Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

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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

(/ /2016)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** the questions.
- Missing data may be suitable assumed
- Use of IS:**1343 -1980** is permitted
- Assume density of concrete as **25kN/m^3**

1A.	A post tensioned beam of span 11.5 m is provided with two plain cold- drawn wires each having an area of 1550 mm^2. Cable 1 is parabolic with zero eccentricity at the supports and 60 mm below the centroid at mid-span. Cable 2 is having zero eccentricity at supports linearly varies to 40 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 1100 N/mm^2 is to be maintained after anchoring. (b) Compute the subsequent losses after anchoring. Given: Grade of concrete = M 40, anchorage slip 1.5mm, co-efficient of wave effect = 0.0046/m and coefficient of friction = 0.18. fp = 1865 N/mm^2, Age at loading = 21 days, f_{c11} = 13 N/mm^2, f_{c12} = 11.75 N/mm^2, f_{c21} = 14.15 N/mm^2, f_{c22} = 17.2 N/mm^2	**7**
1B.	Explain chemical pre-stressing	**3**
2A.	A beam of span 10.75 m is to be loaded with a point load of 30 kN at 7 m from left end and an external UDL of 8 kN/m. If first cable is prestressed with 1210 kN and second cable is prestressed with 800 kN force, obtain two suitable cable profiles for each of the cable using load balancing concept.	**3**
2B.	A simply supported post – tensioned PSC beam of span 8.65 m is prestressed with a parabolic cable having zero eccentricity at supports and, an eccentricity of 200 mm below center of gravity of concrete at mid span. The prestressing force induced in cable is 1950 kN. Live load on the span is 10.25 kN/m. Details of the cross section are given in table 1. Grade of concrete = M50. Draw the stress distribution diagram at mid span section at transfer and working stage. Take loss of prestress as 16%. If member to be designed as type 1 check for stress limits as per the code.	**7**
3A.	Prestressing beams are stiffer than corresponding RCC beams. Substantiate the statement.	**4**
3B.	Check for limit state of serviceability for a type 1 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 200 mm below the centroid at mid span, with an initial prestressing force of 1800 kN. Span = 13 m, Load on beam = 11.25 kN/m. Grade of concrete = M 40, loss of prestress = 18%, Age of loading = 21 days.	**6**

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4A.	For the section given in table 1, check for limit state of collapse in flexure for a pre-tensioned PSC beam for the following data: Effective span = 12.5 m, Live load = 10.5 kN/m. The beam is prestressed with 32 no. of. 7 mm diameter wires. Characteristic strength of prestressing steel = 2100 N/mm^2, Effective cover to prestressing steel = 200 mm, Grade of concrete = M45	**6**
4B.	If the beam given in **Q. No 4A** is pre-tensioned, check for the development length and design the end zone reinforcement, if initial prestress is 0.8fp and effective pre-stress is 0.7fp and fpu = 1600N/mm^2. Use indented wires	**4**
5A.	A PSC beam designed to carry a live load of 12.25 kN/m over a span of 10.5m. Grade of Concrete: M35; Characteristic Strength of Steel: 1865 N/mm^2; Area of steel: 1900 mm^2; Effective prestress: 1300 N/mm^2; Cable profile: Parabolic which is concentric at supports and having an eccentricity of 150 mm at mid span. Effective cover to longitudinal reinforcement = 45 mm. Sectional data is as in table 1. If, the shear resistance of the section cracked in flexure is 90 kN, design the Shear reinforcement using 8 mm diameter HYSD bars if required, by checking shear resistance at section un-cracked in flexure only.	**6**
5B.	The end block of a post-tensioned beam is having a cross section of 400 mm x 400 mm, is prestressed with an effective prestressing force of 800 kN using concentrically placed freyssinet anchorage of 200 mm diameter. Grade of concrete is M40. Compute Bursting Tension and design the end block, reinforcement using 8 mm diameter HYSD steel.	**4**
6.	Design a simply supported type -1 post-tensioned PSC beam of span 14 m loaded with a working load of 12.5 kN/m. The trial section is as given in table 1. Grade of concrete = M 45. Loss of is 19%.	**10**

TABLE: 1

Top flange	450 mm x 150 mm
Web	150 mm x 600 mm
Bottom flange	250 mm x 250 mm
y_t	455.68 mm
I	2.39x 10^{10} mm^4