VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK

VII SEMESTER

CE6702 - PRESTRESSED CONCRETE STRUCTURES

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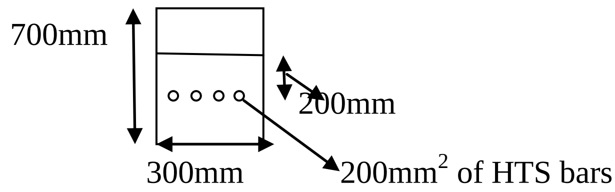
SUBJECT: CE 6702 PRESTRESSED CONCRETE STRUCTURES
SEM / YEAR: VII / IV

UNIT I INTRODUCTION – THEORY AND BEHAVIOUR			
Basic concepts – Advantages – Materials required – Systems and methods of prestressing – Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons – Effect of tendon profile on deflections – Factors influencing deflections – Calculation of deflections – Short term and long term deflections – Losses of prestress – Estimation of crack width.			
Part A			
Q. No	**Content**	**BT**	**Competence**
1.	Why high Tensile steel is needed for prestressed concrete construction.	BT 1	Remembering
2.	Identify the different ways of improving the shear resistance of structural concrete members by prestressing technique.	BT 1	Remembering
3.	List down the various factors that influence the deflections of PSC members.	BT 1	Remembering
4.	What are the advantages of the PSC construction?	BT 1	Remembering
5.	What is the need for the use of high strength concrete and tensile steel in prestressed Concrete?	BT 1	Remembering
6.	What is meant by cracking moment?	BT 1	Remembering
7.	Illustrate the load balancing concept.	BT 2	Understanding
8.	Explain the permissible limit for shrinkage of concrete in pretensioned and post tensioned members as per IS code?	BT 2	Understanding
9.	Outline Pressure Line.	BT 2	Understanding
10.	Explain the losses of prestress.	BT 2	Understanding
11.	Identify the Kern Zone.	BT 3	Applying
12.	Calculate the loss due to anchorage slip.	BT 3	Applying
13.	Choose the grades of concrete to be used in pre tensioned and post tensioned works?	BT 3	Applying
14.	Examine the loss due to shrinkage is more for pretensioned member than post tensioned member?	BT 4	Analyzing
15.	Compare the bonded and unbounded prestressing concrete.	BT 4	Analyzing
16.	How prestressed concrete structures are classified under the limit state of serviceability	BT 4	Analyzing
17.	Explain the Prestressed concrete.	BT 5	Evaluating

18.	When loss due to elastic shortening can be ignored for post tensioned beam?	BT 5	Evaluating
19.	Compare the advantages of pretensioned concrete over post tensioned concrete?	BT 6	Creating
20.	Discuss the mild steel cannot be used for prestressing?	BT 6	Creating
PART B			
1.	A prestressed concrete beam of span 8 m having a rectangular section 150 mm x 300 mm. The beam is prestressed by a parabolic cable having an eccentricity of 75 mm below the centroid axis at the centre of span and an eccentricity of 25 mm above the centroid axis at support section. The initial force in the cable is 350 kN. The beam support three concentrated loads of 10 kN each at intervals of 2m. Ec = 38 kN/mm^2. 1. Neglecting losses of prestress, estimate the short term deflection due to (prestress + self weight). 2. Allowing for 20 % loss in prestress, estimate long term deflection under (prestress + self weight +live load), assume creep co-efficient as 1.80.	BT1	Remembering
2.	A rectangular concrete beam 150mm wide & 300mm deep used for an effective span of 10m. The cable with zero eccentricity at the supports and linearly varying to 50mm at the center carries an effective prestressing force of 500kN. Find the magnitude of the concentrated load located at the centre of the span for the following conditions at the centre of the span section: 1. If the load counteracts the bending effects of the prestressing force (neglecting self weight of beam). 2. If the pressure line passes through the upper kern of the section under the action of the external load, self weight and prestress.	BT 1	Remembering
3.	A prestressed concrete beam, 200mm wide and 300mm deep is used for an effective span of 6m to support an imposed load of 4kN/m. the density of concrete is $24kN/m^3$. Find the magnitude of the eccentric prestressing force located at 100mm from the bottom of the beam which would nullify the bottom fiber stress due to loading.	BT 1	Remembering
4.	A PSC beam of 120mm wide and 300mm deep is used over an span of 6m is prestressed by a straight cable carrying a force of 200kN & located at an eccentricity of 50mm. E_c= 38 kN/mm^2. (i) Find the deflection at centre span Under prestress + self weight (ii) Find the magnitude of live load udl which will nullify the	BT 2	Understanding

