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Reg. No. : | | | | | | | | | | |

Question Paper Code: 99113

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

Elective

Civil Engineering

19UCE913– Prestressed Concrete Structures

(Regulations 2019)

(Use of IS 1343:2012 and IS 3370 (Part IV) – 1967 code books are allowed)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. Creep of concrete in a structural member is due to CO1- U

   (a) Elastic strain (b) elasto- plastic strain

   (c) inelastic strain (d) none of these

2. In partially prestressed members, to which extent tensile stresses are permitted? CO1- U

   (a) Unlimited (b) Limited (c) Constant (d) Zero

3. The economical proportion of diameter to height of circular cylindrical prestressed concrete tank is CO1- U

   (a) 1:4 (b) 4:1 (c) 2:1 (d) 1:1

4. If the precast member is supported only at the ends during the casting, it is called as CO1- U

   (a) propped (b) unpropped (c) anchorage (d) None of the above

5. The precast prestressed I and inverted T beams have been standardized by CO1- U

   (a) Pulverization association (b) Cement and concrete association

   (c) Brick association (d) Steel association

PART – B (5 x 3= 15 Marks)

6.	An ordinary MS bar has been prestressed to a working stress of 150 Mpa. If the young's modulus of steel is 200 GPa and permanent negative strain due to shrinkage and creep is 0.00008, what is the effective stress left in the steel?	CO2- App
7.	Sketch the details showing the stress distribution in the end block by double anchor plate.	CO1- U
8.	How the percentage of reinforcement varies in prestressed concrete pipes to estimate losses of prestress?	CO1- U
9.	Define propped construction.	CO1- U
10.	List the advantages of prestressed concrete bridges.	CO1- U

PART – C (5 x 16= 80Marks)

11.	(a)	A prestressed concrete beam of rectangular section 120mm wide and 300mm deep, spans over 6m the beam is prestressed by a straight cable carrying an effective force of 200 kN at an eccentricity of 50mm. The modulus of elasticity of concrete is 38 kN/m^2. Compute the deflection at center of span for the following cases i) Defection under (prestress + self-weight) ii) Find the magnitude of the uniformly distributed live load which will nullify the deflection due to prestress and self-weight.	CO2- App	(16)
		Or		
	(b)	A prestressed concrete beam , 200mm wide and 300 mm deep, is prestressed with wires (Area = 320 mm2) located at a constant eccentricity of 50 mm and carrying an initial stress of 1000N/mm2. The span of beam is 10 m. Calculate the Percentage of loss of stress in wires if i. The beam is pre-tensioned , and ii. The beam is post tensioned using the following data Es = 210 kN/mm^2 and Ec = 35 kN/mm^2 Relaxation of steel stress = 5% of initial stress Shrinkage of concrete = $300x10^{-6}$ for pre tensioning & 200 X 10^{-6} for post tensioning Creep coefficient = 1.6 Slip at anchorage = 1mm Frictional coefficient for wave effect as 0.0015/m.	CO2- App	(16)

12. (a) A precast pretensioned T- beam has a flange width of 1200mm and thickness of 150 mm .The width and depth of the rib are 300 and 1500 mm, respectively. The high tensile steel tendons of cross sectional area 4700 mm2 are located at an effective depth of 1600mm. if the characteristic strength of concrete and steel are 40 and 1600 N/mm2 , respectively. Calculate the flexural strength of the T- section using Indian standard code provisions. And also, if the cross sectional area of tendons are increased to 5500 mm2 . Estimate the flexural strength of T- section. CO5- Ana (16)

Or

(b) A pretensioned concrete beam with a rectangular section 100mm wide and 160mm deep, is prestressed by 10 high-tensile wires of 2.5mm diameter located at an eccentricity of 40mm. The initial force in each wire is 6.8 kN.The strain loss in wires due to elastic shortening, creep and shrinkage of concrete is estimated to be 0.0012 units. The characteristic compressive strength of concrete is 40 N/mm2. CO5- Ana (16)

Estimate the Ultimate flexural strength of the section using strain Compatibility method.

Also, If no. of wires is increased to 16, estimate the flexural strength of the section.

13. (a) A cylindrical PSC water tank of internal diameter 30 m is required to store water over a depth of 7.5m. Circumferential winding is made of 5mm diameter wires with initial stress of 1000 N/mm^2. Vertical prestressing is made using freyssinet cable of 12 wires of 8mm diameter stressed to 1200 N/mm^2.The loss ratio is 0.75. f_{min} = 1 N/mm^2, f_{ct}= 13 N/mm^2 and f_c = 40 N/mm^2 Design the tank walls assuming base is fixed. CO3- App (16)

Or

(b) A cylindrical PSC water tank of internal diameter 40 m is required to store water over a depth of 9m. Circumferential winding is made of 5 mm diameter wires with initial stress of 1200 N/mm^2. Vertical prestressing is made using freyssinet cable of 12 wires of 8mm diameter stressed to 1200 N/mm^2.The loss ratio is 0.75. f_{min} = 1 N/mm^2, f_{ct}= 13 N/mm^2 and f_c = 40 N/mm^2 Design the tank walls assuming base is fixed. CO3- App (16)

14.	(a)	A precast pre – tensioned beam of rectangular section has a breadth of 100mm and depth of 200mm. The beam with an effective span of 5m is prestressed by the tendons with their centroids coinciding with the bottom kern. The initial force in the tendons is 150kN. The loss of prestress is 15%. The top flange width is 400mm with the thickness of 40mm.If the composite beam supports a live load of 8kN/m2. Calculate the resultant stresses developed if the section is propped and unpropped. Assume same modulus of elasticity in precast beam and in situ slab.	CO2- App	(16)
		Or		
	(b)	A composite T girder of span 5 m is made up of a pre-tensioned rib, 100 mm wide by 200 mm deep, with an in situ cast slab, 400 mm wide and 40 mm thick. The rib is prestressed by a straight cable having an eccentricity of 33.33 mm and carrying an initial force of 150 kN. The loss of prestress may be assumed to be 15%. Check the composite T beam for the limit state of deflection if it supports an imposed load of 3.2 kN/m for: (a) unpropped construction and (b) propped construction. Assume a modulus of elasticity of 35 kN/mm^2 for both precast and in situ cast elements.	CO2- App	(16)
15.	(a)	Explain the steps involved in the design of short span prestressed concrete solid slab bridge decks for national highways to support IRC loads.	CO1- U	(16)
		Or		
	(b)	Outline the procedure for designing a T beam and slab bridge deck for a national highway crossing.	CO1- U	(16)