Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2180612 **Date: 06/05/2017**

Subject Name: Design of Prestressed Concrete Structures & Bridges(Departmental Elective - III)

Time: 10:30 AM to 01:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of code IS: 1343 (2012) is permitted.**

Q.1 (a) i. Why high strength materials are required for prestressed concrete. **03**

ii. Distinguish clearly between Pre-tensioning & Post-tensioning. **04**

(b) i. Explain any one prestressing system used in post-tensioned beams. **03**

ii. Evaluate the ultimate flexural strength of the section according to IS1343:2012. The pretensioned concrete girder of box section 1m * 1m overall dimension has a uniform thickness of 200mm. the girder is post-tensioned by 2250 mm^2 of high tensile steel at an effective depth of 900 mm from top. If f_{ck} is of 40 N/mm^2 and f_p is of 1600 N/mm^2. **04**

Q.2 (a) A pre-stressed beam, 180 mm wide and 400 mm deep, is prestressed with tendons of 3 wires of 8 mm diameter is initially stressed to 1200 N/mm^2 located 80 mm constant eccentricity. Span of the beam is 8.0 m. Find the percentage loss of stress in tendons if, **07**

i. The beam is pre-tensioning

ii. The beam is post-tensioning using following data

If the concrete undergoes a further shortening due to creep and shrinkage while there is a relaxation of 6 percent of steel stress

modular ratio: 6

E_s = 210 kN/mm^2

Anchorage slip: 0.8 mm

Friction co-efficient of wave effect: 0.002/m

Take creep co-efficient (Φ) = 1.6,

Total residual shrinkage strain = 300 $X10^{-6}$ for pre-tensioning and 200 $X10^{-6}$ for post-tensioning.

(b) A rectangular beam of span 8.0 m and cross-section 100mm wide x 250mm deep is prestressed by a straight cable carrying an effective prestressing force 250kN located at an eccentricity of 40 mm. The beam carries a live load 1.2 kN/m all over its span. **07**

i. Calculate top and bottom fiber stress at center of span. Take density of concrete 24 kN/m^3

ii. Find the magnitude of prestressing force with an eccentricity of 40 mm which can balance the stresses due to dead and live loads at the bottom fibre of the central section of the beam.

OR

(b) The floor slab of an Industrial structure, spanning over 8 m is to be designed as a one way slab prestressed concrete slab with parallel post-tensioned cables. The slab is required to support live load of 10 kN/m2 with compressive and tensile stress in concrete at any stage not exceeding 14 N/mm2 and zero respectively. Design the suitable thickness for the slab and estimate the maximum horizontal spacing of the Freyssinet cables (12 number of 5 mm diameter initially stressed to 1200 N/mm2) and their position at mid span section. The loss ratio is 0.8. **07**

Q.3	**(a)**	Explain stress distribution in the end block in the prestressed concrete beam.	**07**
	(b)	Compute the bursting force and Design suitable anchorage zone reinforcement according IS 1343. The end block is size of 200mm wide by 300mm deep is post tensioned with two Freyssinet anchorage each of 100 mm diameter with their centers located at 75 mm from the top and bottom of the beam. The force transmitted by each anchorage being 2000 kN.	**07**

OR

Q.3	**(a)**	A concrete beam with a cross section 150 mm wide X 300 mm deep is Prestressed by a linearly varying cable carrying an effective prestressing force 350 kN. The span of the beam is 8 m. the beam supports a concentrated load of 20 kN at center of span. The cable has an eccentricity of 70 mm below the Centroidal axis the center and 25 mm above the Centroidal axis at the supports. Take E_c = 38 kN/mm^2. Neglecting all losses, find the central deflection of the beam as follows: (a) Self weight + pre-stress and (b) Self weight + pre-stress + live load	**07**
	(b)	A pre-tensioned beam, 90 mm wide and 180 mm deep is to be designed to support two imposed load of 3.5 kN each located at one third points over a span of 3m. Determine the prestressing force and its eccentricity if the permissible stresses in tension are zero at transfer and service loads. Consider 20% losses of prestress. Take density of concrete 24 kN/m^3.	**07**
Q.4	**(a)**	Explain in details the Live load specification for road bridge as per IRC.	**07**
	(b)	Give application and Principles of design of Pre-tensioned Concrete bridge.	**07**

OR

Q.4	**(a)**	Explain different types of Wing wall with diagram.	**07**
	(b)	Enlist and explain different types of foundation for RCC bridges.	**07**
Q.5	**(a)**	Give classification of bridges in details.	**07**
	(b)	What are the special features of prestressed concrete bridge? Also explain various types of prestressed concrete bridge.	**07**

OR

Q.5	**(a)**	Which are the preliminary data to be collected for the design of bridges?	**07**
	(b)	Explain role of pier as a substructure part of Bridges. Also enlist the loads and forces to be considered while designing pier.	**07**

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