GUJARAT TECHNOLOGICAL UNIVERSITY

BE 7 SEMESTER – OLD PAPER – SUMMER 2022 TO SUMMER 2026 – QUESTION BANK

Subject Name & Code: Design of Prestressed Concrete Structures - 3170624

Chapter 1 – Introduction

Repeated Questions:

1. Basic Principle of Prestressed Concrete:

- **Q.** What is the basic principle/concept of prestressed concrete? **(SUMMER 2022, 3 Marks; SUMMER 2023, 3 Marks; WINTER 2023, 3 Marks; SUMMER 2024, 3 Marks; SUMMER 2025, 4 Marks)**

2. High-Strength Concrete and High-Tensile Steel:

- **Q.** Justify why high-strength concrete and high-tensile steel are essential in prestressed concrete. / What is the need for the use of high strength concrete and tensile steel in prestressed concrete? **(WINTER 2022, 4 Marks; SUMMER 2025, 3 Marks OR; WINTER 2025, 3 Marks; SUMMER 2026, 3 Marks OR)**

3. Pre-tensioning vs Post-tensioning:

- **Q.** Compare Pre-tensioning and post-tensioning techniques of prestressed concrete. / Distinguish between Pre-tensioned and Post-tensioned Concrete members. **(SUMMER 2022, 4 Marks; SUMMER 2023, 4 Marks; SUMMER 2024, 4 Marks; WINTER 2024, 3 Marks OR; WINTER 2025, 4 Marks)**

4. Prestressed Concrete vs Reinforced Concrete:

- **Q.** Explain the differences of prestressed concrete over reinforced concrete. / Differentiate between prestressed concrete and reinforced concrete. **(WINTER 2024, 3 Marks; SUMMER 2025, 3 Marks; SUMMER 2026, 3 Marks)**

5. Basic Terms and Definitions:

- **Q.** Explain the terms: (1) Pretensioning (2) Tendon (3) Anchorage **(SUMMER 2023, 3 Marks; SUMMER 2024, 3 Marks; WINTER 2024, 3 Marks; SUMMER 2026, 3 Marks)**
- **Q.** Explain (1) Bonded Prestressed Concrete (2) Post-tensioning (3) Degree of Prestressing. / Define (1) Post-tensioning (2) Bonded Prestressed Concrete (3) Degree of Prestressing. **(SUMMER 2023, 3 Marks OR; SUMMER 2024, 3 Marks OR; WINTER 2024, 3 Marks; SUMMER 2026, 3 Marks)**

6. Tensioning Devices:

- **Q.** List the various types of tensioning device used in prestressed concrete. **(SUMMER 2022, 3 Marks; WINTER 2023, 4 Marks; WINTER 2024, 4 Marks; SUMMER 2026, 4 Marks)**

7. Advantages and Disadvantages of Prestressed Concrete:

- **Q.** State the advantages and disadvantages of Prestressed concrete. / Write advantages and disadvantages of prestressed concrete. **(SUMMER 2022, 4 Marks; WINTER 2022, 3 Marks; SUMMER 2023, 4 Marks; SUMMER 2024, 4 Marks)**

8. Types of Tendons and Prestressing:

- **Q.** Under what situations and types of structures would you recommend the use of unbonded tendons? **(SUMMER 2023, 3 Marks; SUMMER 2024, 3 Marks; SUMMER 2026, 4 Marks OR)**

Other Important Questions:

1. Applications and Post-tensioning Method:

- **Q.** What are the applications of prestressed concrete? **(WINTER 2022, 3 Marks)**

- **Q.** Explain the Post-tensioned method of prestressing concrete. **(SUMMER 2025, 3 Marks)**

2. Types of Tendons and Prestressing:

- **Q.** Distinguish between concentric and eccentric tendon. **(WINTER 2023, 4 Marks)**
- **Q.** What is non distortional prestressing? **(WINTER 2024, 4 Marks OR)**

3. Definitions of Prestressing Terms:

- **Q.** Define the following terms: Post-Tensioning, Tendon, Anchorage, Bonded Prestressed Concrete, Partial Prestressing, Eccentric Prestressing, Circular Prestressing. **(SUMMER 2025, 4 Marks)**

Chapter 2 – Losses in Prestress

Repeated Questions:

1. Types of Losses of Prestress:

- **Q.** Explain the various losses of prestress in post-tensioned members. / List the various types of loss of prestress in pre-tensioned and post-tensioned members. / Define the losses present in post-tensioned member. **(SUMMER 2022, 3 Marks; WINTER 2022, 3 Marks; SUMMER 2023, 4 Marks; WINTER 2023, 3 Marks; SUMMER 2024, 4 Marks; SUMMER 2026, 3 Marks)**

