D 10647 (Pages : 2) Name.....

Reg. No.....

SEVENTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION DECEMBER 2010

CE 04 701—STRUCTURAL DESIGN—III

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Assume missing data if any suitably.

Use of IS 456, IS 3370, IRC 5, IRC 6, IRC 21, IS 1343, IS 800, IS 875, SP 6, SP 16 are permitted.

Part A

1. (a) Briefly describe the behaviour of the various elements of a counterfort retaining wall.

   (b) What is meant by eccentric loading on a footing, and under what circumstances does this occur ?

   (c) Discuss the different types of IRC live load.

   (d) Briefly describe the design steps of staging of rectangular water tank.

   (e) List out the various loss of prestress in post-tensioned members, also mention approximate value of each of these losses.

   (f) What are the merits and demerits of prestressed concrete members over reinforced concrete members ?

   (g) Discuss the design procedure for self supporting steel chimney.

   (h) Discuss horizontal and vertical stiffeners used in plate girders.

(8 × 5 = 40 marks)

Part B

2. (a) Design the reinforcement for a column with $l_{ex} = l_{ey} = 3.5$ m and size 300 mm × 500 mm. subject to a factored axial load of 1250 kN with biaxial moments of 180 kNm and 100 kNm with respect to major and minor axis respectively. Assume M25 concrete and Fe415 steel.

Or

   (b) Design the stem and toe slab to retain an earth embankment of 4.50 m above the ground level using the following data :

Density of earth	: 18 kN/m^3
Angle of internal friction	: 30°
Coefficient of friction between soil and base slab	: 0.4
SBC of soil	: 180 kN/m^2

Use M20 concrete and Fe 415 grade steel.

Turn over

3. (a) Design a circular RC water tank for a capacity of 60000 litres. The joints between base and wall is fixed. Use M25 concrete and Fe 415 grade steel.

Or

(b) Design a simply supported RC slab for the deck of a road bridge for the following data :

Carriage way width	: 7.5 m
Clear span	: 6 m
Width of bearing	: 400 mm
Type of loading	: IRC class A

Use M25 concrete and Fe 415 grade steel.

4. (a) A rectangular beam of cross-section 300 mm depth and 200 mm wide is prestressed by 15 – 5 mm dia. Wires located at 65 mm from the bottom of beam and 3 – 5 mm dia. Wires located at 25 mm from top. Assuming the effective prestressing in steel as 840 N/mm^2.

(i) Calculate the stresses at the extreme fibres of the mid-span section when the beam is carrying its own weight over a span of 6 m.

(ii) If a u.d.l. of 6 kN/m is imposed and the modulus of rupture of concrete is 6.5 N/mm^2, obtain the maximum working stress in concrete and estimate the load factor.

Or

(b) A pre-tensioned beam 200 mm × 300 mm deep is prestressed by 10 wires of 7 mm dia. Initially stressed to 1200 N/mm^2 with their centroids located at 100 mm from the soffit. Find the maximum stress in concrete immediately after transfer allowing only for elastic shortening of concrete. If the concrete undergoes a further shortening of creep and shrinkage while there is relaxatuion of 5 % steel stress. Estimate the final percentage loss of stress in the wires using the following data :

f_{ck} = 42 N/mm^2 Creep coefficient = 1.6

E_s = 210 kN/mm^2 Total residual shrinkage strain = 3×10^{-4}

5. (a) Design a suitable midspan section of a plate girder of 25 m effective span subjected to a superimposed load of 50 kN/m over the entire span. Use power driven rivets.

Or

(b) Design a self supporting lined steel chimney to the following particulars :

Height of the chimney = 80 m.

Diameter of chimney = 4.5 m.

Thickness of lining = 100 m.

Wind pressure = 1500 N/m^2 on flat vertical surface.

Assume suitable safe stresses.

(4 × 15 = 60 marks)