	deflection due to prestress & self weight.		
5.	Explain the systems and methods of prestressing with neat sketches.	BT 2	Understanding
6.	A rectangular concrete beam 100mm wide & 250mm deep spanning over 8m is prestressed by a straight cable carrying a effective prestressing force of 250kN located at an eccentricity of 40mm. The beam supports a live load of 1.2 kN/m. (i).Calculate the resultant stress distribution for the centre of the span cross section of the beam assuming the density of concrete as 24kN/m^2. (ii).Find the magnitude of prestressing force with an eccentricity of 40mm which can balance the stresses due to dead load & live load at the soffit of the centre span section.	BT 3	Applying
7.	A PSC beam with a rectangular section of 120mm wide and 300mm deep is stressed by a straight cable carrying an effective span of 200kN. The cable is straight with a uniform eccentricity of 50mm, if the beam has an uniformly distributed load of 6km/m. Ec = 38 kN /mm^2. Eccentricity used over an span of 6m is prestressed by a straight cable carrying a force of 200 kN & located at an eccentricity of 50mm. Ec = 38 kN/mm^2. Estimate the deflection at the centre of span for the following case: (i) Prestress + self weight of the beam (ii)Prestress + self weight of the beam + live load.	BT 3	Applying
8.	A pretensioned beam 200 mm x 300 mm is prestressed by 10 wires each of 7 mm diameter, initially stressed to 1200 MPa with their centroids located 100 mm from the soffit. Identify the final percentage loss of stress due to elastic deformation, creep, shrinkage and relaxation. Assume relaxation of steel stress = 60 MPa. E_s = 210 GPA, E_c = 36.9 GPa, creep co-efficient = 1.6 and residual shrinkage strain = 3 X10^{-4}.	BT 3	Applying
9.	A PSC beam supports an imposed load of 5kN/m over a span of 10m.The beam has an I section with an overall depth of 450mm.Thickness of flange and web are 75mm and 100mm respectively. The flange width is 230mm. The beam is prestressed with an effective prestressing force of 350kN at a suitable eccentricity such that the resultant stress at the soffit of the beam at mid span is zero. Discover the eccentricity required for the force. Also find the magnitude of prestressing force required for the resultant stress to be zero at midspan, if the tendons are concentric.	BT 4	Analysing

10.	A PSC beam of 120mm wide and 300mm deep is used over a span of 6m to support a udl of 4kN/m including its self weight. The beam is prestressed by a straight cable carrying a force of 180kN & located at an eccentricity of 50mm. Determine the location of the thrust line in beam & plot its position at quarter & central span sections.	BT 4	Analysing
11.	A post tensioned cable of beam 10m long is initially tensioned to a stress of 1000N/mm2at one end. It the tendons are wired so that the slope is 1 in 24 at each end, with the area of 600mmr. Analyse the loss of prestress due to friction with the following data. Coefficient of friction between the duct and cable = 0.55, coefficient of friction for wave effect = 0.0015 per m. during anchorage, if there is a slip of 3mm at the jacking end, calculate the final force in the cable and the % loss of prestress due to friction and slip. E_s = 210 kN/mm^2.	BT 4	Analysing
12.	How do you compute the loss stress due to elastic deformation of concrete in post-tensioned members with several cables which are successively tensioned?	BT-5	Evaluating
13.	A PSC beam of 230mm wide and 450mm deep is used over an span of 4m is prestressed by a cable carrying a force of 650kN & located at an eccentricity of 75mm. The beam supports three concentrated loads of 25kN 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.	BT 5	Evaluating
14.	A PSC beam with rectangular section, 150mm wide 300mm deep is prestressed by three cables each carrying a effective prestress of 200kN. The span of the beam is 12m. The first cable is parabolic with an eccentricity of 50mm above the centroidal axis at the supports. The second cable is parabolic with an eccentricity of 50mm at the centre of the span and zero eccentricity at the supports. The third cable is straight with an eccentricity of 50mm below the centroidal axis. If the beam supports an UDL of 6kN/m and E_c=38kN/mm^2. Estimate the instantaneous deflection for the following stages (i) Prestress + self weight of the beam (ii)Prestress + self weight of the beam + live load	BT 6	Creating
	PART C		
1.	Discuss the difference between the load carrying mechanisms of reinforced and prestressed concrete beams sections with sketches.	BT 2	Understanding
2.	For the figure shown below, find out the stress from stress concept and load balancing concept fp= 1000N/mm2, Live	BT 4	Analysing

	Load = 15kN/m and L =10m. 		
3.	(i)List the various types of tensioning devices used in prestressed concrete. (ii)Explain the principle of Post-tensioning	BT 1	Remembering
4.	(i)Distinguish between the cable line and pressure line with sketches in typical PSC beams (ii)Explain the significance of pressure line or Thrust line with sketches.	BT 3	Applying
UNIT II DESIGN FOR FLEXURE AND SHEAR			
Basic assumptions for calculating flexural stresses – Permissible stresses in steel and concrete as per I.S.1343 Code – Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for strength limit based on I.S. 1343 Code – Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on I.S. 1343 Code.			
Q. No	**Content**	**BT**	**Competence**
1.	What is effective reinforcement ratio?	BT 1	Remembering
2.	What are the basic assumptions for calculating flexural stresses?	BT 1	Remembering
3.	What are the steps for designing stirrups along the length of the beam?	BT 1	Remembering
4.	What is the maximum spacing of stirrups in the design of the shear?	BT 1	Remembering
5.	Why the stirrups are anchored?	BT 1	Remembering
6.	What is the maximum spacing of stirrups in the design of shear?	BT 1	Remembering
7.	Distinguish between pre tensioned and post tensioned concrete members	BT 4	Analysing
8.	Show the expression for minimum prestressing force and maximum eccentricity	BT 2	Understanding
9.	Explain strain compatability method.	BT 2	Understanding
10.	Compare the different types of failure due to shear.	BT 2	Understanding
11.	How will you calculate the shear capacity for uncracked section?	BT 2	Understanding
12.	Write the formula to calculate the total area of the stirrups in PSC sections.	BT 3	Applying
13.	What are the stages to be considered in the design of prestressed concrete section under flexure?	BT 3	Applying