2. Immediate Losses vs Time-Dependent Losses:

- **Q.** Differentiate in detail between Immediate Losses and Time-Dependent Losses. / Explain difference between time dependent and immediate losses in prestressed concrete sections. **(SUMMER 2022, 3 Marks OR; WINTER 2024, 3 Marks; WINTER 2025, 7 Marks; SUMMER 2026, 4 Marks)**

3. Creep and Shrinkage:

- **Q.** Distinguish between creep and shrinkage. / Distinguish between creep and shrinkage losses of prestressed concrete. **(SUMMER 2022, 3 Marks OR; WINTER 2022, 3 Marks OR; SUMMER 2023, 3 Marks; SUMMER 2024, 3 Marks; SUMMER 2025, 4 Marks)**
- **Q.** Explain drying shrinkage strain and autogenous shrinkage strain. **(SUMMER 2022, 3 Marks OR; WINTER 2022, 3 Marks; SUMMER 2026, 3 Marks OR)**

4. Anchorage Slip:

- **Q.** What is anchorage slip? How do you compute the loss of stress due to anchorage slip? / Elaborate anchorage slip. How do you compute the loss of stress due to anchorage slip? **(SUMMER 2023, 4 Marks; SUMMER 2024, 4 Marks; WINTER 2024, 7 Marks OR)**

5. Loss Due to Elastic Deformation (Numerical):

- **Q.** A pre-tensioned concrete beam, 100 mm wide and 300 mm deep, is prestressed by straight wires carrying an initial force of 150 kN at an eccentricity of 50 mm. The modulus of elasticity of steel and concrete are 210 and 35 kN/mm² respectively. Estimate the percentage loss of stress in steel due to elastic deformation of concrete if the area of steel wires is 188 mm². **(SUMMER 2023, 7 Marks; SUMMER 2024, 7 Marks; SUMMER 2025, 7 Marks)**

6. Loss Due to Creep (Numerical):

- **Q.** A prestressed concrete beam 100 mm × 300 mm is post tensioned by the parabolic cable with an eccentricity of 50 mm at the center and concentric at the supports, prestressing force being 240 kN. Estimate the loss of prestress in cable due to the creep of concrete. Take the modular ratio as 6 and the creep coefficient as 3.0. **(SUMMER 2025, 7 Marks OR; WINTER 2025, 7 Marks)**
- **Q.** A post-tensioned concrete beam of rectangular section, 100 mm wide and 300 mm deep, is stressed by a parabolic cable with zero eccentricity at the supports and an eccentricity of 50 mm at the centre of span. The area of the cable is 200 mm² and initial stress in the cable is 1200 N/mm². If the ultimate creep strain is 30×10^{-6} mm/mm per N/mm² of stress and modulus of elasticity of steel is 210 kN/mm², compute the loss of stress in steel only due to creep of concrete. **(SUMMER 2023, 7 Marks; SUMMER 2024, 7 Marks)**

7. Elastic Deformation, Friction and Creep (Theory):

- **Q.** What is creep in prestressed concrete? What are the factors that affect creep of concrete? **(SUMMER 2022, 3 Marks OR; SUMMER 2023, 3 Marks OR; SUMMER 2024, 3 Marks OR)**

8. Loss Due to Shrinkage (Numerical):

- **Q.** A concrete beam is prestressed by a cable carrying an initial prestressing force of 300 kN. The cross-sectional area of the wires in the cable is 300 mm². Calculate the percentage loss of stress in the cable only due to shrinkage of concrete using IS: 1343 recommendations assuming the beam

to be, (a) pretensioned and (b) post-tensioned. Assume Es = 210 kN/mm² and age of concrete at transfer = 8 days. **(SUMMER 2023, 7 Marks OR; SUMMER 2024, 7 Marks OR)**

Other Important Questions:

1. Elastic Deformation, Friction and Creep (Theory):

- **Q.** Explain how to compute the loss of stress due to elastic deformation of concrete in post tensioned members with several cables which are successively tensioned? **(SUMMER 2026, 7 Marks OR)**
- **Q.** Post tensioned members do not suffer the loss of prestress due to elastic deformation, why? **(SUMMER 2026, 3 Marks)**
- **Q.** Enlist the formula for calculating losses due to Elastic deformation and Friction in prestressed concrete sections. **(WINTER 2024, 4 Marks)**

