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320831(20)

APR-MAY

B. E. (Eighth Semester) Examination, 2020

(New Scheme)

(Civil Engg. Branch)

STRUCTURAL ENGINEERING DESIGN-IV

Time Allowed : Four hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Every unit first part is compulsory and attempt any one of next* ***two*** *part. IRC 21 (2000) is allowed. IS 456 : 2000 & IS 3370 is allowed.*

Unit-I

1. (a) What are the different types of combined footing used in structure and also elaborate about conditions when a particular type is adopted? 2

(b) A combined rectangular footing is to be provided for two square columns of size 400 mm and 500 mm, carrying factored axial loads of 700 kN and 1200 kN respectively. The columns are located 3·8 m c/c, the distance from the centre of lighter, column to the boundary line is restricted to 0·8 m. Take safe bearing capacity of soil = 180 kN/m^2. Grade for concrete = M20 Grade of steel reinforcement = Fe 415. 14

(c) Design a strap footing for two columns A and B, spaced 5 meter center to center. Column A 300 mm × 300 mm in size carries a load of 600 kN and is spaced at 0·6 meter from the property line. Column B, 400 mm × 400 mm in size, carries a load of 900 kN. The bearing capacity of soil is 120 km/m^2. Use M20 mix and Fe 415 steel. 14

Unit-II

2. (a) Draw the deflection profile of cantilever retaining wall and counterfort retaining wall. 2

(b) Design a cantilever retaining wall to retain horizontal earthen embankment of height 3·5 m above the ground level. The earthen backfill is having a density of 17 kN/m^3 and angle of internal friction is 35

degree. The safe bearing capacity of the soil is 180 kN/m^2. The coefficient of friction between soil and concrete is assumed to be 0·4. Use M20 concrete and Fe 415 steel. 14

(c) Design a counterfort retaining wall to retain 4·5 m high embankment above ground level. The safe bearing capacity of soil is 200 kN/m^2. The earthen backfill is horizontal and soil density is 15 kN/m^3, with angle of internal friction is 30 degree. Coefficient of friction between soil and concrete is 0·45. Use M20 concrete and Fe 415 steel. 14

Unit-III

3. (a) Draw different types of joints used in water tank. 2

(b) Design a circular water tank with flexible base for a tank 200000 liters capacity resting on ground. The depth of water taken at tank is to be 6 m, including a free board of 200 mm. Use M25 grade concrete and Fe 415 grade steel. Take density of water 9·8 kN/m^3. 14

(c) Design a circular tank with domical top and bottom of the tank consist of a dome having a central rise of 2·0 m. The capacity of tank is 300000 liters. The

depth of water is to be 4 m, including a free board of 200 mm. The tank is to be supported on masonry tower. Take the unit weight of water as 9·8 kN/m^3. Use M25 grade concrete and Fe 415 grade steel. 14

Unit-IV

4. (a) What are the different classes of loading specified by Indian road congress for design of bridge? 2

(b) What are the different types of loads, forces and stresses to be considered in designing super structures of bridges and culverts? Explain in detail. 14

(c) Design a solid slab bridge for class A loading for the following data :

Clear span : 5 m

Clear width of roadways : 7·5 m

Average thickness of wearing coat : 70 mm

Use M20 mix. Take unit weight of concrete as 24 kN/m^3. 14

Unit-V

5. (a) What are the different type of tensioned and post tensioned system? 2

(b) A PSC beam, 200 mm wide and 300 mm deep, is prestressed with wires (area = 320 mm^2) located at a constant eccentricity of 50 mm and carrying an initial stress of 1000 N/mm^2. The span of the beam is 10 m. Calculate the percentage loss of stress in wires if (a) the beam is pretensioned, and (b) the beam is post tensioned, using following data : Es = 210 kN/mm^2, Ec = 35 kN/mm^2, Relaxation of steel stress = 5%, Shrinkage of concrete = 0·0003 for pretensioning and 0·0002 for post tensioning, creep coeff = 1·6, Slip at anchorage = 1 mm. 14

(c) A PSC beam supports an imposed load of 5 kN/m over a simply supported span of 10 m. The beam has an "I" section with an overall depth of 450 mm. The thickness of the flange and web are 75 mm and 100 mm resp. The width of the flange is 230 mm. The beam is to be prestressed by an effective prestressing force of 350 kN at a suitable eccentricity such that the resultant stress at the soffit of the beam at the centre of the span is zero. Find the eccentricity required for the force. 14