DEPARTMENT OF CIVIL ENGINEERING

End Semester Examination (Dec 5th , 2006)

Prestressed Concrete (ST- 002)

(4)

Time Allotted: 3 Hrs | Max. Mks: 90

Course Instr: Ms. Shruti Sharma

Note:

1. *Attempt any five questions.*
2. *Attempt all parts of a question at one place.*
3. *IS 1343 is allowed.*
4. *Use E_c = 38 kN/mm², Creep Coefficient as 2, Losses as 15%, E_s=210kN/mm² and the grade of concrete (unless specified) as 45MPa.*
5. *Assume any missing data suitably.*

1.	(a)	A box girder section of dimensions 1000mm by 1800 mm deep with wall thickness of 200mm throughout has a span of 40 m and is pretstressed with an effective force of 8000kN supplied by a parabolic cable having an eccentricity of +700mm at the centre and -150 mm at support. It is subjected to a superimposed L.L of 12kN/m throughout the span. Compute and sketch the resultant stress distribution at the midspan and support sections using internal resisting couple method.	9
	(b)	A beam of symmetrical I-section spanning 10 m, has flange width of 250mm and depth of 100mm. Web depth is 400mm and thickness is 100mm.Beam is prestressed by a parabolic cable with an eccentricity of 150 mm at the centre of span section and zero at the supports. Live load is 3kN/m. (i) Determine the effective force in the cable for balancing the loads. (ii) Sketch the distribution of resultant stresses at the centre and support sections. (iii) Sketch the pressure line from the tendon centre line.	6
	(c)	Discuss the common applications of post-tensioning.	3
2	(a)	A concrete beam AB of span 12 m is post tensioned by a cable which is concentric at the supports A and B and has an eccentricity of 400 mm in the mid-third span with a parabolic variation towards the supports. If the cable is tensioned from jacking end A, what should be the jacking stress in the wires if the stress at B is 1200N/mm². Assume μ= 0.55 and K=0.0015/m. What will be the minimum stress in the cable if it is tensioned from both ends with a jacking stress of 1200N/mm².	9
	(b)	A concrete beam of span 20m, with a rectangular section of 300 mm by 500mm is prestressed by 2 post tensioned cables of area 600mm² each initially stressed to 1600N/mm². Cable has a constant eccentricity of 150mm in the middle 10m span and has a parabolic profile in the remaining 5 meters near the supports. Find using ACI and Neville's approach, (i) Instantaneous deflection at the centre of span (ii)Long term deflection at the centre of span after 2 years.	9
3	(a)	Design a PSC slab of 300mm thickness for a road bridge of span 8 m to carry a superimposed load live load of 15kN/m². Parallel post-tensioned cables, each capable of carrying a load of 300kN is used. Tensile stresses at any stage should not be allowed to exceed 0.8N/mm².Show the design details clearly.	12
	(b)	A post-tensioned bridge girder with unbonded tendons is of T-section with a flange width of 1200mm and thickness of 200mm. Overall depth of the section is 1600mmm and web thickness is 300mm. High tensile steel has an area of 3000 mm²and is located at an effective depth of 1400mm. The effective prestress in steel after all losses is 1200N/mm²and the effective span of the girder is 20 m. If f_{ck} = 40 MPa and f_p = 1700 N/mm², estimate the flexural strength of the section.	6

4	(a)	A pre-tensioned beam of 10 span has a symmetrical I-section with flange width as 200mm and thickness as 60mm. Web thickness is 100mm and overall depth of girder is 500mm. Member is prestressed by 8 wires of 5 mm diameter located on the tension side such that the eccentricity of prestressing force is 120mm. Initial stress in the wires is 1400N/mm² and the cube strength of concrete at transfer is 42N/mm². Take $\beta = 0.0235$. (i) Determine the transmission length. (ii) Compute the bond stress at ¼ and ½ of transmission length and plot its variation. (iii) Calculate the maximum vertical tensile stress developed in the transfer zone and show the distribution of the same. (iv) Design the transfer zone and show the details.	10
	(b)	Design a free edge prestressed water tank of diameter 25 meters to store water to a depth of 6 m. Take f_{cc}= 16N/mm², f_w= -1 N/mm², direct tensile strength of concrete = 2.5 N/mm² and η= 0.8. High tensile wires of 5mm diameter (U.T.S 1800 N/mm²) with an initial stress of 1000 N/mm² may be used. Desirable load factors against collapse and cracking should not be less than 2 and 1.25 respectively.	8
5	(a)	Design an electric pole with free standing height above ground as 10m carrying high tensioned wires with a pull of 4 kN in a broken wire condition. Soil may be assumed as sandy soil with $\varnothing$= 30°. Neglect the weight of wires. Tendons are initially stressed to 1200 N/mm². Maximum stresses in concrete is limited to 14 N/mm². Take unit weight of soil as 17 kN/m³.	9
	(b)	The end block of a prestressed beam 200mm wide and 400 mm deep has two Freyssinet anchorages of 100mm diameter with their centers at 100mm from the top and bottom of the beam. Force transmitted by each anchorage is 250 kN. Design and detail the anchorage reinforcement for the end block.	9
6	(a)	A T-Section has an overall depth of 1000mm, flange width of 600mm and depth of 150 mm and web thickness of 200mm. Determine (i) The maximum permissible torque if the section is uniformly prestressed by a force of 500kN. Maximum permissible diagonal tension is 0.7 N/mm². (ii) Amount of non-prestressed reinforcement required for the section if the torsional moment is increased to 450kN-m. Permissible tensile stress in steel is 230N/mm².	8
	(b)	A prestressing force of 250 kN is transmitted through a distribution plate 120mm wide and 120mm deep, the centre of which is located at 100mm from the bottom of an end block having a section 120mm wide and 300mm deep. Evaluate the position and magnitude of the maximum tensile stress on a horizontal section passing through the centre of distribution plate using (a) Magnel's Method (ii) Rowe's Method. Also find the area of steel necessary to resist the largest tensile force resulting from these sections. Yield stress in steel = 260N/mm². Take K_1= -5, K_2= 2and K_3= 1.25 .	10

Students can see their evaluated answer sheets on 8th December, 2006 at 12:00pm in the office of the concerned teacher.