2. Loss Due to Elastic Deformation (Numerical):

- **Q.** A pretensioned beam 250 mm wide and 360 mm deep is prestressed by 10 wires of 8 mm dia. Initial stress to 1000 N/mm². The centroid of the steel wires is located at 105 mm from the soffit. Determine the max. stress in concrete immediately after transfer allowing elastic shortening of concrete only at the level of centroid of the steel. If however, the concrete is subjected to additional shortening due to the creep and shrinkage and the steel is subjected to relaxation of stress of 5% of initial stress. Find the final percentage of loss of stress in steel wires. Take Es = 210 kN/mm², Ec = 36.85 kN/mm², ϕ = 1.60, take residual shrinkage strain = 3×10^{-4}. **(WINTER 2022, 7 Marks)**
- **Q.** A rectangular concrete beam, 360 mm deep and 200 mm wide, is prestressed by means of fifteen 5 mm diameter wires located 65 mm from the bottom of the beam and three 5 mm wires, located 25 mm from the top of the beam. If the wires are initially tensioned to a stress of 840 N/mm², calculate the percentage loss of stress in steel immediately after transfer, allowing for the loss of stress due to elastic deformation of concrete only. Es = 210 kN/mm² & Ec = 31.5 kN/mm². **(WINTER 2023, 7 Marks)**
- **Q.** A rectangular concrete beam, 300 mm deep and 200 mm wide, is prestressed by means of 15 wires of 5 mm diameter located 65 mm from the bottom of the beam and 3 wires of 5 mm diameter, 25 mm from the top. Assuming the initial prestress in the steel as 850 N/mm², calculate the percentage loss of stress immediately after transfer, allowing for the loss of stress due to elastic deformation of concrete only. Take Es = 210 kN/m² and Ec = 31.5 kN/m². **(SUMMER 2022, 7 Marks)**

3. Loss Due to Creep (Numerical):

- **Q.** A concrete beam of rectangular section 100 mm wide and 300 mm deep is prestressed by 5 wires of 7 mm diameter located at an eccentricity of 50 mm. Initial stress in the wires are 1200 MPa. Estimate the loss of stress in steel due to creep of concrete using IS code method. **(SUMMER 2026, 7 Marks)**

4. Loss Due to Shrinkage (Numerical):

- **Q.** A concrete beam is prestressed by a cable with initial prestressing force of 300 kN. The cross sectional area of wires in the cable is 300 mm². Calculate the percentage loss of stress in the cable only due to shrinkage, if the beam is Pretensioned. Assume Es = 210 kN/mm². **(WINTER 2024, 7 Marks)**

5. Combined Losses of Prestress (Numerical):

- **Q.** A rectangular beam of size 300 × 600 mm is prestressed by 8 wires of 9 mm diameter with their centroid at 50 mm below the centroidal axis of the beam. Initial prestress = 2000 N/mm², fck = 50 N/mm², Es = 210 kN/mm², relaxation loss = 5%, creep coefficient = 1.6, Total shrinkage strain = 3×10^{-4}, Age of loading = 28 days, Relative humidity 60%. Calculate: (i) Loss of prestress due to elastic shortening of concrete (ii) Loss due to creep of concrete (iii) Loss due to shrinkage of concrete (iv) Loss due to relaxation of stress in steel. **(WINTER 2025, 7 Marks OR)**

Chapter 3 – Flexural Design of Prestressed Concrete Elements

Repeated Questions:

1. Flexural Failure Modes:

- **Q.** What are the different types of flexural failure modes observed in prestressed concrete beam? Explain with sketches. [Diagram required – refer to the original question paper] **(SUMMER 2022, 4 Marks OR; WINTER 2022, 4 Marks; SUMMER 2023, 3 Marks; WINTER 2023, 4 Marks; SUMMER 2024, 3 Marks; WINTER 2024, 4 Marks; WINTER 2025, 4 Marks)**

2. Strain Compatibility Method and Design Assumptions:

- **Q.** Explain the Strain Compatibility Method for determining the ultimate flexural strength of a prestressed concrete section. / State the assumptions made in the design of prestressed concrete members for the limit state of collapse in flexure. **(SUMMER 2022, 4 Marks; SUMMER 2022, 4 Marks OR; WINTER 2022, 4 Marks OR; SUMMER 2023, 3 Marks OR; SUMMER 2024, 3 Marks OR; WINTER 2024, 3 Marks; SUMMER 2025, 3 Marks; WINTER 2025, 3 Marks OR; SUMMER 2026, 4 Marks)**

3. End Block and Anchorage Zone:

- **Q.** Explain the terms: end block, anchorage zone. / Explain the phenomenon of bursting force that develops in the end block. / Explain stress distribution in the end block in the prestressed concrete beam. / Enumerate the requirements of end blocks in post-tensioned pre-stressed concrete element. **(SUMMER 2022, 7 Marks; WINTER 2022, 4 Marks; WINTER 2023, 4 Marks; SUMMER 2025, 4 Marks OR; WINTER 2025, 3 Marks; WINTER 2025, 7 Marks OR; SUMMER 2026, 7 Marks OR; SUMMER 2026, 7 Marks)**

