[Time: 3 Hrs] **[Max. Marks: 80]**

NB 1. Attempt any **four** questions out of **total six** questions

2. Illustrate your answers with neat component sketches wherever required though not sought specifically.

3. Answers should be written neatly and in a systematic manner.

1. Design a box culvert having inside dimensions 3.5 × 3.5 m. The superimposed dead load on the culvert is 18 kN/m^2. The live load on the culvert is 45 kN/m^2. The soil at the site weighs 21 kN/m^3 and has hot an angle of repose 28°. Use M-20 concrete and HYSD steel of grade Fe 415. Draw the neat sketch of reinforcement layout. **20**

2. Analyze the parabolic arch fixed at the abutments having a span of 80 m and central rise of 16m. The arch is subjected to a point load of 20 kN at a quarter span from left abutment and another point load of 30 kN at the crown. Draw the BMD. **20**

OR

Analyze the continuous beam as shown in Fig.1 using **Kani's Method** of rotation and contribution.

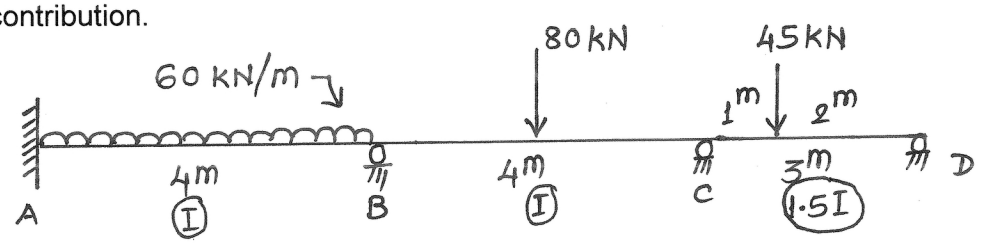

Fig. 1

3. (a) A suspension bridge of 100 m span has two hinged stiffening girders supported by two cables, having a central dip of 10 m. The dead load on the bridge is 5 kN/m^2 and the live load is 10 kN/m^2, which covers the left half of the span. Determine the shear force and bending moment at 25 m from left end. Find also the maximum tension for this position of the load. The roadway is 6 m. **10**

(b) A curved beam is horizontal in plan and in the form of a quadrant of a circle of radius 'R' and having uniform cross-section. It is fixed at end 'A' and free at another end 'B'. It carries a uniformly distributed load of w/ unit run over the entire length of the beam. Calculate the values of shear force, bending moment and twisting moment at A and B and sketch the sketch the variations of the same. Also determine the deflection at the free end B. **10**

4. (a) Analyze the portal frame as shown in **Fig.2** using **Slope Deflection Method**. **10**

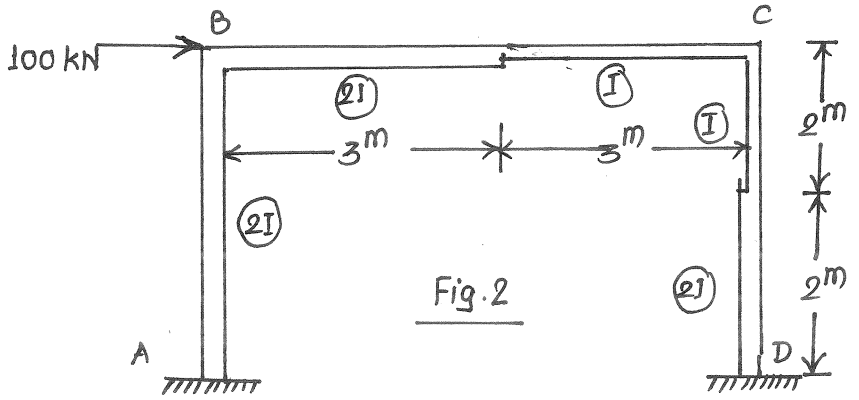

Fig.2

(b) A two span continuous beam ABC as shown in **Fig.3** is of constant width and carries a load as shown in Fig.3. Analyze the beam using **Moment Distribution Method**. Draw the BMD. **10**

$$M^F_{AB} = - M^F_{BA} = M^F_{BC} = -M^F_{CB} = wl^2/10$$

$$k_{AB} = k_{BA} = k_{BC} = k_{CB} = 8\,EI/L;$$

$$C_{AB} = C_{BA} = C_{BC} = C_{CB} = 0.6$$

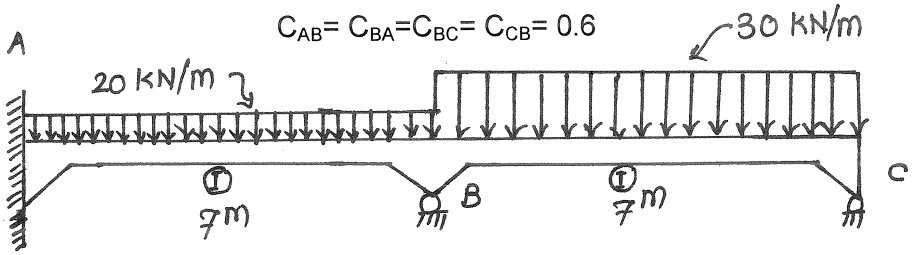

Fig.3

5. Analyze the rigid jointed sway frame as shown in **Fig. 4** using **Stiffness Method (Joint Approach)**. Draw the BMD. Also find out the horizontal thrust at the support. **20**

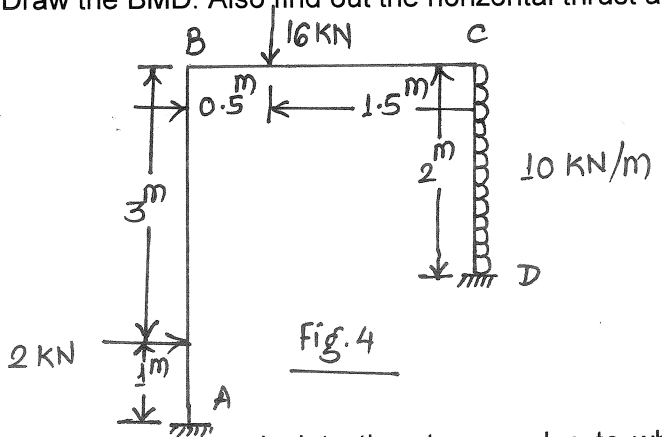

Fig.4

6. (a) Using the data given below, calculate the stresses due to wheel load at (i) interior, (ii) edge and (iii) corner region of the cement concrete pavement using **Westergaard Stress Equations**. **10**

- Wheel Load (P): 5100 kg;
- Modulus of Elasticity (E): 3 × 105kg/cm^2;
- Pavement Thicknes (h): 20 cms;

- Posson's Ratio (μ) : 0.15;
- Modulus of Subgrade Reaction (K): 6 kg/cm^3;
- Radius of Contact Area (a): 15 cms.

Also, determine the probable location where the crack is likely to develop due to load and show the same.

(b) Determine the warping stress at interior, edge and corner of 25 cm thick cement concrete pavement with transverse joints at 5 m interval and longitudinal joint, 3.6 m interval. The modulusof subgrade reaction K= 6.9 kg/cm3 and radius of loaded area is 15 cms. Assume maximum temperature differential during day time to be 0.6° C per cm slab thickness for warping stress at interior and edge; and maximum temperature differential of 0.4° per cm slab thickness during the night for warping stress at the corner. The values of C_x and C_y may be assumed directly to be 0.88 and 0.54, respectively. **10**