No. of Printed Pages : 3

ET-508(A)

B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering)

Term-End Examination

December, 2013

00281

ET-508(A) : STRUCTURAL DESIGN-I

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **any four** questions. Use of **IS.456** and scientific **calculator** is permitted. Any missing data may be suitably assumed and mentioned. Support your answers with neat sketches.*

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1. (a) Describe balanced, under-reinforced and over reinforced sections in limit state design, showing the stress and strain variation along the depth of section for these cases. **5½**

(b) Determine the ultimate moment of resistance of a T-beam section having M-20 grade of concrete and Fe-415 of steel, for the following data. **12**

.Flange width = 1200 mm; Flange depth = 90 mm;

.overall depth = 650 mm; effective cover to tension reinforcement = 50 mm; web width = 240 mm; Area of tension steel = 2000 mm^2;

2. (a) Under what condition are doubly reinforced sections preferred ? **5½**

(b) Determine and provide the reinforcement for a bean section of 300mm width and 500mm overall depth. The section is subjected to an ultimate moment 350 kN.m. Take effective cover to reinforcement as 50mm. Adopt m20 and Fe-415 and use limit state design. **12**

3. (a) Describe the terms "Primary Torsion" and "Secondary Torsion". **5½**

(b) A simply supported singly reinforced rectangular beam is subjected to ultimate shear at support of 350kN. Span of the beam is 6 m and section has the following data. Width=300mm, effective depth=600mm, effective cover to tension reinforcement=30mm; Tension reinforcement=3 bars of 24mm dia; section is provided with 2 hanger bars of 10mm diameter at top. Using limit state design. **12**

(i) Design the shear reinforcement at support if one of the bar of 24 ϕ is bent up at 45° near support.

(ii) Design the shear reinforcement at mid-span region assuming beam is uniformly loaded.

(iii) Draw a neat longitudinal section showing all reinforcements.

Use m-20 concrete and Fe-415 steel.

4. A simply supported one way R.C slab having an overall thickness of 150 mm is reinforced with 12 mm diameter bars at an effective depth of 130 mm and at spacing of 100 mm c/c. The effective span of slab is 4 m. If the self weight of slab (including finishes) is 4.2 kN/m^2, estimate the maximum allowable live load on the slab. Adopt m-15 and Fe-250. Use WORKING STRESS method. **17½**

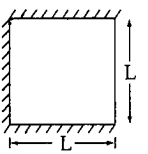
5. Design the reinforcement in a circular column of diameter 300 mm with helical reinforcement to support an ultimate load of 1500 kN. The column has an unsupported length of 3 m and is braced against sidesway. Adopt m-20 concrete and Fe-415 steel. Use limit state design. **17½**

6. Design a reinforced concrete footing for a rectangular column (300 mm x 500 mm) supporting an axial ultimate load of 1500 kN. The safe bearing capacity of the soil at site is 185 kN/m^2. Adopt m20 concrete Fe-415 steel and use limit state design. The column is provided with 6 bars of 20 mm diameter as longitudinal reinforcement. Give a neat dimensional sketch of footing (plan and sectional elevation) showing reinforcement details. **17½**

7. (a) Describe stability requirements for a cantilever retaining wall. **5½**

   (b) Describe the characteristic features of yield lines in slab. Show the typical yield line patterns for the following slabs : **12**

(i)



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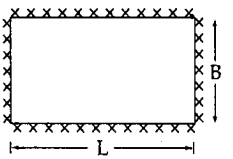
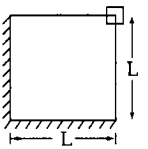


(iii)



(iv)