(b) A pre-stressed girder of rectangular section 150 mm wide by 300 mm deep is to be designed to support an ultimate shear force of 130 kN. The uniform pre-stress across the section is 5 $N/mm^2$. Given the characteristic cube strength of concrete as 40 $N/mm^2$ and Fe-415 HYSD bars of 8 mm diameter, design suitable spacing for the stirrups conforming to the IS:1343 recommendations. Assume cover to the reinforcement as 50 mm. (8M) CO3

UNIT – IV

8. (a) Discuss IS: 1343 code provisions regarding bond and transmission length. (6M) CO4

(b) A pre-stressed beam of rectangular section, 200 mm wide by 500 mm deep is pre-tensioned by five high-tensile wires of 7 mm diameter located at an eccentricity of 150 mm. The maximum shear force at quarter span section is 200 kN. If the modular ratio as 6, compute the bond stress developed assuming (i) section is uncracked (ii) section is cracked. (8M) CO4

(OR)

9. (a) Describe the typical tensile stress distribution in an end block of a post-tensioned beam with single anchorage. (7M) CO4

(b) The end block of a post-tensioned beam is 80 mm wide and 160 mm deep. A pre-stressing wire, 7 mm in diameter, stressed to 1200 $N/mm^2$ has to be anchored against the end block at the centre. The anchorage plate is 50 mm x 50 mm. The wire bears on the plate through a female cone of 20 mm diameter. Given the permissible stress in concrete at transfer, $f_{ci}$ as 20 $N/mm^2$ and the permissible shear in steel as 94.5 $N/mm^2$, determine the thickness of anchorage plate. (7M) CO4

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**CE412(CEEL10) (R20)**

## B.TECH. DEGREE EXAMINATION, DECEMBER-2024

Semester VII [Fourth Year] (Regular & Supplementary)

## PRESTRESSED CONCRETE

Time: Three hours Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:

(a) State the basic principle of pre-stressed concrete. CO1

(b) State the minimum concrete strength requirements for pre-stressed concrete members as per IS:1343 code. CO1

(c) Write any two differences between post-tensioned and pre-tensioned concrete members. CO1

(d) Define tendon splices. CO1

(e) Define the load balancing in pre-stressed concrete members. CO1

(f) List the various factors influencing the loss of stress due to creep of concrete. CO2

(g) Define Anchorage slip. CO2

(h) Define the long-term deflection of pre-stressed concrete beams. CO2

(i) List out various types of flexural failure modes in pre-stressed concrete beams. CO3

(j) Define effective reinforcement ratio. CO3

(k) Write any two ways of improving the shear resistance of structural concrete members by pre-stressing techniques. CO3

(l) Define transmission length. CO4

(m) List out any two methods used for investigation of anchorage zone stress. CO4

(n) Define flexural bond stresses. CO4

UNIT – I

2. (a) Explain the analysis of pre-stress for concentric and eccentric tendons along with their assumptions. (6M) CO1

(b) A pre-stressed concrete beam of section 200 mm wide by 300 mm deep is used over an effective span of 6 m to support an imposed load of 4 kN/m. The density of concrete is 24 $kN/m^3$. At the centre-of-span section of the beam, determine the magnitude of (8M) CO1

(i) The concentric pre-stressing force necessary for zero fibre stress at the soffit when the beam is fully loaded.

(ii) The eccentric pre-stressing force located 100 mm from the bottom of the beam which would nullify the bottom fibre stresses due to loading.

(OR)

3. An unsymmetrical I-section beam is used to support an imposed load of 2 kN/m over a span of 8 m. The sectional details are top flange, 300 mm wide and 60 mm thick; bottom flange, 100 mm wide and 60 mm thick; thickness of web = 80 mm; overall depth of the beam = 400 mm. At the centre of span, the effective pre-stressing force of 100 kN is located at 50 mm from the soffit of the beam. Calculate the stresses at the centre-of-span section of the beam for the following conditions: CO1

(i) Pre-stress + self-weight

(ii) Pre-stress + self-weight + live load

UNIT – II

4. (a) Explain various factors affecting deflections of pre-stressed concrete members. (6M) CO2

(b) A pre-tensioned concrete beam of rectangular cross section, 150 mm wide and, 300 mm deep, is pre-stressed by eight high tensile wires of 7 mm diameter located at 100 mm from the soffit of a beam. If the wires are tensioned at a stress of