14.	Choose the different types of flexural failure modes observed in PSC beams	BT 3	Applying
15.	Differentiate the Type I, Type II and type III structures.	BT 4	Analysing
16.	How will you carry out the analysis of the reinforced and prestressed concrete members under shear?	BT 4	Analysing
17.	Justify the need for providing untensioned reinforcement in PS beam?	BT 5	Evaluating
18.	List out the factors which influence the ultimate flexural strength of PSC beams.	BT 5	Evaluating
19.	Mention the different types of flexural failure.	BT 6	Creating
20.	Write the principle of mechanisms for the analysis of axial load and flexural in PSC structures	BT 6	Creating
	PART B		
1.	A pretensioned T section has a flange width of 1200mm and 150mm thick. The width and depth of the rib are 300mm and 1500mm respectively. The high tension steel has an area of 4700mm^2 and is located at an effective depth of 1600mm. If the characteristic cube strength of the concrete and the tensile strength of steel are 40 and 1600Mpa respectively, calculate the flexural strength of the section.	BT 1	Remembering
2.	A post tensioned prestressed beam of rectangular section 250mm wide is to be designed for an imposed load of 12kN/m uniformly distributed on a span of 12m. The stress in the concrete must not exceed 17N/mm^2 in compression or 1.4N/mm^2 in tension at any time and the loss of prestress may be assumed to be 15%. Calculate 1) the minimum possible depth of the beam, 2) For the section provided the minimum prestressing force and the corresponding eccentricity.	BT 1	Remembering
3.	A prestressed concrete T section has 1800mm x 200mm flange, 450mm x 1500mm rib and 100 nos of 8mm HTS wires are located at 1600mm from the top of flange. Calculate the flexural strength of the beam using M_{40} and Fe1600.	BT 1	Remembering
4.	A class 3 type post tensioned PSC beam of 10m span has a cross section as shown in figure. The beam is post tensioned using three high tensile bars of 40mm diameter located at an effective depth of 700mm. the effective prestressing force in each bar after all losses is 600kN. Calculate the UDL that the beam can carry.	BT 1	Remembering
5.	Explain the various methods of flexural failure encountered in PSC member.	BT 2	Understanding
6.	A post tensioned bridge of girder of 24m length with	BT 2	understanding

	unbounded tendons is of box section of overall dimensions 1200mm wide by 1800mm deep, with wall thickness of 150mm. the high tensile steel has an area of 4000mm^2 and is located at an effective depth of 1600mm. the effective prestress in steel after all losses is 1000N/mm^2. Estimate the ultimate flexural strength of the section. Take f_{ck} = 40N/mm^2, f_p = 1600N/mm^2.		
7.	A pretensioned beam 80mm wide and 120mm deep is to be designed to support working loads of 4kN, each concentrated at the third points over a span of 3m. If the permissible stresses in tension are zero at transfer and 1.4N/mm^2 under working loads, design the number of 3mm wires and the corresponding eccentricity required at the midspan section. Permissible tensile stress in wires is 1400N/mm^2. The loss of prestress is 20% and the density of concrete is 25kN/m^3.	BT 2	Understanding
8.	The support section of a prestressed concrete beam 100 x 250mm is required to support an ultimate shear force of 60 kN. The compressive prestress at the centridal axis is 5N/mm^2. the characteristic strength of concrete is 40N/mm^2. The cover to the tension reinforcement is 50mm. if the characteristic tensile strength of steel in stirrup is 250N/mm^2, design suitable shear reinforcement.	BT 3	Applying
9.	The support section of prestressed concrete beam, 200 mm wide and 250 mm deep, is reuired to support an ultimate shear force of 80 KN. the compressive prestress at the centroidal axis is 5 N/mm^2. The characteristic cube strength of concrete is 40 N/mm^2. The cover to the tension reinforcement is 50 mm. if the characteristic tensile strength of steel in stirrups is 250 N/mm^2, design suitable reinforcements at the section using the IS: 1343 recommendations.	BT 3	Applying
10.	Design a simply supported type II prestressed beam with Mt = 435kNm (including an estimated Msw = 55 kNm). The height of the beam is restricted to 950mm. the prestress at transfer f_{po} = 1035N/mm^2 and the prestress at service f_{pe} = 860N/mm^2. Based on the grade of concrete, the allowable compressive stresses are 12.5N/mm^2 at transfer and 11N/mm^2 at service. The properties of the prestressing strands are given below: 1. Type of prestressing tendon 7 wire strand 2. Nominal diameter = 12.8 mm 3. Nominal area = 99.3mm^2	BT 3	Applying
11.	A PSC beam of effective span 16m is of rectangular section	BT 4	Analysing

	400mm wide and 1200mm deep. A tendon consists of 3300mm^2 of strands of characteristic strength 1700 N/mm^2 with an effective prestress of 910 N/mm^2. The strands are located 870mm from the top face of the beam. If f_{cu} =60 N/mm^2, estimate the flexural strength of the section as per IS1343 provisions for the following cases: (i) Bonded tendons (ii) Unbonded tendons		
12.	A prestressed concrete beam 10m span of rectangular section 120mm wide and 300mm deep, is axially prestressed by a cable carrying an effective force of 180kN. The beam supports a total udl of 5kN/m which includes the self weight of the member. Compare the magnitude of the principal tension developed in the beam with and without the axial stress.	BT 4	Analysing
13.	Write the recommendations for Design for shear based on I.S. 1343 Code.	BT 5	Evaluating
14.	The support section of prestressed concrete beam, 100mm wide and 250mm deep, is required to support an ultimate shear force of 60KN. the compressive prestress at the centroidal axis is 5N/mm^2. The characteristic cube strength of concrete is 40N/mm^2. The cover to the tension reinforcement is 50 mm. if the characteristic tensile strength of steel in stirrups is 250N/mm^2, design suitable reinforcements at the section using the IS: 1343 recommendations.	BT 6	Creating
	PART C		
1.	The cross-section of a symmetrical I-section prestressed beam is 500 mm by 650 mm (overall), with flanges and web 150mm thick. The beam is post-tensioned by cables containing 45 wires of 5mm diameter high-tensile steel wires at an eccentricity of 250mm. The 28-days strength of concrete in compressing is 40N/mm^{2}and the ultimate tensile strength of wires is 16500N/mm^2. Assuming that the grouting of the tendons is 100 percent effective, determine the ultimate moment of the section as per IS 1343.	BT2	Understanding
2.	How do you check a designed unsymmetrical I-section prestressed girder for flexural and shear strength?	BT 1	Remembering
3.	A prestressed concrete beam 10m span of rectangular section 200mm wide and 600mm deep, is axially prestressed by a parabolic cable located at an eccentricity of 100mm at midspan and zero at the supports The beam supports a total udl of 4kN/m which includes the self weight of the member.	BT 4	Analysing

