Reg. No.



MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institution of Manipal University

VII SEMESTER B.TECH. (CIVIL ENGINEERING) END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: STRUCTURAL DESIGN IV [CIE 409]

REVISED CREDIT SYSTEM (30/11/2016)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ANY FIVE FULL questions.
- Missing data may be suitable assumed.
- **♦** Use of **IS: 1343-1980** is permitted.
- ✤ Assume density of concrete as 25 kN/m³

1A.	 A post tensioned beam of span 10 m is provided with two 'plain cold- drawn wires each having an area of 1450 mm². Cable 1 is parabolic with zero eccentricity at the supports and 50 mm below the centroid at mid-span. Cable 2 is having zero eccentricity at supports linearly varies to 35 mm below the centroid at mid span, cables are successively prestressed from one end. (a) Compute the jacking force required to compensate for loss due to length, curvature effect and slip of anchorage for each cable if, a stress of 1200 N/mm² is to be maintained after anchoring. (b) Compute the subsequent losses after anchoring. Given: Grade of concrete = M 45, anchorage slip 2mm, co-efficient of wave effect = 0.0091/m and coefficient of friction = 0.25 f_p = 1865 N/mm², Age at loading = 14 days, f_{c11} = 12.4 N/mm², f_{c12} = 13 N/mm², f_{c21} = 13.2 N/mm², f_{c22} = 14.6 N/mm² 	7
1B.	Define: i) Non distortional prestressing ii) Moderate prestressing iii) Proof stress	3
2A.	A beam of span 12m is to be loaded with a point load of 15kN at 3m from left end and an UDL of 5 kN/m. If first cable is prestressed with 1000 kN and second cable is prestressed with 950 kN force, obtain two suitable cable profiles for each of the cable using load balancing concept	3
2B.	A simply supported post - tensioned PSC I section beam of span 9 m is prestressed with a parabolic cable having zero eccentricity at supports and an eccentricity of 150 mm below center of gravity of concrete at mid span. The prestressing force induced in cable is 2200 kN. Live load on the span is 13.25 kN/m. Details of the cross section are given in table 1. Grade of concrete = M45. Draw the stress distribution diagram at mid span section at transfer and working stage. Take loss of prestress as 18%. If member to be designed as type 1 check for stress limits as per the code	7
3A.	Explain rupture of tendons and under reinforced modes of failure.	4

3B.	Check for limit state of serviceability of a Pre - tensioned beam with section as given in table 1. The beam is prestressed with a parabolic cable having zero eccentricity at the supports and an eccentricity of 175 mm below the centroid at mid span, with an initial prestress of 1900 N/mm ² Span = 11.5 m, Load on beam = 15 kN/m. Grade of concrete = M 45, loss of prestress = 15%. Age of loading = 14 days.	6		
4A.	For the section given in table 1, check for limit state of collapse in flexure for pre- tensioned PSC beam for the following data: Effective span = 14.25 m, Live load = 9.45 kN/m. The beam is prestressed with 30 no. of 8 mm diameter wires. Characteristic strength of prestressing steel = 1865 N/mm ² . Effective cover to prestressing steel = 150 mm Grade of concrete = M40	6		
4B.	If the beam given in Q.No 4A is pre-tentioned, check for the development length and design the end zone reinforcement, if initial prestress is $0.8f_p$ and effective pre stress is $0.7f_p$ and $f_{pu}=1350$ N/mm ² . Indented wires to be used			
5A.	A PSC beam designed to carry a live load of 10 kN/m over a span of 12 m. Details are as follows, Grade of Concrete: M40; Characteristic Strength of Steel: 1750 N/mm ² ; Area of steel: 1600 mm ² ; Effective prestress: 1280 N/mm ² ; Cable profile: Parabolic which is concentric at supports and having an eccentricity of 200 mm at mid span. Effective cover to longitudinal reinforcement = 60 mm. Sectional data is as in table 1. If, shear resistance of the section cracked in flexure is 100 kN, design shear reinforcement using 8mm diameter HYSD bars if required, by checking shear resistance at section un-cracked in flexure	6		
5B.	The end block of a post-tensioned beam is having a rectangular section of 450 mm x 900 mm. It is pre-stressed using two anchor plates of size 300 mm x 245 mm. c.g.c of which are placed symmetrically 225 mm from the top and the bottom edges respectively. Effective pre-stressing force imparted to each plate is 1000 kN. Grade of concrete is M 40. Compute Bursting Tension and design the end block reinforcement using 8mm diameter HYSD steel.	4		
6A.	Design a simply supported type-1 post-tensioned PSC beam of span 12 m loaded with a working load of 10 kN/m. The trial section is as given in table 1. Grade of concrete = M 45. Loss of pre-stress is 17%.	10		

TABLE: 1			
Top flange	550 mm x 150 mm		
Web	160 mm x 500 mm		
Bottom flange	200 mm x 250 mm		
y _t	362.06mm		
Ι	1.75 x 10 ¹⁰ mm ⁴		