1100 $N/mm^2$, calculate the percentage loss of stress due to elastic deformation assuming the modulus of elasticity of concrete and steel as 31.5 and 210 $kN/mm^2$ respectively. (8M) CO2

(OR)

5. A pre-stressed concrete beam of rectangular section, 120 mm wide and 300 mm deep, spans over 6 m. The beam is pre-stressed by a straight cable carrying an effective force of 180 kN at an eccentricity of 50 mm. If it supports an imposed load of 4 kN/m and the modulus of elasticity of concrete is 38 $kN/mm^2$, compute the deflection at the following stages and check whether they comply with the IS code recommendations: CO2

(i) Upward deflection under (pre-stress + self-weight)

(ii) Final downward deflection under (pre-stress + self-weight + imposed load)

Including the effects of creep and shrinkage. Assume the creep coefficient to be 1.80.

UNIT – III

6. (a) Explain with sketches the IS: 1343 code method of computing the moment of resistance of rectangular sections. (7M) CO3

(b) A post-tensioned pre-stressed concrete Tee beam having a flange width of 1200 mm and flange thickness of 200 mm, thickness of web being 300 mm is pre-stressed by 2000 $mm^2$ of high tensile steel located at an effective depth of 1600 mm. If $f_{ck}$ = 40 $N/mm^2$ and $f_p$ = 1600 $N/mm^2$, calculate the ultimate flexural strength of the unbounded tee section, assuming span/depth ratio as 20 and $f_{pe}$ = 1000 $N/mm^2$. (7M) CO3

(OR)

7. (a) Describe the following: (6M) CO3

(i) web-shear crack (ii) flexural crack (iii) flexural-shear crack.

section is 5 $N/mm^2$. Given the characteristic cube strength of concrete as 40 $N/mm^2$ and Fe-415 HYSD bars of 8 mm diameter, design suitable spacing for the stirrups conforming to the Indian standard code IS:1343 recommendations. Assume cover to the reinforcement as 50 mm. (7M) CO3

UNIT – IV

8. A pre-tensioned beam of 8 m span has a symmetrical I-section. The flanges are 200 mm wide and 60 mm thick. The web thickness is 80 mm and the overall depth of girder is 400 mm. The member is prestressed by 8 wire of 5 mm diameter located on the tension side such that the effective eccentricity is 90 mm. The initial stress in the wires is 1280 $N/mm^2$ and the cube strength of concrete at transfer is 42 $N/mm^2$. CO4
   (i) Determine the maximum vertical tensile stress developed in the transfer zone and
   (ii) Design suitable mild steel reinforcement, assuming the permissible stress in steel as 140 $N/mm^2$

(OR)

9. (a) The end block of a prestressed concrete girder is 200 mm wide and 300 mm deep. The beam is post-tensioned by two Freyssinet anchorages each of 100 mm diameter with their centres located at 75 mm from the top and bottom of the beam. The force transmitted by each anchorage being 2000 kN. Compute the bursting force and design suitable reinforcement according to the Indian standards code IS:1343 code provisions. (7M) CO4
   (b) Explain the terms (i) End Block (ii) Anchorage Zone and (iii) Bursting tension with reference to post-tensioned prestressed members. (7M) CO4

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Hall Ticket Number:

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**CE314(CEEL10) (R20)**

## B.TECH. DEGREE EXAMINATION, JUNE-2023

Semester V [Third Year] (Supplementary)

## PRESTRESSED CONCRETE

Time: Three hours Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) The grade of concrete for prestressed members should be in the range of_______. CO1
   (b) Uniformly distributed load on a concrete beam can be effectively counter balanced by selecting______. CO1
   (c) Distinguish between creep and shrinkage of concrete. CO1
   (d) What are tendons? How are they used in prestressing systems? CO2
   (e) In a pretensioned beam, there will be loss of stress due to_______. CO2
   (f) Maximum permissible final deflection of a beam should not exceed_______. CO2
   (g) The maximum effective reinforcement ratio of a bonded prestressed concrete beam at failure according to IS: 1343 is limited to a value of_______. CO3
   (h) The spacing of stirrups in a prestressed beam should not exceed_______. CO3
   (i) Write the formula for the calculation of minimum pre stressing force in the PSC members. CO3
   (j) Minimum section modulus depends on_______. CO4
   (k) Transfer of prestress in pretensioned members is due to_________. CO4
   (l) Define bond stress. CO4
   (m) The transmission length according to the Indian standard code IS:1343 :2012 is_________. CO4
   (n) The bursting tension in the anchorage zone is a function of the ratio of_________. CO4