4. Load Balancing, Pressure Line and Thrust Line:

- **Q.** Explain the concept of load balancing / pressure line / thrust line. How is it related to the Load Balancing Concept? **(WINTER 2022, 4 Marks; WINTER 2022, 3 Marks OR; WINTER 2023, 3 Marks; WINTER 2024, 4 Marks; WINTER 2025, 7 Marks; WINTER 2025, 3 Marks; SUMMER 2026, 4 Marks)**

5. Deflection of Prestressed Members:

- **Q.** List the factors influencing the short term and long-term deflections of prestressed concrete members. **(WINTER 2022, 4 Marks; WINTER 2025, 3 Marks)**

6. Composite Construction:

- **Q.** Explain the concept of composite construction using prestressed and in-situ concrete. / Enlist the advantages of composite construction with prestressed and in situ concrete for structural members. **(WINTER 2024, 7 Marks OR; SUMMER 2025, 7 Marks; WINTER 2025, 4 Marks OR; SUMMER 2026, 3 Marks OR)**

7. Flexural Strength as per IS 1343:

- **Q.** Explain the method of computing the flexural strength of rectangular and T-beam sections as per IS: 1343-2012. / Explain with sketch IS 1343 recommendations for computing the Moment of resistance of rectangular section. / Enlist the formula for calculation of Moment of resistance of Flanged sections as per IS 1343 recommendations. [Diagram required – refer to the original question paper] **(WINTER 2024, 7 Marks; WINTER 2025, 7 Marks; SUMMER 2026, 4 Marks)**

8. IS 1343 Provisions and Transmission Length:

- **Q.** Explain IS 1343 recommendations for design of prestressed members subjected to bending and torsion. **(WINTER 2022, 3 Marks; WINTER 2023, 3 Marks OR; WINTER 2024, 4 Marks)**
- **Q.** Explain transmission length in pre-tensioned members and what is expression of it as per IS 1343 recommendations. **(SUMMER 2022, 3 Marks; WINTER 2022, 3 Marks; SUMMER 2023, 4 Marks; SUMMER 2024, 4 Marks; WINTER 2024, 3 Marks; SUMMER 2026, 4 Marks)**

9. Flexural Strength (Numerical):

- **Q.** A Pretensioned prestressed concrete beam of rectangular section 150 mm wide and 350 mm deep has effective cover of 50 mm. If fck = 40 MPa, fp = 1600 MPa and Ap = 461 mm², Calculate ultimate flexural strength using IS code provisions. / A Pretensioned prestressed concrete beam having a rectangular section of 150 × 350 mm has an effective cover of 50 mm. If fck = 40 MPa, fp = 1600 MPa, Ap = 461 mm², calculate ultimate flexural strength of section. **(WINTER 2024, 7 Marks; SUMMER 2025, 7 Marks; SUMMER 2026, 7 Marks; SUMMER 2026, 7 Marks OR)**
- **Q.** A Pretensioned T section has a flange which is 300 mm wide and 200 mm thick. The rib is 150 mm wide by 350 mm deep. The effective depth of cross section is 500 mm. Ap = 200 mm², fck = 50 MPa and fp = 1600 MPa. Estimate ultimate moment capacity of the T section using IS code method. **(SUMMER 2025, 7 Marks OR; SUMMER 2026, 7 Marks)**
- **Q.** The cross-section of a symmetrical I-section prestressed beam is 300 mm by 700 mm (overall), with flange and web 100 mm thick. The beam is posttensioned by cables containing 40 wires of 5 mm diameter high-tensile steel wires at an eccentricity of 200 mm. The 28-days strength of concrete in compression is 40 N/mm². Assuming that the grouting of the tendons is 100 percent effective, determine the ultimate moment of resistance of the section using IS 1343 (2012) recommendations. **(SUMMER 2023, 7 Marks; SUMMER 2024, 7 Marks)**
- **Q.** A bonded prestressed concrete beam is of rectangular section of width 400 mm and overall depth 1200 mm. The tendons consisting of 3300 mm² of standard strands with characteristic strength of 1700 N/mm². The strands are located at 870 mm from the top face of the beam. The characteristic cube strength of concrete is 60 N/mm². Estimate the ultimate moment capacity of section using IS 1343 (2012) recommendations. **(SUMMER 2022, 7 Marks; SUMMER 2023, 7 Marks OR; SUMMER 2024, 7 Marks OR)**
- **Q.** A pretensioned T section has a flange 1200 mm wide and 150 mm thick. The width and depth of the rib are 300 mm and 1500 mm respectively. The high tensile steel has an area of 4700 mm² and is located at an effective depth of 1600 mm. Calculate the flexural strength of T section. (Assume fck = 40 N/mm², fp = 1600 N/mm² and use IS Code method) **(SUMMER 2023, 7 Marks; WINTER 2023, 7 Marks; WINTER 2023, 7 Marks OR; SUMMER 2024, 7 Marks)**