	Evaluate the forces and principal stresses at support section.the density of concrete is 24 kN/mm^3		
4.	Outline the factors influencing the ultimate shear resistance of PSC sections with flexure shear cracks.	BT2	Understanding

UNIT III DEFLECTION AND DESIGN OF ANCHORAGE ZONE

Factors influencing deflections – Short term deflections of uncracked members – Prediction of long term deflections due to creep and shrinkage – Check for serviceability limit state of deflection. Determination of anchorage zone stresses in post-tensioned beams by Magnel"s method, Guyon"s method and IS1343 code – design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.

PART A

Q. No	Content	BT	Competence
1.	Define Bursting tension	BT-1	Remembering
2.	List the factors influencing the deflection?	BT-1	Remembering
3.	List any two functions of end block	BT-1	Remembering
4.	Define the zone of transmission in end block of prestressed concrete structures?	BT-1	Remembering
5.	What are the codal provisions for bond and transmission length?	BT-1	Remembering
6.	Explain the Magnel's method for end block	BT-1	Remembering
7.	Discuss the various methods of predicting long term deflections of uncracked PSC members	BT-2	Understanding
8.	Explain the importance of creep of concrete in long term deflections of prestressed concrete members	BT-2	Understanding
9.	Explain how do you use bilinear moment curvature relationships for computing the deflections of cracked PSC members	BT-2	Understanding
10.	Explain the effect of tendon profile in deflection	BT-2	Understanding
11.	Interpret the stress distribution in end block	BT-3	Applying
12.	Draw a sketch showing the stress distribution in end block by double anchor plate.	BT-3	Applying
13.	Illustrate the various factors influencing the effective moment of inertia of cracked concrete sections.	BT-3	Applying
14.	Explain Guyon's theorom	BT-4	Analyzing
15.	Differentiate between short term and long term deflection in PSC members.	BT-4	Analyzing
16.	Discuss on limiting zone for prestressing force	BT-4	Analyzing
17.	How do you evaluate the deflection of a concrete member prestressed by a trapezoidal cable with concentric anchors.	BT-5	Evaluating

18.	How do you evaluate the deflection of a concrete member prestressed by a parabolic cable with eccentric anchors?	BT-5	Evaluating
19.	Write are the forces considered in the calculation of the deflection of prestressed concrete beams?	BT-6	Creating
20.	Write the methods of stress analysis in anchorage zone?	BT-6	Creating
	PART B		
1.	(i)Write briefly outline the Magnel's method of computing the horizontal and transverse stresses in end blocks subjected to Concentrated force from anchorage. (ii) Explain how do you compute the bursting tension in an end block subjected to evenly distributed forces by Guyon's method	BT-1	Remembering
2.	The prestressing force of 250 KN is transmitted to a distribution plate, 120mm X 120mm,the centre of which is located at 100mm from the bottom of an end block having a section 120mmx300mm.. Calculate the position and the magnitude of tensile stress on the horizontal section through the centre of the distribution plate using the Methods (i) Magnel (ii) Guyon (iii) Rowe.	BT-1	Remembering
3.	(i)Define the terms (a) end block (b) Anchorage zone (c) Bursting tension. (ii)Explain with sketches the effect of varying the ratio of depth anchorage to the depth of end block on the distribution of bursting tension.	BT-1	Remembering
4.	The end block of a PSC beam with rectangular cross section is 100mm wide and 200mm deep. The prestressing force of 100kN is transmitted to the concrete by a distribution plate of 100mm x 50mm, concentrically loaded at the ends. Calculate the position and the magnitude of tensile stress on the horizontal section through the centre and edge of the anchor plate. Compute the bursting tension on the horizontal planes.	BT-1	Remembering
5.	Explain the factors influencing the deflection and the effect of tendon profile in the deflection of PSC members with a neat sketch	BT-2	Understanding
6.	A PSC beam of 120mm wide and 300mm deep is used over an span of 6m is prestressed by a straight cable carrying a force of 200kN & located at an eccentricity of 50mm.E_c=38 kN/mm2. Estimate the deflection at centre span a) Under prestress + self weight b) Find the magnitude of live load udl which will nullify the deflection due to prestress & self weight	BT-2	Understanding
7.	The end block of a post tensioned concrete beam 300mm X	BT-2	Understanding

