(24)

Total No. of Questions—8] [Total No. of Printed Pages—8

Seat No.	

S.E. (Civil) (I Sem.) EXAMINATION, 2014

STRENGTH OF MATERIALS

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (*i*) Answer Q. No. **1** *or* Q. No. **2,** Q. No. **3** *or* Q. No. **4,** Q. No. **5** *or* Q. No. **6,** Q. No. **7** *or* Q. No. **8.**

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

(*v*) Use of non-programmable electronic Scientific calculator is allowed.

1. (*a*) A circular rod of 120 mm diameter and 500 mm long is subjected to a tensile load of 1000 kN. Determine Modulus of Rigidity, Bulk Modulus and change in volume. Assume Poisson's ratio 0.3 and $E = 2 \times 10^{11}$ Pa. [6]

P.T.O.

(*b*) Fig. 1 shows a rectangular section of a beam 100 mm wide and 200 mm deep. If the maximum bending stress is 80 MPa, determine (*i*) total force on the shaded area, (*ii*) moment of this force about NA. [6]

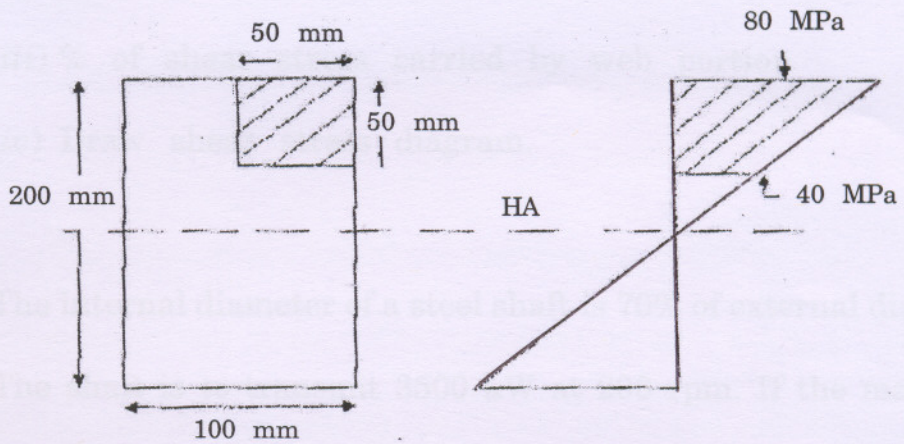

Fig. 1

Or

2. (*a*) The concrete columns is reinforced with six steel bars each of 22 mm diameter. Knowing that rod is initially unstressed, determine normal stresses developed in steel and concrete. Assume $E_{concrete} = n\ 13.34$ GPa, $E_{steel} = 200$ GPa and $\alpha_{conc} = 9.9 \times 10^{-6}/°C$, $\alpha_{steel} = 11.7 \times 10^{-6}/°C$. [6]

(*b*) An I-beam having the top and bottom flange 120 mm × 20 mm and web of 160 mm × 20 mm is subjected to a shear force 100 kN. Determine : [6]

(*i*) Maximum and minimum shear stress

(*ii*) Average shear stress

(*iii*) % of shear stress carried by web portion

(*iv*) Draw shear stress diagram.

3. (*a*) The internal diameter of a steel shaft is 70% of external diameter. The shaft is to transmit 3500 kW at 200 rpm. If the maximum allowable stress in the shaft is 50 MPa, calculate the diameter of the shaft. Also find the maximum twist when it is stressed to maximum permissible value. The length of the shaft is 4 m. [6]

(*b*) For the given state of plane strain $\varepsilon_x = 60 \times 10^{-6}, \varepsilon_y = 60 \times 10^{-6}$ and $Y_{xy} = -50 \times 10^{-6}$, determine : [6]

(*i*) Principal axis of strains

(*ii*) Principal strains

(*iii*) Maximum shearing strain.

Or

4. (*a*) A 2 m long alloy bar of 1500 mm^2 cross sectional area hangs vertically and has a collar securely fixed at its lower end. Find the stress induced in the bar, when a weight 2 kN falls from a height of 100 mm on the collar. Take E = 120 GPa. Also find the strain energy stored in the bar. [6]

(*b*) A steel shaft is subjected to a torque on 20 kNm and a bending moment of 10 kNm. The diameter of the shaft is 100 mm. Calculate the maximum and the minimum principal stresses and also the maximum shear stress in the shaft at this surface. [6]

5. (*a*) Draw the S.F. and B.M. diagrams indicating principal values for an overhanding beam ABC with AB = 6 m and BC = 3 m. It is loaded with u.d.l. of intensity 2 kN/m all over the span in addition to a point load 5 kN at free end 'C'. Also locate the point of contraflexure. [6]

(*b*) Fig. 2 shows the shear force diagram of a loaded beam. Find the loading on the beam and draw the bending moment diagram : [7]

