BE - Sem - VII - CBSGS - Civil - P.C

18/12/1

Q.P.Code: 018224

(3 Hours) [Total Marks: 80]

Note: 1) Q1 is compulsory. Attempt any three out of remaining five questions.
2) Use of IS 1343:2012 is permitted in the examination.
3) Assume suitable data if required and mention it clearly.
4) Support answers and solutions with suitable sketches.

Q1. A] What do you mean by a load balancing cable? Sketch the profile of load balancing cable for the following cases.

1. A fixed ends beam subjected to uniformly distributed load on entire span.
2. A cantilever beam subjected to uniformly distributed load on entire span. [05]

B] Match the pairs for M45 concrete.

1. Principal tensile stress	a. 38.237×10^3 MPa
2. Modulus of rupture	b. 1.61 MPa
3. Young's modulus of elasticity of concrete	c. 36 MPa
4. Maximum permissible compressive stress in flexure due to final prestress (Zone-I)	d. 17.1 MPa
5. Permissible bearing stresses on concrete just behind the anchorages	e. 4.7 MPa

[05]

C] What are bottom and top kern points? Show that greater magnitude of loads can be counteracted if greater is the distance between kern points. [05]

D] Determine loss of stresses in cable1 and cable2 due to elastic deformation of concrete alone for a post tensioned beam for the following conditions.
(i) Cables are tensioned and anchored simultaneously
(ii) Cables are tensioned and anchored successively
Cross sectional dimension of beam are 250mmx450mm, cable1 is straight at 100mm below the neutral axis and cable2 is linear which is concentric at support and 100 below neutral axis at mid span. Prestressing force in each cable is 400kN. Take m=6. [05]

Q2. A post-tensioned concrete beam of 6m span and rectangular section 200mmx450mm is provided with two cables as under;

Cable	Position at support	Position at mid span	Profile	Effective PF
C1	150mm above n.a	150mm below n.a	Parabolic	300kN
C2	150mm below n.a	150mm below n.a	Straight	300kN

Grade of concrete is M50, f_p and f_{pi} are 1600 MPa and 1000 MPa respectively for prestressing steel. Calculate safe uniformly distributed imposed load such that beam is safe in limit sate of flexure, shear. Take η=0.8 [20]

Q3.A] A cantilever portion of a prestressed concrete bridge with a rectangular cross section 600mm wide and 1600mm deep is 8m long and carries a reaction of 350kN (ultimate) from suspended span at the free end together with an uniformly distributed load (ultimate) of 60kN/m (inclusive of self weight). The beam is prestressed by 6 cables, each carrying a force of 1000kN, of which 3 are located at 150mm and 3 are located at 400mm from top edge. Cables are straight. Calculate principal tensile stress at a fiber 500mm from top and 500mm from bottom at 2m from support section and compare with respective permissible limit. Assume M40 concrete. [15]

B] Develop equations for the minimum sectional modulus to be provided for a prestressed concrete section such that section is safe in limit state of serviceability cracking. [05]

Q4. A] A post tensioned rectangular section 400mm wide and 1000mm deep has to carry an imposed load of 25kN/m on 10m simply supported span. Determine prestressing force and eccentricity. Suggest suitable cable profile and locate it in safe cable zone. The stresses in concrete must not exceed 17N/mm^2 in compression and 1.4N/mm^2 in tension at any time. 15% Loss in prestress may be assumed. **[15]**

B] Sketch stress vs strain variation for rectangular prestressed concrete section and hence develop the equation for Ultimate Moment of Resistance. **[05]**

Q5. A] The end block of a post-tensioned prestressed concrete beam is 250mm x450mm which is subjected to a concentric force of 600kN by a Freyssenet anchorage (mild steel-circular plate) of 150mm diameter. Take f_{ck}=50MPa and f_{ci}=40MPa. Ensure that concrete just behind the anchorages is safe against crushing and no punching of plate in the concrete takes place. Suggest suitable change in diameter of plate if needed. Also determine thickness of plate if sheathing duct diameter is 60mm.Design reinforcement to counter the bursting of the section. **[10]**

B] A simply supported concrete beam of 6m span is post tensioned by a parabolic cable with eccentricity 200mm below neutral axis at mid span and concentric at support.
Take; E_S= 200kN/m^2, E_C=35kN/m^2, μ = 0.2, K = 0.004/m, Anchorage Slip = 1mm,
Shrinkage strain in concrete = 300 x 10^{-6},
Consider low relaxation and initial stresses in steel as 0.7f_p where f_p=1500 MPa
Creep coefficient of concrete =1.6
Rectangular cross section: 250mm x500mm; Area of prestressing steel=1500mm^2 **[10]**
Determine loss of stress in steel.

Q6. A span continuous beam AB=BC=12m of 300mmx800mm below is prestressed by 1000kN force initially. Beam has to carry 15kN/m uniformly distributed load in addition to its self weight. Cable profile is parabolic which is concentric at supports having maximum eccentricity of 300mm below neutral axis at mid of spans. Draw pressure line at transfer and service stage. Take η=0.8 **[20]**
