53 (CE 801) DGST-III

2019

DESIGN OF STRUCTURES–III

Paper : CE 801

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer ***any five*** *questions.*

1. *(a)* Explain in what way, limit state method of design is different from working stress method of design. 6

(b) Analyze the beam shown in *Fig.* 1 by three moment theorem. Also, draw the bending moment diagram and shear force diagram. 14

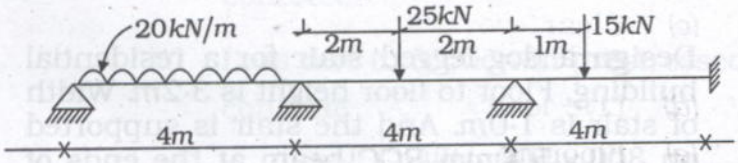

Fig. 1

Contd.

2. *(a)* Analyze the frame shown in *Fig.* 2 by Portal method. And draw the axial force diagram, bending moment diagram and shear force diagram. 18

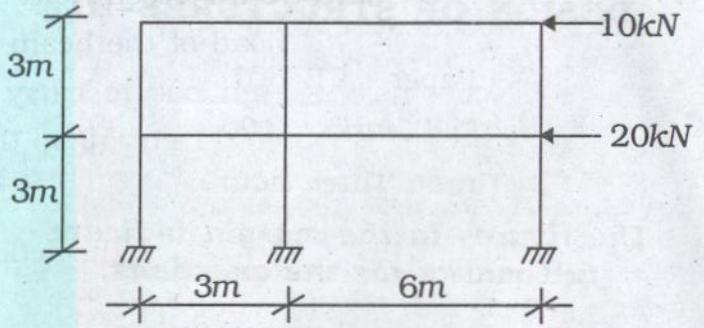

Fig. 2

(b) State the assumptions made in Cantilever method of analysis. 2

3. Design an open rectangular water tank for a capacity of 50,000 litres resting on firm ground. Use *M* 30 grade of concrete and *Fe* 415 steel. Assume any missing data. 20

4. Design a dog-legged stair for a residential building. Floor to floor height is 3·2*m*. Width of stair is 1·0*m*. And the stair is supported on 300 × 500*mm* RCC beam at the ends of landings. Use *M* 20 grade of concrete and *Fe* 415 steel. 20

5. *(a)* A prestressed concrete beam of rectangular section 300 × 600*mm* has a span of 9*m*. The effective prestressing force is 1000*kN* at an eccentricity of 120*mm*. The dead load of the beam is 5*kN*/*m* and the beam has to carry a live load of 10*kN*/*m*. Determine the extreme stress in concrete

(a) at the mid-span without the action of live load

(b) at the mid-span with the action of live load

(c) at the end of the section with dead load and live load. 12

(b) Explain the following : 8

(i) Loss due to friction in prestressed concrete

(ii) Loss due to friction in prestressed concrete

(iii) Loss due to shrinkage and creep in prestressed concrete.

6. A prestressed concrete beam 200*mm* wide and 300*mm* deep is prestressed with wires (area = 320mm^2) located at a constant eccentricity of 50*mm* and carrying an initial stress of 1000N/mm^2. The span of the beam is 10·0*m*. Calculate the percentage loss of stress in wires if

(*a*) the beam is prestressed

(*b*) the beam is post-tensioned.

$E_s = 210 kN/mm^2$ and $E_c = 35 kN/mm^2$

Relaxations of steel stress = 5% of initial stress

Shrinkage of concrete = 300×10^{-6} for pretensioning and 200×10^{-6} for post-tensioning. Creep coefficient = 1.6.

Slip at anchorage = 1*mm*

Frictional coefficient for wave effect = 0·0015 per *m*. 20

7. Design a steel foot bridge for the following data given : 20

(*a*) Span of girder = 16*m c/c*

(*b*) Cross girder to be spaced at 2*m c/c*

(*c*) Clear working width between main girders = 2·5*m*

(*d*) Live load = 4000N/m^2

(*e*) Flooring–Timber plank

Assume any missing data.