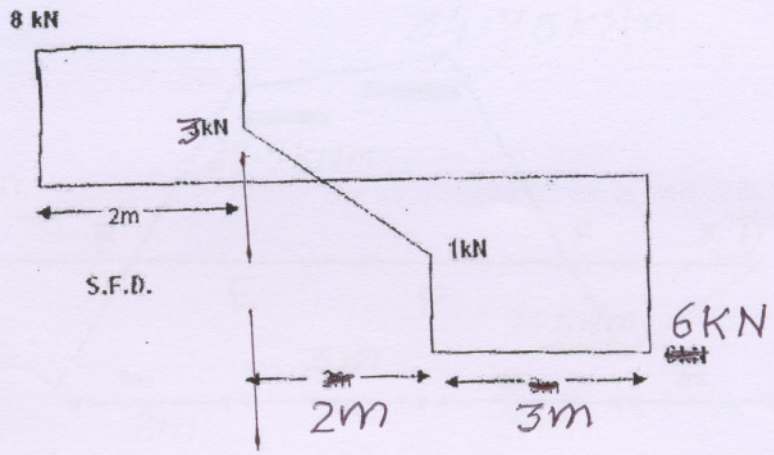

Fig. 2

Or

6. (*a*) Draw shear force and bending moment diagram for the beam shown in Fig. 3 : [6]

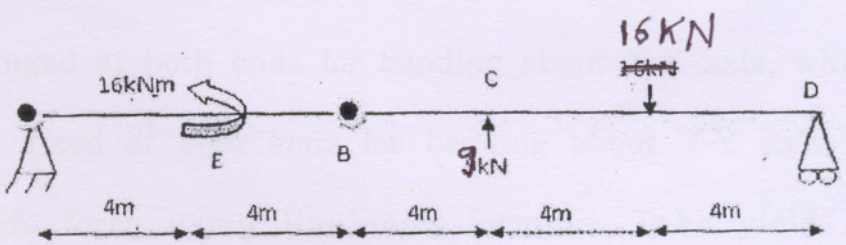

Fig. 3

(*b*) The bending moment diagram for a beam ABCD supported at B and C is shown in Fig. 4. Draw the loading diagram for the same. Also plot shear force diagram. [7]

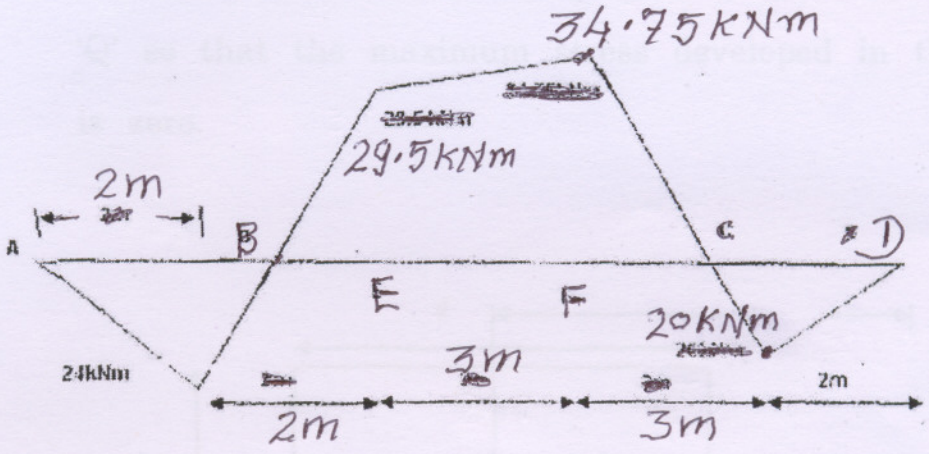

Fig. 4

7. (*a*) The cross section of a certain member of dimension 300 mm × 400 mm has to transmit axial compressive force. The distance between the end conditions is 1.2 m. It behaves as a strut hinged at both ends for bending about X-X axis, while it acts as fixed at both ends for bending about Y-Y axis. Find the safe force using Rankine's formula. Take yield stress as 330 MPa. Rankine's constant a = 1/7500 and factor of safety = 2. [6]

(*b*) Fig. 5 shows a plan of short column having dimensions $b \times d$ mm. An external vertical force 'P' N is applied at a distance of '*d*' mm from Y-Y axis. There is an additional vertical load of 'Q' N acting on the column. Calculate the load 'Q' so that the maximum stress developed in the column is zero. [7]

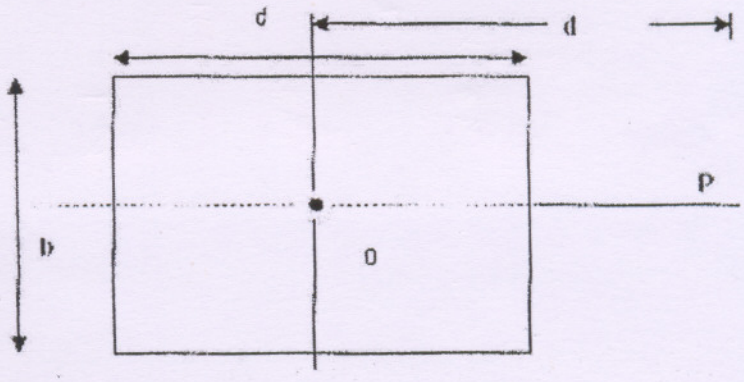

Fig. 5

Or

8. (*a*) A hollow alloy tube 4 m long with external and internal diameters of 40 mm and 25 mm respectively was found to extend 4.8 mm under a tensile load of 60 kN. Find the buckling load for the tube with both ends pinned. Also find the safe load on the tube taking a factor of safety as 5. [6]

(*b*) A masonry dam 8 m high, 1.5 m wide at the top and 5 m wide at the base retains water to a depth of 7.5 m, the water of the dam being vertical. Find the maximum and minimum intensities of stress at the base. The weight of water is 9810 N/m^3 while the weight of masonry is 22000 N/m^3.

[7]