This question paper contains **8** printed pages]

Code No. : 06(I) *Roll No. .....*

0(CCEM)9

CIVIL ENGINEERING

Paper : I

Time Allowed : 3 hours] *[Maximum Marks : 300*

Note : (i) Answer must be written in ***English.***

(ii) Number of marks carried by each question are indicated at the end of the question.

(iii) Part/Parts of the same question must be answered together and should not be interposed between answers of other questions.

(iv) ***Each questions or part thereof should begin on a fresh page.***

(v) ***Your answers should be precise and coherent.***

(vi) Candidates should attempt ***Q. No. 1****, which is* ***compulsory*** *and any of* ***three*** *of the remaining questions, selecting at least* ***one*** *question from each Section.*

(vii) Assume missing data suitably.

P. T. O.

*Answer any **three** of the following subdivisions, including **(d)**, which is **compulsory**.*

1. (a) Analyze the continuous beam shown in the Fig. 1 and draw the shear force and bending moment diagrams. Assume EI=constant. 25

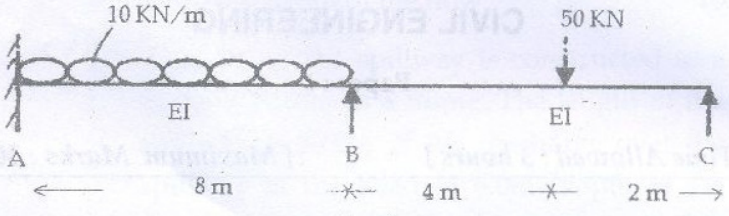


Fig.-1

(b) A beam of uniform section and length l is simply supported at its ends and carries a symmetrical triangular loading, the intensity varying from zero at each end to 'w' at the centre. Find the slope at each end and the deflection at centre. 25

(c) Write a computer program to determine the real roots of a quadratic equation $ax^2 + bx + c = 0$, where a, b and c are real numbers and 'a' is not equal to zero. 25

(d) A simply supported beam is 250 mm by 500 mm overall and has 2# 20 mm diameter bar going into the support. If the shear force at the centre of support is 110 kN at working loads determine the anchorage length. Use M20 concrete mix and Fe415 grade steel. 25

SECTION – A

2. (a) Design a rectangular beam for an effective span of 6m. The superimposed load is 80 kN/m and the size of the beam is limited to 300 × 700 mm overall. Use M20 concrete mix and Fe 415 grade steel. 25

(b) A prestressed concrete beam, 200m wide and 300 mm deep is prestressed with wires (area = 160 mm^2) located at a constant eccentricity of 50 mm, carrying an initial prestress of l000MPa. The span of the beam is 10m. Calculate the percentage loss of stress if

(i) The beam is pretensioned and

(ii) The beam is posttensioned

The data is as

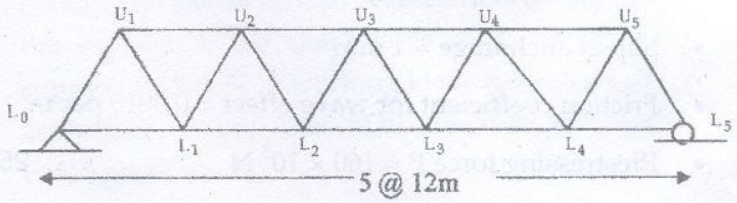
- E_s= 210 kN/mm^2 and Ec= 35 kN/mm^2
- Relaxation of stress= 5% of the initial stress
- Shrinkage of concrete = 300 × 10^{-6} for pretensioning and 200 × 10^{-6} for post tensioning
- Ultimate creep strain = 40 × 10^{-6} and 20 × 10^{-6} mm/mm per N/mm^2 for pretensioning and post tensioning respectively
- Slip at anchorage = 1 mm
- Friction coefficient for wave effect = 0.0015 per m
- Prestressing force P = 160 × 10^3 N 25

(c) A three hinged arch has a span of 50m and a rise of 15m. It carries a point load of 10 kN at quarter span. Calculate the reactions and draw the BMD. Also calculate the normal thrust and radial shear force at quarter span. 25