	300mm is subjected to a concentric anchorage force of 832800N by a freyssinet anchorage system of area 117200mm^2. Discuss and detail the anchorage reinforcement for the end block.		
8.	Explain the various methods used for the investigation of anchorage zone stresses.	BT-3	Applying
9.	A simply supported beam of 6m span and rectangular section 125mm x 250mm is prestressed by a cable in which the total tensile force as 220kN. The cable is located at a constant eccentricity of 75mm above the soffit at the middle third of the beam and the cable is curved towards the extreme ends and the eccentricity of the cable at both ends are 50mm above the centre line. Consider concrete weight 24kN/m^3 and E_c = 40kN/mm^2. Interpret the deflection of the beam (i)when it is supporting its own weight, (ii)when the beam carries an imposed load of 4.5kN/m.	BT-3	Applying
10.	A PSC beam of 300mm wide and 400mm deep is used over an span of 8m is prestressed by a cable carrying high tensile wires of cross sectional area 2000mm2. If the beam supports a live load of 20kN/m excluding its self weight, examine the initial deflection due to prestress, self weight and live loads for the following: (i)Cable profile is straight with a constant eccentricity of 100mm (ii)Cable profile is parabolic with a dip of 100mm at the mid span and concentric at supports. Assume E_c = 36kN/mm^2.	BT-4	Analyzing
11.	A prestressed concrete beam of span 8m has a section of area 42 x l0^3 mm^2. The moment of inertia of the section being 1.75 x 10^8 mm^4. The beam is prestressed with a parabolic cable providing a prestressing force of 245 kN. The cable has an eccentricity of 50mm at the centre and zero eccentricity at the ends. Ignoring all losses, examine the deflection at the centre when (a) The beam carries its own weight and prestress. (b) The beam carries in addition to its own weight and prestress, a superimposed load of 1.8kN/m. consider concrete weight 24kN/m^3 and E_c = 40kN/mm^2.	BT-4	Analyzing
12.	A PSC beam with rectangular section, 150mm wide 300mm deep is prestressed by three cables each carrying a effective prestress of 200kN. The span of the beam is 12m. The first cable is parabolic with an eccentricity of 50mm below the centroidal axis at the centre of the span and 50mm above the centroidal axis at the supports. The second cable is parabolic with an eccentricity of 50mm at the centre of the span and zero	BT-4	Analyzing

	eccentricity at the supports. The third cable is straight with an eccentricity of 50mm below the centroidal axis. If the beam supports an UDL of 6kN/m and E_c=38kN/mm^2. Estimate the instantaneous deflection for the following stages (i) Prestress + self weight of the beam (ii) Prestress + self weight of the beam+ live load.		
13.	A concrete beam having a rectangular cross section 150mm wide and 300mm deep is prestressed by a parabolic cable of eccentricity 75mm at the at the centre of the span towards the soffit, and an eccentricity of 25mm towards the top at the support section. The effective force in the cable is 350kN. The beam supports the concentrated load of 20kN at the centre of the span in addition to the self weight. If the modulus of elasticity of the concrete is 38kN/m^2 and the span is 8m, Evaluate, (i) Short term deflection at the center of the span under prestress, dead load and live load (ii)Long term deflection assuming a loss ratio as 0.8 and creep coefficient as 1.6.	BT-5	Evaluating
14.	The end block of a post tensioned bridge girder is 500mm wide by 1000mm deep. Two cables, each comprising 90 high tensile wires of 7mm dia are anchored using square plates of side length 400mm with their centres located at 500mm from the top and bottom of the edges of the beam. The jacking force in each cable is 4000kN. Design a suitable anchorage reinforcement using Fe 415 grade HYSD bars conforming to IS: 1343 provision.	BT-6	Creating

PART C			
1.	The End block of PSC beam, rectangular in section is 120mm wide and 300mm deep. The prestressing force of 250 KN is transmitted to concrete by a distribution plate, 120mm wide and 75mm deep, concentrically located at the ends. Calculate the position and magnitude of the maximum tensile stress on the horizontal section through the centre of the end block using methods of (i) Magnels (ii) Guyon (iii) Rowe. Design the reinforcement for the end block for the maximum transverse tension. Yield stess in steel is 260 N/mm^2	BT-6	Creating
2.	Sketch the typical arrangement of reinforcements in end blocks for post tensioned prestressed concrete beam with single and multiple anchorages.	BT-5	Evaluating

3.	(i)Briefly explain the importance of creep of concrete in long term deflection of prestressed members (ii)List the various factors influencing the deflections of PSC Members.	BT-1	Remembering
4.	A concrete beam is prestressed by a parabolic cable having an eccentricity $e_1$towards the soffit at centre of span and an eccentricity of e_2 towards the top near support sections . find the ratio of these eccentricities for zero deflection at the centre of span due to prestress only.	BT-6	Creating

UNIT IV COMPOSITE BEAMS AND CONTINUOUS BEAMS

Analysis and design of composite beams – Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design.