UNIT – I

2. (a) Explain the Freyssinet system of prestressing and advantages of prestressing. (7M) CO1

   (b) Discuss why high-grade concrete and high strength steel are basic requirements for a PSC member. (7M) CO1

(OR)

3. A rectangular concrete beam of cross section 30 cm deep and 20 cm wide is prestressed by means of 15 wires of 5 mm diameter located 6.5 cm from the bottom of the beam and 3 wires of diameter of 5 mm, 2.5 cm from the top. Assuming the prestress in the steel as 840 $N/mm^2$, calculate the stresses at the extreme fibers of the mid-span section when the beam is supporting its own weight over a span of 6 m. If a uniformly distributed live load of 6 kN/m is imposed, evaluate the maximum working stress in concrete. The density of concrete is 24 $kN/m^3$. CO1

UNIT – II

4. (a) A pretensioned concrete beam of rectangular cross section, 150 mm wide and, 300 mm deep, is prestressed by 8 high tensile wires of 7 mm diameter located at 100 mm from the soffit of the beam. If the wires are tensioned to a stress of 1100 $N/mm^2$, calculate the percentage loss of stress due to elastic deformation assuming the modulus of elasticity of concrete and steel as 31.5 and 210 $kN/mm^2$. (7M) CO2

   (b) Explain different type of losses in pretension and post tension. (7M) CO2

(OR)

5. A prestressed concrete beam of rectangular section 120 mm wide by 300 mm deep, spans over 6 m. The beam is prestressed by a straight cable carrying an effective force of 200 kN at an eccentricity of 50 mm. The modulus of elasticity of concrete is 38 $kN/m^2$. CO2

   (i) Deflection under (prestress + self-weight)

   (ii) Find th magnitude of the uniformly distributed live load which will nullify the deflection due to prestress and self-weight.

UNIT – III

6. (a) A pretensioned prestressed concrete beam having a rectangular section, 150 mm wide and 350 mm deep, has an effective cover of 50 m. If $f_{ck} = 40$ $N/mm^2$, $f_{pu} = 1600$ $N/mm^2$, and the area of prestressing steel $A_p = 461$ $mm^2$, estimate the flexural strength of the section using the Indian standard specifications. (7M) CO3

   (b) Derive an expression for minimum section modulus in terms of dead and live load moments, loss ratio and range of stress. (7M) CO3

(OR)

7. (a) A pretensioned beam 80 mm wide and 120 mm deep, is to be designed to support working loads of 4 kN, each concentrated at the third points over a span of 3 m. If the permissible stresses in tension are zero at transfer and 1.4 $N/mm^2$ under working loads, design the number of 3 mm wires and the corresponding eccentricity required at the mid span section. Permissible tensile stress in wires is 1400 $N/mm^2$. The loss of percentage is 20% and the density of concrete is 24 $kN/m^3$. (7M) CO3

   (b) A prestressed girder of rectangular section 150 mm wide and 300 mm deep, is to be designed to support an ultimate shear force of 130 kN. The uniform prestress across the and magnitude of the maximum tensile stress on the horizontal section through the centre and edge of the anchor plate. Compute the bursting tension on the horizontal planes using Magnel method. CO4

(OR)

9. Calculate the position and magnitude of the maximum tensile stress and the bursting tension on the horizontal planes using Guyon's method. The end block of a prestressed concrete beam, rectangular in section is 150 mm wide and 250 mm deep. A concentric anchor force of 100 kN is transmitted to concrete by a distribution plate, 100 mm wide and 50 mm deep, concentrically located at the ends. CO4

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**CE314(CEEL10) (R20)**



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**CE314(CEEL10) (R20)**

B.TECH. DEGREE EXAMINATION, MARCH-2023

Semester V [Third Year] (Regular)