10. Design of Section for Prestressing Force and Eccentricity (Numerical):

- **Q.** An unsymmetrical I section having top flange 750 × 200 mm bottom flange 450 × 250 mm thickness of web 150 mm overall depth 1000 mm. If permissible tensile and compressive stress at transfer and working load are not to exceed zero in tension 15 N/mm² in compression. Determine P and e to resist self weight and applied moment 1012 kNm and 450 kNm. Assume loss of prestress 15%. **(WINTER 2022, 7 Marks; SUMMER 2023, 7 Marks OR; SUMMER 2024, 7 Marks OR)**

11. Deflection (Numerical):

- **Q.** A PSC beam of span 8 m has the following data: Area = 32 × 10³ mm², E = 38 kN/m², width of gyration 72 mm. Cable: parabolic, 6 wires of 7 mm HTS, concentric at supports and eccentric by 50 mm at mid span. Fpe = 1000 N/mm². Determine the deflection for the following cases: i) Self weight + Prestress ii) Self weight + Prestress + Live load of 3 kN/m **(WINTER 2022, 7 Marks OR; SUMMER 2023, 7 Marks OR; SUMMER 2024, 7 Marks OR)**

12. Pressure Line and Load Balancing (Numerical):

- **Q.** A PSC beam of 230 mm wide and 450 mm deep is used over an span of 4 m is pre stressed by a cable carrying a force of 650 kN & located at an eccentricity of 75 mm. The beam supports three concentrated loads of 25 kN at each quarter span points. Determine the location of the pressure line in beam at centre, quarter & support sections. Neglect the moment due to self weight of the beam. **(WINTER 2022, 7 Marks OR; SUMMER 2023, 7 Marks; SUMMER 2024, 7 Marks)**

Other Important Questions:

1. Tendon Profile and Reinforcement Ratio:

- **Q.** Discuss the effect of tendon profile on the deflection of the prestressed concrete beam. **(SUMMER 2025, 3 Marks OR)**
- **Q.** What is effective reinforcement ratio? In what way it influence the stress in tendons and the neutral axis depth at the limit state of collapse of prestressed concrete sections? **(WINTER 2024, 7 Marks)**
- **Q.** Explain the concordant profile. **(WINTER 2024, 4 Marks OR)**

2. Flexural Strength (Numerical):

- **Q.** A pre-tensioned T-section has a flange 1200 mm wide and 200 mm thick. The rib is 250 mm wide and 450 mm deep. The effective depth of cross section is 600 mm. The high tensile steel has an area of 800 mm². If the characteristic cube strength of concrete and tensile strength of steel is 50 and 1860 N/mm² respectively, calculate the flexural strength of the T-section. **(WINTER 2025, 7 Marks)**
- **Q.** A Post tensioned prestressed concrete T beam having a flange width of 1200 mm and flange thickness of 200 mm, thickness of web being 300 mm is prestressed by 2000 mm² at an effective depth of 1600 mm. If fck = 40 MPa, fp = 1600 MPa, Calculate ultimate flexural strength of unbonded T section assuming span/depth ratio as 20 and fpe = 1000 MPa. **(WINTER 2024, 7 Marks)**

3. Deflection (Numerical):

- **Q.** A rectangular concrete beam having section 150 × 450 mm is prestressed by a parabolic cable carrying initial prestressing force of 400 kN. The cable has an eccentricity of 100 mm at the center of span and is concentric at the supports. If span of the beam is 10 m and live load 4 kN/m, estimate short term deflection. Assuming E = 35 kN/mm² and creep coefficient is 2.0, loss of prestress = 15% of initial prestress after 6 months, estimate long term deflection at the center of the span, assuming that dead load and live loads are simultaneously acting after the release of prestress. **(WINTER 2025, 7 Marks)**
- **Q.** A concrete beam having a rectangular section 100 × 300 mm is prestressed by a parabolic cable with an initial prestressing force of 260 kN. The cable has an eccentricity of 50 mm at the centre and concentric at the supports. If the span of the beam is 12 m and subjected to a live load of 5 kN/m. Calculate the short term deflection at midspan. Assume Ec = 38 kN/mm², creep coefficient = 2, loss of prestress = 20%. Estimate the long-term deflection. **(WINTER 2022, 7 Marks)**

