2b, 04 marks), S22 (Q3a, 03 marks), S24 (Q4b, 04 marks), W23 (Q4c, 07 marks)
 4. **Calculate max/min pressure at base of masonry dam under water pressure.**
 - Appeared in: S22 (Q4c, 07 marks), S24 (Q2c, 07 marks), S22 (Q5c, 07 marks)
 5. **Find base width of dam for no-tension condition.**
 - Appeared in: S22 (Q4c, 07 marks)
 6. **A chimney under wind pressure—find max/min stress at base.**
 - Appeared in: W23 (Q4c, 07 marks), W22 (Q5c, 07 marks)
 7. **A retaining wall under earth/water pressure—check stability/overturning/sliding.**
 - Appeared in: S23 (Q4c, 07 marks), W23 (Q4c, 07 marks)
 8. **Differentiate between long and short columns.**
 - Appeared in: S24 (Q4a, 04 marks), W25 (Q4a, 03 marks), W22 (Q3a, 03 marks)
 9. **Find safe load/size of column using Euler's/Rankine's formula with given end conditions.**
 - Appeared in: S24 (Q4c, 07 marks), W24 (Q4c, 07 marks), W23 (Q5c, 07 marks)
 10. **A column with initial curvature / lateral loading—analyze behavior.**
 - Appeared in: W23 (Q5b, 04 marks)
 11. **A hollow circular column under eccentric load—find max/min stress and permissible eccentricity.**
 - Appeared in: W25 (Q4c, 07 marks), W24 (Q3b, 04 marks)
 12. **A rectangular pier under biaxial bending—find stresses at corners.**
 - Appeared in: S23 (Q4c, 07 marks), W22 (Q3c, 07 marks)
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Unit 4: Statically Indeterminate Beams

(Propped Cantilevers, Fixed Beams, Continuous Beams, Moment Distribution)

Repeated Questions:

1. **Find fixed end moments for a fixed beam under UDL / point load.**
 - Appeared in: S22 (Q2a, 03 marks), W22 (Q5a, 03 marks), S24 (Q5b, 04 marks)
2. **Analyze a propped cantilever beam using Consistent Deformation Method.**
 - Appeared in: S23 (Q5c, 07 marks), S22 (Q5c, 07 marks), W25 (Q5c, 07 marks), W22 (Q5c, 07 marks)
3. **State advantages/disadvantages of fixed beam over simply supported beam.**
 - Appeared in: S22 (Q4b, 04 marks), S22 (Q5a, 03 marks), W25 (Q5a, 03 marks), W24 (Q5a, 03 marks)
4. **Use Moment Distribution Method to analyze continuous beams.**
 - Appeared in: S24 (Q5c, 07 marks), W24 (Q5c, 07 marks)
5. **Define: Carry-over factor, stiffness, distribution factor.**
 - Appeared in: S24 (Q5a, 03 marks), W24 (Q4a, 03 marks)

Other Important Questions:

1. **Differentiate between fixed and simply supported beams.**
 - Appeared in: S22 (Q4b, 04 marks)
2. **Analyze a fixed beam under point loads / UDL—draw SFD & BMD.**
 - Appeared in: S22 (Q3c, 07 marks), S24 (Q5c, 07 marks)
3. **Find reactions of propped cantilever under central point load / UDL.**
 - Appeared in: W25 (Q5c, 07 marks), W23 (Q4b, 04 marks)
4. **A fixed beam with support settlement / rotation—find fixed end moments.**
 - Appeared in: S23 (Q5b, 04 marks), W24 (Q5c, 07 marks)
5. **Explain Consistent Deformation Method for indeterminate beams.**
 - Appeared in: S22 (Q5c, 07 marks)
6. **Draw SFD & BMD for fixed beam with central point load.**
 - Appeared in: S23 (Q3b, 04 marks)
7. **Analyze a beam with varying EI using Moment Distribution Method.**
 - Appeared in: S24 (Q5c, 07 marks)
8. **A fixed beam with UDL—find fixed end moments using area-moment method.**
 - Appeared in: S22 (Q5b, 04 marks), W22 (Q5b, 04 marks)
9. **A propped cantilever with UDL—analyze and draw SFD & BMD.**
 - Appeared in: S23 (Q5c, 07 marks)
10. **A continuous beam with support moments—find reactions and draw BMD.**
 - Appeared in: W24 (Q5c, 07 marks)
