26.5.06

Ex/BESUS/CE-602/06

B.E. (CE) Part-III 6th Semester Examination, 2006

Design of Structure-II

(CE-602)

Time : 3 hours **Full Marks : 100**

Use separate answerscript for each half.
Answer any SIX questions taking THREE from each half.
The questions are of equal value.
Two marks are reserved for neatness in each half.
Assume any data if needed.

FIRST HALF

1. Design suitable pile cap to support column of size 600 mm x 600 mm carrying an axial load of 2400 kN. The maximum capacities of 450 mm diameter and 500 mm diameter piles are 600 kN and 800 kN respectively. Use M25 grade concrete and Fe415 steel. Take permissible shear stress as 0.3 MPa.

2. a) Design and detail the longitudinal beam and cantilever bottom slab of a slab-beam type combined footing, in flexure only, for two columns A and B carrying load of 750 kN and 1500 kN, respectively. Column A is 400 mm square and B is 600 mm square in size, and are placed 5 m center to center. The property line restriction is 270 mm beyond the face A. Take safe bearing capacity of soil as 150 kN/m^2. Use M20 grade concrete and Fe415 steel.

   Given : i) Dimension of foundation : 7.6 m x 2.2 m in plan
   ii) Net soil pressure : 134.6 kN/m^2.

   b) Prepare a suitable layout of a Trapezoidal footing for the two columns of Q.2.(a). The center to center distance between two columns is 5m. The property line is 270mm beyond the outer face of A and 1200mm beyond the outer face of B.

3. Design a slab-type combined footing for bending moment in lingitudinal direction only for two columns C_1 (350 mm square) and C_2 (450 mm square) located at a center to center distance of 4m, carrying loads of 600 kN and 850 kN, respectively. The property line restriction is 560 mm beyond the outer face of C_1. Take bearing capacity of soil as 160 kN/m^2. Use M20 grade concrete and Fe415 steel.

4. Calculate maximum flexural stresses in a Gantry girder made of ISHB 600 with ISMC 300 placed at top flange for the following data :

   i) Crane capacity = 200 kN.
   ii) Weight of crab = 80 kN
   iii) Self weight of crab girder = 150 kN
   iv) Minimum approach of crane hook = 1.2 m
   v) Wheel base = 3.5 m
   vi) Span of Crane girder = 15 m
   vii) Span of Gantry girder = 5 m
   viii) Self weight of rail section = 0.2 kN/m
   ix) Height of rail section = 0.075 m
   x) Properties of overall section :

   $I_{xx} = 136 \times 10^7$ mm^4, I_{yy} of compression flange = 87×10^6 mm^4, position of N.A. from the top flange = 245 mm. Cross-sectional area = 21602 mm^2.

5. Check the adequacy of a column section ISHB 450 @ 92.5 kg/m for the following data :

   i) Length of the column = 6 m. Both ends are hinged.
   ii) The column carries an axial load of 250 kN at the top and a bracket at the height of 3.5m from the base of column. The bracket is subjected to 75 kN vertical load at a distance of 200 mm from the face of column.
   iii) Properties of ISHB 450 @ 92.5 kg/m :
   Area = 117.89 cm^2, Z_{xx} = 1743.1 cm^3, Z_{yy} = 242.1 cm^3,
   b_f = 250 mm, t_f = 13.7 mm, t_w = 11.3 mm, I_{xx} = 40349.9 cm^4,
   I_{yy} = 3045.0 cm^4, r_{xx} = 18.5 cm, r_{yy} = 5.08 cm,
   iv) Allowable stresses :
   $\sigma_{bcx} = \sigma_{bcy}$ = 100 MPa, σ_{ac} = 70 MPa,
   v) $C_{mx} = C_{my}$ = 0.85.

SECOND HALF

6. Design the mid span section of a simply supported welded plate girder carrying an uniformly distributed load of 60 kN/m, exclusive of self-weight on an effective span of 20m. Check both for flexural and shear stresses. Given permissible bending stress σ_{bc} = 140 MPa.

7. A simply supported welded plate girder of span 20m is made up of flange plate 500 mm x 50 mm and web plate of 2000 mm x 12 mm. The girder carries an u.d.l. of 40 kN/m inclusive of self-weight. Design the end bearing stiffeners.

8. A simply supported rivetted plate girder of span 20m consists of web plate 2000 mm x 20 m, flange plate 450 mm x 16 mm and flange angles ISA 150 x 150 x 15mm (area = 42.8cm^2, I_{xx} = 897 cm^4, C_{xx} = 42.6 mm). The girder carries an u.d.l. of 30 kN/m. Design a web splice at a section 8m from the support.

9. A rivetted plate girder consists of flange plates of 500 mm x 20 mm web plate 2000 mm x 10 mm and flange angle ISA 200 x 200 x 10 mm carries an u.d.l. of 50 kN/m over a span of 15m. Design the connection between flange plate and flange angles.

   Properties of ISA 200 x 200 x 18mm angles :

   $A = 6881 \text{ mm}^2$

   $C_{xx} = C_{yy} = 56.1 \text{ mm}$

   $I_{xx} = I_{yy} = 2588.7 \text{ cm}^4$

10. Design a base of the column having section ISHB300 @ 0.588 kN/m and carrying an axial load of 300 kN and a moment of 45 kN-m in the plate of the web. The allowable pressure on the footing is 5 MPa. For ISHB300, given A = 74.8cm^2, b_f = 250 mm, t_f = 10.6 mm, t_w = 7.6 mm.

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