4. Pressure Line and Load Balancing (Numerical):

- **Q.** A prestressed rectangular concrete beam 200 mm wide and 600 mm deep is supporting a live load of 8 kN/m over a span of 8 m. Find the effective prestressing force in the parabolic cable having an eccentricity of 80 mm at the center of span and concentric at the supports. Case 1) In this beam the bending effect of the prestressing force is nullified by the imposed load for the mid span section, neglecting self weight of the beam. Case 2) if the resultant force due to self weight, LL and prestressing force is zero at the soffit of the beam at the center of span section. **(SUMMER 2026, 7 Marks)**
- **Q.** A rectangular prestressed beam of 150 × 300 mm is used over an effective span of 10 m. The cable is having with zero eccentricity at support and linearly varying to 50 mm at the center, carries a prestressing force of 500 kN. Find the magnitude of the concentrated load Q located at the center of the span, if the load counteracts the bending effect of the prestressing force. **(WINTER 2024, 7 Marks)**
- **Q.** A prestressed concrete beam of section 120 mm wide by 300 mm deep is used over an effective span of 6 m to support a uniformly distributed load of 4 kN/m, which includes the self-weight of the beam. The beam is prestressed by a straight cable carrying a force of 180 kN and

located at an eccentricity of 50 mm. Determine the location of the thrust-line in the beam and plot its position at quarter and central span sections. **(WINTER 2023, 7 Marks)**

- **Q.** A rectangular concrete beam 250 mm wide by 300 mm deep is prestressed by a force of 540 kN at a constant eccentricity of 60 mm. The beam supports a concentrated load of 68 kN at the centre of a span of 3 m. Determine the location of the pressure line at the centre, quarter span and support sections of the beam. Neglect the self-weight of the beam. **(WINTER 2023, 7 Marks OR)**
- **Q.** A simply supported prestressed concrete beam with a rectangular section 150 mm wide, 300 mm deep supports a uniformly distributed load of 4 kN/m, which includes the self-weight of the beam. The effective span of the beam is 5 m. The beam is concentrically prestressed by cable carrying a force of 180 kN. Locate the position of the pressure line in the beam. **(SUMMER 2022, 7 Marks OR)**
- **Q.** A beam of symmetrical I-section spanning 8 m has flange width of 150 mm and flange thickness of 80 mm respectively. The overall depth of the beam is 450 mm. Thickness of web is 80 mm. The beam is prestressed by a parabolic cable with an eccentricity of 150 mm at the centre of the span and zero at the supports. The Live Load on the beam is 3 kN/m. (1) Determine the effective force in the cable for balancing the Dead Load and Live Load on the beams (2) Calculate the shift of the pressure line from the tendon centre line. **(WINTER 2022, 7 Marks)**
- **Q.** A concrete beam with a single overhang is simply supported at A and B over a span of 8 m and overhang BC is 2 m. The beam is of size 300 × 900 mm and supports a UDL of live load of 3.52 kN/m over entire span in addition to self weight. Determine the profile of prestressing cable with effective force of 500 kN which can balance dead load and live load. **(WINTER 2024, 7 Marks)**

5. End Block and Bursting Force (Theory and Numerical):

- **Q.** If the end block of a post-tensioned concrete beam, with an overall square cross-section of side 400 mm, is subjected to a prestressing force of 500 kN through a square anchorage plate of side 120 mm. Calculate the bursting force as per IS 1343:2012. **(WINTER 2025, 7 Marks OR)**
- **Q.** Explain the method of computing bursting tension in an end block subjected to evenly distributed forces. **(SUMMER 2026, 7 Marks OR)**
- **Q.** Compute the bursting force and Design suitable anchorage zone reinforcement according IS 1343. The end block of size 200 mm wide and 300 mm deep is post tensioned with two Freyssinet anchorage each of 100 mm diameter with their centers located at 75 mm from the top and bottom of the beam. The force transmitted by each anchorage being 3000 kN. **(WINTER 2022, 7 Marks)**
- **Q.** Write a detail note on Bursting tensile forces according to IS 1343. The end block of a post-tensioned prestressed member is 550 mm wide and 550 mm deep. Four cables, each made up of 7 wires of 12 mm diameter strands and carrying a force of 1000 kN, are anchored by plate anchorages, 150 mm by 150 mm, located with their centres at 125 mm from the edges of the end block. The cable duct is of 50 mm diameter. fck is 45 N/mm². The cube strength of concrete at transfer is 25 N/mm². Permissible bearing stresses behind anchorages should conform with IS: 1343. The characteristic yield stress in mild steel anchorage reinforcement is 260 N/mm². Design suitable anchorages for the end block. **(WINTER 2023, 7 Marks)**
- **Q.** The end block of a post-tensioned prestressed concrete beam, 300 mm wide and 300 mm deep, is subjected to a concentric anchorage force of 832800 N by a Freyssinet anchorage of area 11720 mm². Design and detail the anchorage reinforcement for the end block. **(WINTER 2023, 7 Marks OR)**
- **Q.** Compute the bursting force and Design suitable anchorage zone reinforcement according IS 1343. The end block of size 200 mm wide and 300 mm deep is post tensioned with two Freyssinet anchorage each of 100 mm diameter with their centers located at 75 mm from the top and bottom of the beam. The force transmitted by each anchorage being 2000 kN. **(SUMMER 2022, 7 Marks OR)**