PART A

Q. No	Content	BT	Competence
1.	Define propped construction in composite PSC construction?	BT-1	Remembering
2.	List the effects of differential shrinkage in composite beams?	BT-1	Remembering
3.	List the advantages of composite prestressed concrete beams	BT-1	Remembering
4.	What are the advantages of continuous members in prestressed concrete structures?	BT-1	Remembering
5.	Define concordant cables?	BT-1	Remembering
6.	List the commonly used methods to analyse the secondary moments in prestressed concrete continuous members.	BT-1	Remembering
7.	Describe about shear connectors in composite construction?	BT-2	Understanding
8.	What is meant by propped and unpropped construction?	BT-2	Understanding
9.	Explain how do you form the bonding between prestressed units and reinforced units?	BT-2	Understanding
10.	Explain the method of computing the ultimate shear strength in composite PSC members.	BT-2	Understanding
11.	Explain the term primary moment, secondary moment and resultant moment.	BT-3	Applying
12.	Sketch the most common type of composite construction?	BT-3	Applying
13.	Sketch a typical concordant cable profile in a two span continuous prestressed concrete beam.	BT-3	Applying
14.	Differentiate between propped and unpropped composite construction?	BT-4	Analyzing
15.	Why is transverse prestressing done for bridge decks?	BT-4	Analyzing
16.	Evaluate the effects of prestressing the indeterminate structures?	BT-4	Analyzing
17.	How do you evaluate the shrinkage and resultant stresses in composite member?	BT-5	Evaluating
18.	Write about redundant reaction with respect to prestressed concrete continuous members?	BT-5	Evaluating
19.	What are cap cables and where they are used?	BT-6	Creating
20.	What are the assumptions used in calculations of differential	BT-6	Creating

	shrinkage?		

Q.No.	PART – B	BT	Competence
1.	A precast pretensioned beam of rectangular section has a breadth of 100mm and depth of 200mm. The beam with an effective span of 5m is prestressed by the tendons with their centroids coinciding with the bottom kern. The initial force in the tendons is 150kN. The loss of prestress is 15%. The top flange width is 400mm with the thickness of 40mm.If the composite beam supports a live load of $7kN/m^2$ calculate the resultant stresses developed if the section is unpropped. M40 and M20 concrete are used for pretensioned and insitu concrete.	BT-1	Remembering
2.	i. List the advantage of using precast prestressed elements along with in situ Concrete. ii. List the different types of composite construction with neat sketches	BT-1	Remembering
3.	A continuous beam ABC (AB=BC=25m) with a overall depth of 1m, is prestressed by a continuous cable carrying a force of 300kN. The cable profile is parabolic between the supports, with zero eccentricity at ends A and C. The cable has an eccentricity of 100mm towards the soffit at mid span sections and 200mm towards the top fibre at the mid support section. Evaluate the reactions developed at the supports due to prestress and show that the cable is concordant.	BT-1	Remembering
4.	A composite prestressed concrete beam consists of a prefabricated stem of 325mm X 820 mm and a cast insitu slab of 820mm X 150mm. If the differential shrinkage is 1.2 X 10^{-4} mm/mm, evaluate the shrinkage stresses at the extreme edges of the slab and the stem. Take $E_c = 2.75 \times 10^4$ N/mm^2	BT-1	Remembering
5.	Briefly explain the necessity of using composite section in PSC structures. Also discuss about the shear in composite beams. What are the provisions usually made to counteract the effects.	BT-2	Understanding
6.	Briefly explain the various steps involved in the design of continuous prestressed concrete beams	BT-2	Understanding
7.	(i)Explain with neat sketches the various methods of achieving continuity in prestressed concrete members. (ii)Explain the terms (a) line of thrust (b) concordant cable in prestressed concrete continuous members	BT-2	Understanding
8.	Design a composite slab for the bridge deck using a standard inverted T-section. The top flange is 300mm wide and 110mm thick. The bottom flange is 550mm wide and 250mm thick. The web thickness is 100mm and the overall depth of the inverted T. Section is 655mm. The bridge deck has to support a characteristic imposed load of 70 kN/m^2, over an effective span of 12m. Grade 40 concrete is specified for the precast	BT-3	Applying

	pretensioned T-with a compressive strength at transfer of 34 N/mm^2. Concrete of grade-30 is used for the insitu part. Calculate the minimum prestress necessary and check for safety under serviceability limit state.		
9.	A continuous beam ABC (AB=BC=10m) is prestressed by a parabolic cable carrying an effective force of 200kN. The cable profile is shown in Fig. The beam supports dead load and live load of 0.24kN/m and 2.36 kN/m respectively. Calculate the resultant moments developed in the beam and locate the pressure line.	BT-3	Applying
10.	The cross-section of a composite beam consists of a 300mm x 900mm precast stem and cast-in-situ flange 900mm x 150mm. The stem is a post-tensioned unit with an initial prestressing force of 2500 kN. The effective prestress available after making deduction for losses is 2200 kN. The dead load moment at mid span due to the weight of the precast section is 250 kNm. The dead load moment due to the weight of the flange is 125 kNm. After hardening of the flange concrete, the composite section has to carry a live load which produces a bending moment of 700 kNm. Examine the stress distribution in concrete at the various stages of the loading.	BT-4	Analyzing
11.	A composite T-girder of span 5m is made up of a pre-tensioned rib, 120mm wide by 240mm depth, with an insitu cast slab, 400mm wide and 40mm thick. The rib is prestressed by a straight cable having an eccentricity of 33.33 mm and carrying initial forceof,200kN.The loss of prestress is 20%. Check the composite T-beam for the limit state of deflection if its supports an imposed load of 3.2kN/m for (i) unpropped (ii) propped. Assume modulus of Elasticity of 35kN/mm2 for both precast & insitu cast elements.	BT-4	Analyzing
12.	A prestressed beam with rectangular cross section with a width of 120mm and depth of 300mm is continuous over two spans AB=BC= 8m. The cable with zero eccentricity at the ends and an eccentricity of 50mm towards the top fibres of the beam over the central support, carries an effective force of 500kN. (i)Calculate the secondary moments developed at B. (ii)If the beam supports the concentrated load of 20kN each at mid points of the span, evaluvate the resultant stresses at the central support section B. (iii)Also locate the position of pressure line at the section.	BT-4	Analyzing
13.	A simply Supported PSC beam of span 5m and size l50mm x 300 mm has 15 MPa priestess at soffit and Zero at top after all loses is Prestress. A slab of 450mm wide and 60 mm deep is cast on the top of the beam to induce composite T-beam action. Evaluate the maximum udl that can be supported without any tensile stress at soffit for the following conditions. (i)Slab is externally supported during casting	BT-5	Evaluating