# PRESTRESSED CONCRETE

Time: Three hours Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   - (a) Define transmission length. CO1
   - (b) Differentiate between pre-tensioning and post-tensioning method. CO1
   - (c) What are the disadvantages of prestressed concrete? CO1
   - (d) How tendons are used in prestressing system? CO2
   - (e) How frictional loss happens in prestressing system? CO2
   - (f) What is short and long term deflection? CO2
   - (g) What type of stresses is induced in a concrete when the tendons are placed eccentrically? CO3
   - (h) What type of cable will effectively counter balance the uniformly distributed load on a concrete beam? CO3
   - (i) Define anchorage slip. CO3
   - (j) Define bond stress. CO4
   - (k) What are the methods of analysis of anchorage stress? CO4
   - (l) Draw the forces on the end block of a pre-tensioned prestressed concrete member for single anchor plate. CO4
   - (m) How do you compute bursting tension? CO4
   - (n) Mention two methods of improving the bond strength of tendon in a pretensioned prestressed member. CO4

UNIT – I

2. (a) Explain the basic concept of pre-stressed concrete with examples? Compare any two types of pre-stressing. (7M) CO1
   (b) Discuss the necessity of high strength concrete and high tensile steel in the prestressed concrete than in reinforced cement concrete structures. (7M) CO1

(OR)

3. A rectangular concrete beam of cross-section 200 mm x 300 mm is pre–stressed by means of 10 wires of 5 mm diameter located at 60 mm from the soffit of the beam and 5 number of 5 mm diameter wires located at 25 mm from the top. Assuming the pre–stress in the steel as 850 N/mm$^2$, calculate the stresses at the extreme fibres of the mid-span section when the beam is supporting its own weight over a span of 8 m. Assume the live load as 6 kN/m is imposed. CO1

UNIT – II

4. A post-tensioned concrete beam, 100 mm wide and 300 mm deep, spanning over 10 m is stressed by successive tensioning and anchoring of three cables 1, 2 and 3, respectively. The cross-sectional area of each cable is 200 mm$^2$ and the initial stress in the cable is 1200 N/mm$^2$, $\alpha_e = 6$. The first cable is parabolic with an eccentricity of 50 mm below the centroidal axis at the centre of span and 50 mm above the centroidal axis at the support sections. The second cable is parabolic with zero eccentricity at the supports and an eccentricity of 50 mm at the centre of the span. The third cable is straight with a uniform eccentricity of 50mm below the centroidal axis. Estimate the percentage loss of stress in each of the cables, if they are successively tensioned and anchored. CO2

(OR)

5. A simply supported beam with uniform section spanning over 6 m is post-tensioned by two cables, both of which have an eccentricity of 100 mm below the centroid of the section at mid-span. The first cable is parabolic and is anchored at an eccentricity of 100 mm above the centroid at each end, the second cable is straight and parallel to the line joining the supports. The cross-sectional area of each cable is 100 mm$^2$ and they carry an initial prestress of 1200 N/mm$^2$. The concrete has a cross-section of 2 x 10$^4$ mm$^2$ and a radius of gyration of 120 mm. The beam supports a concentrated load of 20 kN at the mid-span and modulus of elasticity of concrete is 38 kN/mm$^2$. Calculate CO2
   (i) The instantaneous deflection at the centre of the span.
   (ii) The deflection at the centre of span after 2 years assuming 20 percent loss in prestress and the effective modulus of elasticity to be one third of the short-term modulus of elasticity.



UNIT – III

6. (a) A pretensioned prestressed concrete beam of rectangular section is required to support a design ultimate moment of 100 kNm. Design the section if $f_{ck}$ is 50 N/mm$^2$ and $f_p$=1600 N/mm$^2$. (7M) CO3
   (b) A post-tensioned bonded beam of unsymmetrical I-section is required to support a design ultimate moment of 1200 kNm. Determine the overall depth and the thickness of the compression flange required if $f_{ck}$ is 35 N/mm$^2$ and $f_p$= 1500 N/mm$^2$. (7M) CO3

(OR)

7. A prestressed girder of rectangular section 200 mm wide by 400 mm deep is to be designed to support an ultimate shear force of 150 kN. The uniform prestress across the section is 5 N/mm$^2$. Given the characteristic cube strength of concrete as 40 N/mm$^2$ and Fe-415 HYSD bars of 8 mm diameter, design suitable spacing for the stirrups confirming to the Indian Standard Code IS 1343 recommendations. Assume cover to the reinforcement as 50 mm. CO3

UNIT – IV

8. The end block of a prestressed concrete beam, rectangular in section is 100 mm wide and 200 mm deep. The prestressing force of 100 kN is transmitted to concrete by a distribution plate, 100 mm wide and 50 mm deep, concentrically located at the ends. Calculate the position