6. Slab Design (Numerical):

- **Q.** The floor slab for an auditorium of span 10 m is to be designed as a one-way prestressed concrete slab with parallel post-tensioned cables in each of which the force at transfer is 400 kN. The slab is required to support a uniformly distributed L.L of 26 kN/m² with compressive and tensile stress in concrete at any stage not exceeding 15 N/mm² and zero respectively. Design the suitable thickness for the slab and estimate the maximum horizontal spacing of the cables and their position at the mid-span section. Assume the prestress loss ratio as 0.75. **(WINTER 2022, 7 Marks OR)**
- **Q.** The floor slab for an auditorium of span 10 m is to be designed as a one-way prestressed concrete slab with parallel post-tensioned cables in each of which the force at transfer is 500 kN. The slab is required to support a uniformly distributed LL of 25 kN/m² with compressive and tensile stress in concrete at any stage not exceeding 15 N/mm² and zero respectively. Design the suitable thickness for the slab and estimate the maximum horizontal spacing of the cables and their position at the mid-span section. Assume the prestress loss ratio as 0.80. **(SUMMER 2022, 7 Marks OR)**

Chapter 4 – Shear and Torsional Strength Design

Repeated Questions:

1. Types of Cracks in Beams:

- **Q.** Distinguish between web shear, flexural and flexure-shear cracks in concrete beam with sketches. / Explain flexural, flexural-shear, and web shear cracks in the concrete beam with the sketches. [Diagram required – refer to the original question paper] **(WINTER 2022, 4 Marks OR; SUMMER 2023, 4 Marks; SUMMER 2024, 4 Marks; WINTER 2024, 4 Marks; SUMMER 2025, 3 Marks; WINTER 2025, 3 Marks OR; SUMMER 2026, 7 Marks)**

2. Shear Strength as per IS 1343:

- **Q.** Explain the procedure for calculating shear capacity of cracked and uncracked sections in prestressed concrete beams as per IS 1343:2012. / Write a note on the computation of the ultimate shear resistance of the prestressed concrete section when the section is cracked, and uncracked in flexure. / Explain IS 1343 recommendations for design of prestressed members subjected to shear. / Explain the provision of the design of shear reinforcement as per the IS:1343-2012. **(SUMMER 2022, 4 Marks OR; WINTER 2023, 4 Marks OR; WINTER 2024, 3 Marks OR; SUMMER 2025, 4 Marks OR; SUMMER 2025, 7 Marks; WINTER 2025, 4 Marks OR)**

3. Torsion in Prestressed Concrete:

- **Q.** What is the effect of torsion on prestressed concrete sections? How do you compute the shear stressed developed in different types of cross sections due to torque? / Explain the modes of failure in prestressed concrete beams subjected to combined bending, shear and torsion. **(SUMMER 2025, 3 Marks OR; WINTER 2025, 3 Marks OR; SUMMER 2026, 7 Marks OR)**

4. Combined Bending, Shear and Torsion:

- **Q.** Explain the procedure as per the IS 1343:2012 for designing a rectangular RC beam subjected to combined bending, shear, and torsion. / Explain the reinforcement provisions for resisting combined shear, torsion, and bending stresses in prestressed concrete according to IS:1343-2012. **(SUMMER 2025, 7 Marks OR; WINTER 2025, 7 Marks OR)**

5. Shear Resistance and Shear Cracks (Theory):

- **Q.** Briefly explain failure due to flexure-shear cracks with neat sketch. / Explain web shear cracks with neat sketch. Discuss briefly the basic of Indian standard IS: 1343 code recommendations regarding the design of prestressed section subjected to shear. [Diagram required – refer to the original question paper] **(WINTER 2023, 3 Marks OR; WINTER 2023, 4 Marks OR)**

Other Important Questions:

1. Shear Resistance and Shear Cracks (Theory):

- **Q.** What are the different ways of improving the shear resistance of structural concrete members by prestressing techniques? **(WINTER 2023, 4 Marks)**
- **Q.** Briefly explain failure due to web-shear cracks with neat sketch. [Diagram required – refer to the original question paper] **(WINTER 2023, 3 Marks)**