	(ii)Slab is supported by the PSC beam during casting		
14.	Design a composite PSC beam for the following data: Span=12m; live load = 5kN/m^2; σ_{ci} = 14 N/mm^2; η =85%; Depth of the slab =150mm; f_{pe}= 950 N/mm^2 ; m=0.6; spacing of beam= 3.5m; Breadth of the web = 150mm; b_f= 1500mm. Assume post tension.	BT-6	Creating

PART C

1.	A Composite T beam is made up of a pre tensioned rib 100mm wide and 200mm deep and a cast insitu slab 400mm wide and 40 mm thick having a modulus of elasticity of 28 KN/mm2. If the differential shrinkage is 100 X 10^{-6} units. Determine the shrinkage stresses developed in the precast and cast insitu units.	BT-1	Remembering
2.	List the various methods of achieving continuity in prestressed concrete members	BT-2	Understanding
3.	A precast Pretensioned beam of rectangular section has a breadh of 100 mm and depth of 200mm. The beam with an effective span of 5m is prestressed by the tendons with their centroids coinciding with the bottom kern. The initial force in the tendon is 150KN. The loss of prestress is15%. The top flange width is 400 mm with the thickness of 40mm. If the composite beam supports a liveload of 7 KN/m2, calculate the resultant stresses developed if the section is unpropped. M40 and M20 concrete are used for Pretensioned and in-situ concrete.	BT-3	Applying
4.	A Continuous concrete beam ABC (AB=BC) has a uniform cross-section throughout its length. The beam is pre-stressed by a straight cable carrying an effective force of P. The cable has an eccentricity ‘e’ towards the soffit at end supports A and C and e/2 towards the top fibre at the central support B. Show that the cable is concordant.	BT-3	Applying

UNIT V MISCELLANEOUS STRUCTURES

Design of tension and compression members – Tanks, pipes and poles – Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.

PART A

Q. No	Content	BT	Competence
1.	Define circular prestressing.	BT-1	Remembering
2.	What is meant by composite construction in prestressed concrete?	BT-1	Remembering
3.	Define partial prestressing	BT-1	Remembering

4.	List the applications of partial prestressing.	BT-1	Remembering
5.	List the methods of achieving the partial prestresssing?	BT-1	Remembering
6.	Define two stage construction of non cylindrical pipe.	BT-1	Remembering
7.	Explain the needs of prestressing in compression members?	BT-2	Understanding
8.	Explain the effect of pre-stressing force in concrete poles.	BT-2	Understanding
9.	What are the design criteria for pre-stressed concrete pipes	BT-2	Understanding
10.	List some of the junction types of tank wall and base slab.	BT-2	Understanding
11.	Illustrate the stress induced in concrete due to circular prestressing?	BT-3	Applying
12.	illustrate the merits and demerits of partial prestressing?	BT-3	Applying
13.	Sketch the different shapes of PSC tanks?	BT-3	Applying
14.	Write the various types of loadings that act on pre-stressed concrete poles?	BT-4	Analyzing
15.	Differentiate prestressed cylindrical and non cylindrical pipes.	BT-4	Analyzing
16.	Write the various stresses induced in the concrete during circular prestressing	BT-4	Analyzing
17.	Evaluate the need of vertical prestressing in water tanks?	BT-5	Evaluating
18.	How will you evaluate factor of safety against bursting pressure in cylindrical pipes?	BT-5	Evaluating
19.	Write the general failures of prestressed concrete tanks?	BT-6	Creating
20.	Write short notes on prestressed concrete tank floors.	BT-6	Creating

PART B			
1.	Design a non cylindrical PSC pipe of 600mm internal diameter to withstand a working hydrostatic pressure of 1.05 N/mm^2 using 2.5mm HYSD stressed to 800 N/mm^2 at transfer. Permissible maximum and minimum stresses in concrete at transfer and service load are 14 N/mm^2 and 0.7 N/mm^2. The loss ratio is 0.75. E_s = 210kN/mm^2 and E_c =35kN/mm^2	BT-1	Remembering
2.	A cylindrical PSC water tank of capacity 3.5 X 10^6 litres and ratio of diameter to height is 4.The maximum permissible compressive stress in concrete at transfer is 14N/mm^2 and the minimum compressive stress under working pressure is 1N/mm^2. Prestressed Wires of 5mm diameter are available for circumferential winding and Freyssinet cables made up of 12 wires of 7mm diameter. The stress in wires at transfer is 1000N/mm^2. Loss ratio is 0.75 Design the tank walls and	BT-1	Remembering

