Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Remedial Examination April 2010

Subject code: 712007

Subject Name: Prestressed concrete

Date: 09 / 04 / 2010 **Time: 12.00 noon – 02.30 pm**

Total Marks: 60

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of IS:1343 is permitted.**

Q.1 **(a)** Explain the basic concept of Prestressing and various types of prestressing methods. Distinguish clearly between Pre-tensioning & Post-tensioning. Why high strength materials are required for prestressed concrete. **06**

(b) Compute the cracking moment for the symmetrical I-section beam having flange size 600mm*200mm and web size 600mm*100mm. It is prestressed by a straight cable carrying an effective force of 1.8MN at an eccentricity of 380mm. The beam supports an imposed load of 4kN/m over a span of 8m. If the modulus of rupture of concrete is 4N/mm^2, evaluate the cracking moment for the given beam. **06**

Q.2 **(a)** Narrate various types of losses in Pre-tensioned & Post-tesioned prestressed concrete. A concrete beam AB of effective span 24m is post-tensioned by a symmetrical cable which is concentric at supports A & B with eccentricity of 450mm for a length of 12m in the middle zone of the span. The cable is horizontal in the middle 12m portion and has sloping profile in the remaining 6m near the supports. If the coefficient of friction between the cable duct & concrete (μ) is 0.35 and the coefficient for wave effect (k) is 0.0022/m, estimate the stress in the cable at 'B' if the jacking stress at 'A' is 1300N/mm^2, what will be the minimum stress in the cable if it is tensioned from both ends with jacking stress of 1300N/mm^2. **06**

(b) A prestressed concrete beam spanning over 10m is of rectangular section 200mm wide & 350mm deep. The beam is prestressed by a parabolic cable having an eccentricity of 100mm below the centroidal axis at the centre of span and eccentricity of 40mm above the centroidal axis at the support sections. The initial force in the cable is 400kN. The beam supports a udl live load of 4kN/m and central concentrated load of 40kN. Ec=37kN/mm^2, allowing 20% loss in prestress, estimate long term deflection assuming creep coefficient as 1.8. **06**

OR

(b) A foundation pile of square section and 4m length is to carry an axial load of 600kN with a possible moment of 10kN.m. Design the pile with concrete having specific cylinder compressive strength of 35N/mm^2 and the permissible effective prestress is not to exceed 4.8N/mm^2. Assume a uniform load factor of 2 against collapse. **06**

Q.3 **(a)** A prestressed T-section has a flange 1000mm wide and 120mm thick. The width and depth of the rib are 250mm and 1200mm respectively. The high- **06**

tensile steel has an area of $400mm^2$ and is located at an effective depth of 1240mm. If the characteristic cube strength of the concrete and the tensile strength of steel are 40MPa and 1600MPa respectively. Calculate the flexural strength of the T-section using IS:1343 codal provisions.

(b) Give advantages of Limited prestressing. Explain various methods (British code method, Nawy's method) for determining crack width in partially prestressed concrete. **06**

OR

Q.3 **(a)** List the advantages of continuous members, effect of prestressing the indeterminate structures and method of achieving continuity in continuous members. **04**

(b) A composite beam having a T-section with flange size 1200mm* 200mm & web size 800mm*150mm formed by unpropped construction technique has top flange made from in-situ concrete and the web made from precast prestressed concrete. The beam has an effective span of 16m. It carries only its self weight at the initial stage and a superimposed load of 10kN/m at the final stage. Determine the stresses at the two stages. The area of prestressing steel located at a distance of 200mm from bottom of the web, $Ap=720mm^2$. The initial & final stress in steel is 1200MPa & 1000 MPa respectively. Take the density of in-situ and precast concrete as $24kN/m^3$ and $25kN/m^3$ respectively. Draw neat sketches of the stress distribution diagrams. **08**

Q.4 **(a)** The end block of post tensioned prestressed concrete beam, 500mm wide and 500mm deep is subjected to a concentric anchorage force of 1000kN by a circular anchorage area of $15000mm^2$. Design and detail the anchorage reinforcement for the end block. Use IS 1343 codal provisions. **06**

(b) A post tensioned bonded beam of symmetrical I-section is required to support a design ultimate moment of 1000kN.m. Determine the overall depth and thickness of the compression flange repuired if fck is 35MPa and fp=1400MPa. **06**

OR

Q.4 **(a)** Design the thickness and circumferential reinforcement required for a cylindrical tank wall subjected to a design tensile force of 650kN/m. The permissible compressive stress in concrete at transfer (fct)=14MPa and under working loads (fcw)= -0.6MPa, direct tensile strength of concrete = 2.5MPa and loss ratio η=0.82. High tensile wires of 6mm dia (ultimate tensile stress=$1650N/mm^2$) with an initial stress of $1000N/mm^2$ may be used. Desirable load factors against collapse & cracking should not be less than 2 and 1.3 respectively. **06**

(b) Explain transmission of prestressing force by bond in pretensioned members with neat sketches. What is 'the transmission length' & give expression for determining the same suggested by Hoyer, specifying all the terms involved in the expression. **06**

Q.5 **(a)** A concrete beam ABC with a single overhang is simply supported at A & B over a span of 10m and the overhanging portion BC is 2m. The beam is of rectangular section 400mm*1000mm deep and supports udl of 2.4kN/m over its entire length in addition to its self weight. Determine the profile of the prestressing cable with an effective force of 600kN which can balance the dead and live loads on the beam. Sketch the profile of the cable along the length. **06**

	(b)	A pre-tensioned beam, 100mm wide and 200mm deep is to support a udl live load of 2kN/m over a span of 5m. Determine the prestressing force and its eccentricity if the permissible stresses in tension are zero at transfer and 2MPa(tensile) under working loads. Consider 18% losses of prestress. Also design number of 3mm diameter wires if permissible tensile stress in wires is $1400 N/mm^2$	**06**

OR

Q.5	**(a)**	Discuss Pressure line and internal resisting couple in detail.	**06**
	(b)	Explain the limitation of prestress in long spans. Explain the concordant cable profile in brief.	**06**

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