2. Shear Reinforcement Design (Numerical):

- **Q.** The support section of a prestressed concrete beam, 200 mm wide by 400 mm deep is required to support an ultimate shear force of 180 kN. The compressive prestress at the centroid axis is 6 N/mm². The characteristic cube strength of concrete is 50 N/mm², the cover to reinforcement is 40 mm. If the characteristic tensile strength of stirrups is 500 N/mm², design suitable shear reinforcement in the section as per the IS: 1343-2012. **(WINTER 2025, 7 Marks OR)**
- **Q.** The support section of a prestressed concrete beam, 100 mm wide and 250 mm deep, is required to support an ultimate shear force of 60 kN. The compressive prestress at the centroidal axis is 5 N/mm². The characteristic cube strength of concrete is 40 N/mm². The cover to the tension reinforcement is 50 mm. If the characteristic tensile strength of steel in stirrups is 250

N/mm², design suitable reinforcements at the section using the IS: 1343 recommendations. **(WINTER 2023, 7 Marks OR)**

3. Principal Tensile Stress (Numerical):

- **Q.** A prestressed concrete beam span 12 m of rectangular section 200 mm wide and 450 mm deep is axially prestressed by a cable carrying an effective force of 350 kN. The beam supports total udl of 7 kN/m including self-weight. Compare the magnitude of principal tensile stress in the beam with and without axial prestress. **(WINTER 2025, 7 Marks)**
- **Q.** A prestressed concrete beam spans 10 m of rectangular section 120 mm wide and 300 mm deep and is axially prestressed by a cable carrying an effective force of 180 kN. The beam supports a total udl of 5 kN/m including self-weight. Compare the magnitude of the principal tensile stress in the beam with and without axial prestress. **(SUMMER 2025, 7 Marks)**

4. Combined Bending and Torsion (Numerical):

- **Q.** A post-tensioned bonded prestressed concrete beam of rectangular cross-section, 400 mm wide by 550 mm deep, is subjected to an ultimate bending moment of 250 kNm, ultimate torsional moment of 70 kNm and ultimate shear force of 100 kN. The section has an effective prestressing force, determined from service load requirements, of magnitude 500 kN at an eccentricity of 150 mm, provided by 5 numbers of 12.5 mm stress-relieved strands of cross-sectional area 506 mm² with an ultimate tensile strength of 1820 N/mm². If the cube strength of concrete is 40 N/mm², design suitable longitudinal reinforcements in the beam using IS: 1343 code recommendations based on the skew bending approach. **(WINTER 2023, 7 Marks)**

Chapter 5 – Prestressed Compression and Tension Members

Repeated Questions:

1. Types of Prestressed Tension and Compression Members:

- **Q.** List various types of prestressed tension and compression members. / Enlist various tension members of prestressed concrete and explain the elastic design of prestressed tension member. / Explain various types of prestressed compression members. **(WINTER 2023, 3 Marks; SUMMER 2025, 3 Marks; WINTER 2025, 3 Marks OR; WINTER 2025, 4 Marks)**

2. Stresses in Short Prestressed Columns:

- **Q.** Write the stress equations for a short prestressed concrete column at transfer and service load conditions. Define all the terms used. / Describe the stresses that occur in a short prestressed concrete column during the transfer stage and under service conditions. **(SUMMER 2025, 7 Marks OR; WINTER 2025, 4 Marks OR)**

3. Fundamental Conditions for Stresses:

- **Q.** State the four fundamental conditions for stresses at transfer and service stage. **(SUMMER 2022, 4 Marks; SUMMER 2026, 4 Marks OR)**

Other Important Questions:

1. IS 1343 Permissible Stresses:

- **Q.** Briefly explain IS 1343 codal provision for limit state of serviceability for Maximum Compression. **(WINTER 2023, 4 Marks OR)**
- **Q.** Discuss the maximum allowable compressive stress limits in flexure due to prestressing at both the service stage and transfer stage for posttensioned and pre-tensioned members, as per IS:1343-2012. **(SUMMER 2025, 4 Marks)**

2. Stresses in Beams (Numerical):

- **Q.** A prestressed concrete beam has a rectangular cross-section of 500 × 800 mm and a span of 12 meters. It carries a uniformly distributed load of 25 kN/m, which includes its own self-weight. The beam is axially prestressed by a cable providing an effective force of 2000 kN, applied along the longitudinal centroidal axis. Determine the extreme fiber stresses in the concrete at the mid-span section. **(WINTER 2025, 3 Marks)**
- **Q.** A simply supported prestressed concrete beam with 10 m span and a rectangular section of 600 × 900 mm is subjected to prestressing force of 5600 kN applied at an eccentricity of 200 mm below the centroid of the section. Find top and bottom fibre stresses at transfer and after application of live load 80 kN/m. Consider losses 15%. Draw stress distribution diagram at mid span for stresses at transfer stage and at the service stage. [Diagram required – refer to the original question paper] **(SUMMER 2025, 7 Marks OR)**

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