	circumferential wire winding and vertical cables for the following joint condition at the base. Sliding base (assume co efficient of friction as 0.5).		
3.	List and explain the types of prestressed concrete pipes with neat sketches.	BT-1	Remembering
4.	Explain any the methods of circumferential wire winding adopted in circular prestressing with a neat sketch.	BT-1	Remembering
5.	(i) Explain the general features of prestressed concrete tanks. (ii) Explain the junctions of tank wall and base slab with neat sketch	BT-2	Understanding
6.	(i) What is meant by partial prestressing? Discuss the advantages and disadvantages if partial prestressing is done. (ii) Discuss the difference in load deflection behavior of under prestressed, partial prestressed and over prestressed cases. Why partial prestressing is preferred in the design	BT-2	Understanding
7.	Explain the criteria of design and design procedure for prestressed concrete circular tanks.	BT-2	Understanding
8.	Design a electric pole 12m high to support wires at its top at which can exert a reversible horizontal force of 3kN. The tendons are initially stressed to 1000N/mm^2 and the loss of stress due to shrinkage and creep is 20%. Maximum compressive stress in concrete is limited to 12N/mm^2. Assume modular ratio=6, angle of repose=30^o and the specific weight of the soil is 18kN/mm^3.	BT-3	Applying
9.	(i)With neat sketches, explain the various cross sectional profiles adopted for PSC Poles (ii)State the general advantages of PSC poles.	BT-3	Applying
10.	Evaluate and design a free edge water tank of diameter 36m to store water for a depth of 5m. Assume ultimate stress in steel = 1000 N/mm^2. Stress in steel at transfer =70% of ultimate stress. Safe stress in concrete = 0.5fck .Compressive stress in concrete at service condition = 0.1f_{ck}. Final stress in steel = 0.8 x stress in steel at transfer. Take modular ratio= 5.5, f_{ck}= 45N/mm^2	BT-4	Analyzing
11.	A prestressed concrete pipe of 1.2m diameter having a core thickness of 75mm is required to withstand a service pressure intensity of 1.2 N/mm^2. Examine the pitch of 5mm diameter high tensile wire winding if the initial stress is limited to 1000N/mm^2. Permissible stresses in concrete are being 12 N/mm^2 in compression in zero in tension. The loss ratio is 0.8, if the direct tensile strength of concrete is 2.5N/mm^2; Estimate the load factor against cracking.	BT-4	Analyzing

12.	Examine and design a prestressed concrete pipe of internal diameter 900 mm to withstand the internal pressure of 0.8N/mm^2. The maximum permissible compressive stress in concrete is 18N/mm^2 and no tensile stress is to be permitted. Modular ratio between steel and concrete is 5.8. Adopt 5mm diameter high tensile wires which can be stressed to 1100 N/mm^2. Expected loss of prestress is 15%.	BT-4	Analyzing
13.	A prestressed cylindrical pipe is to be designed using a steel cylinder of 700mm diameter and thickness 2.5mm with a layer of spun concrete 35mm thick. If the pipe is required to withstand a hydraulic pressure of 0.85 N/mm^2 , without developing any tensile stress in concrete, evaluate: (i)The required pitch of 4mm wires, wound around the cylinder at the tensile strength of 1000 N/mm^2. (ii)Test pressure to produce a tensile stress of 1.4 N/mm^2 in the concrete immediately after winding, and (iii)The appox bursting pressure, Modular ratio = 6 Tensile strength of the wire = 1700 N/mm^2 Yield stress of the cylinder = 280 N/mm^2 Loss ratio =0.85	BT-5	Evaluating
14.	A cylindrical PSC water tank of internal diameter 30m is required to store water over a depth of 7.5m. The permissible compressive stress in concrete at transfer is 13 N/mm2 and the minimum compressive stress under working pressure is 1 N/mm^2. The loss ratio is 0.75. Wires of 5mm diameter with an initial stress of 1000 N/mm^2 are available for circumferential winding and Freyssinet cables made up of 12 wires of 8mm diameter stressed to 1200 N/mm^2 are to be used for vertical prestressing. Design the tank walls assuming the base as fixed. The cube strength of concrete is 40 N/mm^2	BT-6	Creating

PART C			
1.	A Prestressed concrete sleeper produced by pretensioning method has a rectangular cross section of 300 X 250 mm. It is prestressed with 8 numbers of straight 7mm diameter wires at 0.8 times the ultimate strength of 1570 N/mm^2. Estimate the percentage loss of stress due to elastic shortening of concrete. Consider m=6.	BT-1	Remembering
2.	A non-cylindrical PSC Pipe of internal diameter 1000mm and thickness of cone shell 75mm is required to convey water at a working pressure of 1.5 N/mm^2. The length of each pipe is 6m.	BT-3	Applying

	the loss ratio is 0.8 (i) Design the circumferential wire winding using 5mm dia wires stretched 1000/mm$^{2.}$ (ii) Design the longitudinal pre-stressing using 7 mm dia wires tensioned to 1000/mm^2. The max permissible tensile stress under the critical transient loading not greater than 0.8 where f_{ci}=40 N/mm^2.		
3.	The partially prestressed beam of rectangular section provided with non prestressed reinforcement both on tension and compression face. Assuming that the concrete fibre at level of non prestressed steel is stressed to a value of 14N/mm^2. Find the effect of shrinkage strain of 0.0002. Assume creep coefficient =1.5 and m = 6.	BT-4	Analyzing
4.	A PSC Circular cylindrical tank is required to store 24,500 million liters of water. The permissible compressive stress in concrete at transfer should not exceed 13 N/mm^2 & min compressive stress under working pressure should not be less than 1 N/mm^2. The loss ratio is 0.75. HYSD wires of 7 mm dia with an initial stress of 1000 N/mm^2 are available for winding round the tank. Freyssinet cables of 12 wires of 8mm dia which are stressed to 1200 N/mm^2 are available for vertical pre-stressing. The cube strength of concrete is 40 N/mm^2. Design the tank walls.	BT-5	Evaluating