Total number of printed pages – 8 **B. Tech**

CPCE 8403

Eighth Semester Examination – 2008

PRESTRESSED CONCRETE

Full Marks – 70

Time : 3 Hours

Answer either from Set-A or Set-B, but not from both.

SET – A

*Answer Question No. **1** which is compulsory and any **two** from the rest.*

The figures in the right-hand margin indicate marks.

Indian Standard Codes, Books of Reference and Tables are allowed. Notes including class notes are not allowed.

1. A five storied hospital building is to be constructed in Bhubaneswar on hard soil. Determine the lateral force and storey shears in an outer frame due to earthquake using following data. 20

   Bay width = 5 m centre to centre

   Frame spacing = 4 m centre to centre

   Floor thickness including finish = 20 cms

   Outer columns = 30 cms × 30 cms

   Inner columns = 40 cms × 30 cms

   Girders below floor slab = 30 cms × 40 cms

   Live load = 3 kN/m^2

   Damping = 5%

   Total weight of brick wall on each floor is 100 kN which act at 1.5 m below the floor level. Reduced level of ground, 1^{st}, 2^{nd}, 3^{rd}, 4^{th} and roof level is 100 m, 104 m, 107 m, 115 m and 118 m respectively.

2. Design a RCC slab culvert for a National Highway to suit the following data. 25

Carriage way two lane = 7.5 m wide

Foot path = 1 m on either side

Clear span = 6.5 m

Wearing coat = 80 mm

Width of bearing = 400 mm

Diameter of reinforcement bars = 25 mm

Clear cover to reinforcement bars = 30 mm

Grade of concrete = M20

Grade of steel = Fe 415

Loading on bridge = IRC Class A.

3. In a classroom, there are two lines of columns four being in each line. The centre to centre distance of columns is 5 m in longitudinal direction and 4 m in transverse direction. The central columns carry a load of 1000 kN each and the load on each end column is 750 kN. Design a mat foundation for the columns. The SBC of soil is 100 kN/m^2. Use M20 grade of concrete and Fe 415 grade of steel. Unit weight of soil is 20 kN/m^3 and angle of repose is 30 degrees. 25

4. A cylindrical silo has an internal diameter of 4.2 m and 25 m deep and is filled with wheat weighing 8 kN/m^3. The angle of repose for wheat is taken as 25°. The coefficient between wheat and silo wall is 0.45. Ratio of horizontal to vertical pressure intensity is 0.42. Design the silo wall using M20 grade of concrete and Fe 415 grade of steel. 25

5. Design a counter fort retaining wall for retaining 8 m high earth above ground level considering the following data.

Weight of soil = 15 kN m^3

Grade of concrete = M 20

Angle of repose = 30°

Grade of steel = Fe 250

Coefficient of friction at base = 0.5

Allowable SBC of soil = 150 kN/m^2

Check the stability of the trial section and design the heel slab and toe slab. 12+7+6

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SET – B

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

Indian Standard Codes, Books of Reference and Tables are allowed. Notes including class notes are not allowed.

1. A prestressed concrete beam supports a live load of 4 kN/m over a simply supported span of 8 m. The beam has an I section with an overall depth of 400 mm. The thickness of flange and web are 60 and 80 mm respectively. The width of flange is 200 mm. The beam is to be prestressed by an effective prestressing force of 235 kN at a suitable eccentricity such that the resultant stress at the soffit of the beam at the centre of the span is zero.
   (a) Find the eccentricity required for the force.
   (b) If the tendon is concentric, what should be the magnitude of the prestressing force for the resultant stress to be zero at the bottom fibre of the central span section. 10+10

2. A pretensioned beam 250 mm wide and 300 mm deep is prestressed by 12 wires each of 7 mm diameter initially stressed to 1200 N/mm^2 with their centroids located 100 mm from the soffit. Estimate the final percentage loss due to elastic deformation, creep, shrinkage and relaxation using IS : 1343-1980 and following data : 10
   Es = 210 kN/m^2 Ec = 35 kN/m^2
   Creep coefficient = 1.6
   Residual shrinkage strain = 3×10^{-4}
3. A double T section having a flange 1200 mm wide and 150 mm thick is prestressed by 4700 mm^2 of high-tensile steel located at an effective depth of 1600 mm. The ribs have a thickness of 150 mm each. If the cube strength of steel is 1600 N/mm^2, determine the flexural strength of the double T-girder using IS : 1343 provisions. 10
4. A concrete beam having a rectangular section 300 mm wide and 650 mm deep, is prestressed by a parabolic cable having an eccentricity of 120 mm at the centre of span reducing to zero at the supports. The span of the beam is 8 m. The beam supports a live load of 25 kN/m. Determine the effective force in the cable to

balance the dead and live loads on the beam. Determine the principal stresses at 250 mm from the support. 10

5. A two span continuous beam ABC (AB = BC= 10 m) is of rectangular section, 200 mm wide and 500 mm deep. The beam is prestressed by a parabolic cable, concentric at end supports and having an eccentricity 100 mm towards the soffit of the beam at centre of spans and 200 mm towards the top of the beam at mid support B. The effective force in the cable is 500 kN. Show the cable is concordant and also locate the pressure line in the beam when, in addition to its self-weight, it supports an imposed load of 5.6 kN/m. 10

6. The end block of a prestressed concrete beam, rectangular in section, is 120 mm wide and 300 mm deep. The prestressing force is 250 kN is transmitted to concrete by a distribution plate, 120 mm wide and 75 mm deep, concentrically located at the ends. Calculate the position and magnitude of the maximum tensile stress on the horizontal section through the centre of the end block using Guyon method. Design the reinforcement for the end block for the maximum transverse tension. Yield stress in steel = 260 N/mm^2. 10

7. A prestress concrete beam spanning over 8 m is of rectangular section, 150 mm wide and 300 mm deep. The beam is prestressed by a parabolic cable having an eccentricity of 75 mm below the centroidal axis at the centre of span and an eccentricity of 25 mm above the centroidal axis at the support sections. The initial force in the cable is 35 kN. The beam supports 3 concentrated loads of 10 kN each at intervals of 2 m. Ec = 38 kN/mm^2.

   Allowing for 20 percent loss in prestress, estimate the long term deflection under (prestress + self-weight + live load), assuming creep coefficient as 1.8. 10

8. Write short notes on any *four* : 2.5×4
   (a) Principle of post tensioning
   (b) Load balancing concept
   (c) Concordant cable profile
   (d) Short term and long term deflection
   (e) Types of steel lor prestressing.

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