3. (a) A masonry retaining wall of trapezoidal section with a vertical face on the earth side is 1.5m wide at the top and 3.5m wide at the base and 6m high. It retains sand fill which slopes at 1 vertical to 2 horizontal. The weight of sand is 18000N per cubic metre, the angle of repose being 30°. Find the maximum and minimum pressure intensities at the base. Masonry weighs 23000N per cubic metre. 25

(b) Design a single equal angle 100 × 100 × 8 mm, connected to a gusset plate at the ends with 20mm diameter bolts with the connection length of 250mm to transfer tension. 25

(c) Draw influence line diagram for members L_1L_2 & L_1U_2 of the Warren truss shown in Figure below, when the load moves on the bottom chord. The height of the truss is 6.5m. 25



SECTION – B

4. (a) A 2.2 m square footing is located at a depth of 4.4m in a stiff clay of saturated unit weight of 21 kN/m^3. The undrained strength of clay at 4.4m depth is given by parameters C_u= 120kN/m^2 and $\varphi_u = 0$. For a factor of safety of 3 with respect to shear failure, compute

- The net value of bearing capacity and
- The value of maximum load that could be carried by footing 25

(b) A counter fort wall of 10m height retains non-cohesive backfill. The void ratio and angle of internal friction of the back fill respectively are 0.7 and 30° in the loose state and 0.4 and 40° in a dense state. Calculate the comparative active and passive earth pressures in both the sates. Take specific gravity of soil grains as 2.7. 25

(c) A precast concrete pile was driven in sand using a 4 ton hammer having a free fall of 1.0 m. If the penetration of the pile in the last blows of the hammer was noted as 8 mm. Determine the load carrying capacity of pile in Kn. Use Engineering News formula. 25

5. (a) Explain Standard penetration test as per IS: 2131-1981 25

(b) Compute the shearing strength of a soil along a horizontal plane at a depth of 5m in a deposit of sand having the following properties.

Angle of internal friction = 36°

Dry unit weight = 16.68kN/m^2

Specific gravity = 2.7

Assume the ground water table at a depth of 2.4m from the ground level. Also determine the change in shear strength if the water table rises up to ground level. 25

(c) Explain Vane shear test. 25

SECTION – C

6. (a) A pipe line of 0.6m diameter is 1.5 km long. In order to augment the discharge another line of the same diameter is introduced parallel to the first in the second half of the length. Neglecting minor losses, find the increase in discharge if f = 0.04. The head at inlet is 30 m. 25

(b) (i) Find the critical depth for a specific energy head of 1.5m in the following channels.

Rectangular channel B=2.0m

Triangular channel m = 1.50m

Trapezoidal channel B = 2. 0m & m = 1.0m

Circular channel D = 1.50m 10

(ii) A weir installed across a rectangular open channel raises the depth of water from 2.0m in a normal flow to 3.0m above the weir. The channel is 15m wide and laid at a slope of 1 in 10,000 with a rough bed, n = 0.03. Estimate the length of the backwater curve. 15

(c) A rectangular channel 3.0m wide has a flow of $3.6m^3$/Sec with a velocity of 0.8m/s. If a sudden release of additional flow at the upstream end of the channel causes the depth to rise by 50%. Determine the absolute velocity of the resulting surge and the new flow rate. 25

7. (a) An overflow spillway is 40.0m high. At the design energy head of 2.5m over the spillway find the sequent depths and energy loss in a hydraulic jump formed on a horizontal apron at the toe of the spillway. Neglect energy loss due to flow over the spillway face. (Assume Cd = 0.738). Also determine the energy loss as a % of the initial energy. 25

(b) (i) Examine the growth of a boundary layer over a flat plate and on an aerofoil, indicating the region of growth and separation points, if any 10

(ii) Derive the momentum integral equation of the boundary layer 15

(c) (i) Prove that for a wide rectangular channel the critical depth is given as

$$y_c = (q^2 / g)^{1/3}$$

where q is the discharge/unit width. Also prove that minimum specific energy is 1.5 times the depth of the flow 10

(ii) A model of the spillway is constructed to a scale of 1 :30m in a flume. The length of the spillway is 30.0m. If the discharge over the spillway at the head of 6.0m (depth of the flow over spillway) is 443.6 cumecs, calculate the corresponding head and discharge of the model required for this model study. 15
