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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M.TECH DEGREE EXAMINATION, FEBRUARY 2016

Civil Engineering

(Structural Engineering and Construction Management)

04 CE 6415 Prestressed Concrete Structures

Max. Marks : 60 Duration: 3 Hours

PART A

Answer All Questions.
Each question carries 3 marks.

1) Comment about resultant stresses in a pre-stressed concrete section.
2) Derive the equation for short term deflection of any two cable profiles
3) What are the advantages of using composite construction with pre-stressed and insitu concrete in structural members?
4) How do we compute resultant stresses in composite members with un- propped condition?
5) Explain transmission length.
6) What are the advantages of prestressed concrete piles.
7) What are the different methods for the analysis of continuous beams
8) Explain linear transformation

(8x3=24 marks)

PART-B (6x6 = 36 marks)

Each question carries 6 marks.

9 a.) A Pre-Tensioned T-section has a flange 1200 mm wide and 150 mm thick. The width and depth of rib are 300 mm and 1500 mm respectively.The high tensile steel has an area of 4700 mm^2 and is located at an effective depth of 1600 mm. If the characteristics cube strength an tensile strength of steel are 40 N/ mm^2 and 1600 N/ mm^2. Calculate the flexural strength of of T-section.

OR

9.b) Design a post tensioned pre-stressed beam of rectangular section 250 mm wide for an imposed load of 12 KN/m uniformly distributed on a span of 12 m. Stress in concrete must not exceed 17 N/mm^2. In compression and 1.4 N/ / mm^2in tension at any time. The loss of prestress may be assumed to be 15 %.

10.a) Floor slab of an industrial structure spanning over 8 m is to be designed as one way pre-stressed concrete slab with parallel post tensioned cables. The slab is required to support a live load of 10 KN/ $m^2$with compression and tensile stress in concrete at any stage should not exceed 14 and zero N/ mm^2 respectively. Design a suitable thickness for the slab and estimate the horizontal spacing of Freyssinet cables (12 of 5 mm diameter initially stressed to 12000 N/ mm^2) and their position at mid span section. The loss ratio is 0.8.

OR

10.b) A concrete beam with cross section 32 x 10^3 mm^2 and radius of gyration 72 mm is prestressed by a parabolic cable having an effective stress 1000 N/ mm^2. Span of the beam is 8 m. The cable composed of 6 wires of 7 mm diameter with an eccentricity of 50 mm at the centre and zero at support. Neglecting all losses, find the central deflection of the beam as follows

a) Self weight + Prestress

b) Self weight + Prestress + live load of 2 KN/m run

11.a) A prestressed concrete cylindrical pipe is formed by lining a steel cylinder of 750mm diameter and thickness 2.5 mm with a layer of spun concrete 38mm thick. If the pipe is required to withstand a hydraulic pressure 0.85 N/mm^2 without developing any compressive stress in concrete. The maximum permissible compressive stress in concrete at transfer is 41 N/mm^2. Calculate

a) The required pitch of 4mm would round the cylinder at a tensile stress of 980 N/mm^2.

b) The test pressure required to produce a tensile stress of 1.4 N/mm^2 in the concrete immediately after winding?

c) The approximate bursting pressure.

OR

11.b) A concrete beam of rectangular section , 200mm wide and 600mm deep, is prestressed by a parabolic cable located at an eccentricity of 100mm at the mid span and zero at the supports. If the beam has a span of 10m and carries a uniformly distributed live load of 4 kN/m, find the effective force necessary in the cable for zero shear stress at the support section. For this condition, calculate the principal stresses. The density of concrete is 24 kN/m^3

12.a) A building is to be supported on a prestressed concrete pile foundation. The pile has an effective height of 5m. They have to support a service load of 1100 kN together with a moment 37.5 kNm. Calculate the area of steel required for the pile and also check whether the pile is safe against handling stresses.

OR

12.b) Design a tie member 25m long is to carry a load of 500kN. Design the tie using the following details.

The compressive stress initially (f_{ct}) =14 N/mm^2

Loss of prestress = 20 %

Stress in steel at transfer (f_{si}) = 1000 N/mm^2

The modular ratio between steel and the concrete, m = 6

Design must ensure a residual compressive stress (f_{cw}) of 2 N/mm^2. Also calculate the load factor against cracking if the tensile strength of concrete (f_t) = 5 N/mm^2

13.a) A rectangular pre tensioned concrete beam has a breadth of 200mm and depth 230mm and prestressed after all loses have occurred is 12 N/mm^2 at the soffit and zero at the top. The beam is incorporated in a composite T beam by casting a top flange of breadth 300mm and depth 50mm. calculate the maximum uniformly distributed LL that can be supported on a simply supported span of 4.5m with out tensile stresses occurring .Assume support condition to be propped and modular ratio as 1.

The modular ratio of cast in situ to precast concrete as 1.0.

OR

13. b) The mid span section of a composite T beam comprises a pre-tensioned beam, 300 mm wide and 900 mm deep and an in situ cast slab of 900 mm wide and 150 mm deep. The effective pre-stressing force located 200 mm from the soffit of the beam is 2180 KN. The moment due to the weight of precast section is 273 KNm at mid span. After this is erected in place, the top slab is cast producing a moment of 136.5 KNm at mid span.

After slab concrete is hardened the composite section is to carry a maximum live load moment of 750 KNm. Compute the resultant final stresses at

a) The top of slab
b) The top and bottom of precast section

14.a) A continuous prestressed concrete beam ABC (AB=BC=10m) has a uniform rectangular cross section with a width of 100mm and depth of 300mm. The cable carrying an effective prestressing force of 360 kN is parallel to the axis of the beam and located at 100mm from the soffit.

a) Determine the secondary and resultant moment at the central support B.

b) If the beam supports an imposed load of 1.5 kN/m. calculate the resultant stresses at the top and bottom of the beam at B. Assume density of concrete as 24 kN/m^3.

c) Locate the resultant line of thrust through beam AB.

OR

14.b) A two span continuous beam ABC (AB=BC=10m) is of rectangular section 200mm wide and 500mm deep. The beam is prestressed by a parabolic cable concentric at end support and having an eccentricity of 100mm towards the soffit of the beam at centre of span and 200mm towards the top of the beam at midspan support B. the effective force in the cable is 500kN. Show that the cable is concordant