(7)

May 2016

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

Seat No.	

[4957]-103

S.E. (Civil) (First Semester) EXAMINATION, 2016
STRENGHT OF MATERIALS
(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Neat diagrams must be drawn wherever necessary.
(*ii*) Figures to the right indicate full marks.
(*iii*) Use of electronic pocket calculator is allowed.
(*iv*) Assume suitable data, if necessary.
(*v*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** and Q. No. **7** *or* Q. No. **8**. Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12**.
(*vi*) Answers to each section must be written in separate answer-book.

SECTION I

1. (*a*) A bar of cross-section 6 mm × 6 mm is subjected axial pull of 15 kN. The lateral dimensions of the bar are found to be reduced by 3×10^{-3}. Find Poisson's ratio and modulus of elasticity assuming G = 80 GPa. [6]

(*b*) Estimate the force required to punch out a circular hole of 60 mm diameter through a 2 mm thick plate. Ultimate shear stress of the plate is 300 N/mm^2. [5]

(*c*) A steel bar diameter '*d*' of length 'L' hung rigidly at the top ceiling. Determine its deformation due to self weight. [5]

P.T.O.

Or

2. (*a*) A steel bar (E = 200 GPa) is supported and loaded as shown in fig. The cross-sectional area of the bar is 250 mm^2. Determine the force P so that the lower end D of bar does not move vertically when the loads are applied. (Fig. 1) [8]

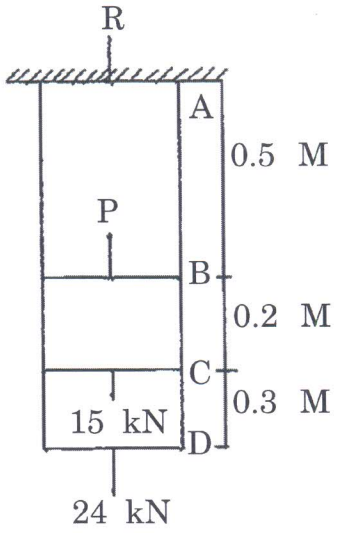

Fig. 1

(*b*) A reinforced column 300 mm has four bars of 20 mm diameter and lenght 4 m. Determine the stresses in steel and concrete due to 25 ºC rise in temperature, if the coefficient of expansion are 23 × 10^{-6}/ºC for steel and 10.8 × 10^{-6}/ºC for concrete. Assume E_{steel} = 210 GPa and $E_{concrete}$ = 22 GPa (Fig. 2) [8]

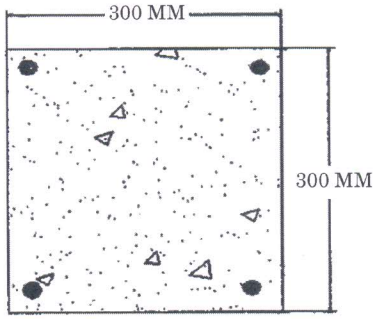

Fig. 2

3. (*a*) A beam ABCD has an internal hinge at B and is loaded as shown in fig. Determine the reaction at A, C, and D. Also plot shear force and bending moment diagrams indicating principal values (Fig. 3) [8]

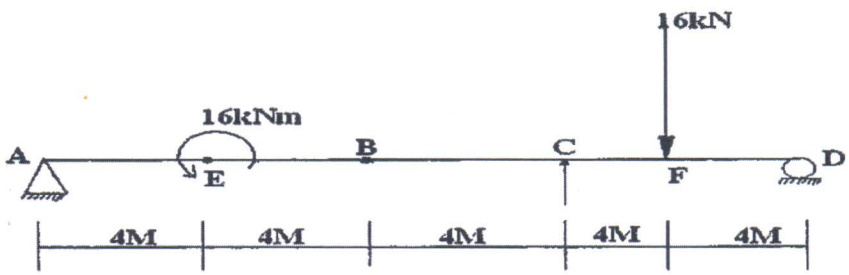

Fig. 3

(*b*) For beam ABCD the shear force diagram is as shown in fig. construct the bending moment diagram from the given shear force diagram. No couple is acting on the beam (Fig. 4) [10]

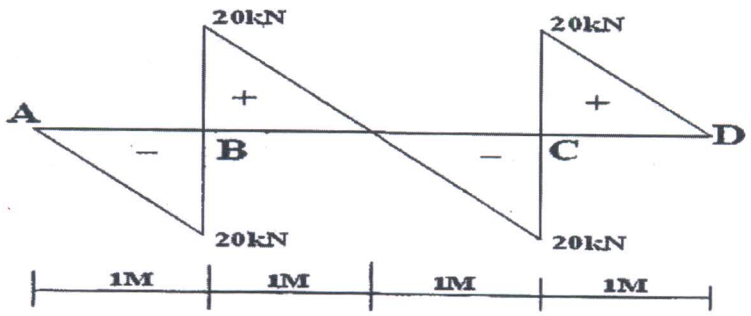

Fig. 4

Or

4. (*a*) Draw shear force and bending moment diagrams for the beam as shown in Fig 5. [9]

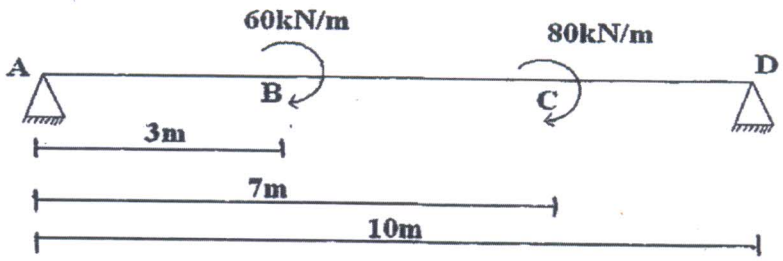

Fig. 5

(*b*) Draw S.F.D. and B.M.D. for the beam as shown in fig. Indicate the numerical values at all important sections. Find the position of contraflexure, magnitude and position of maximum BM (Fig. 6). [9]

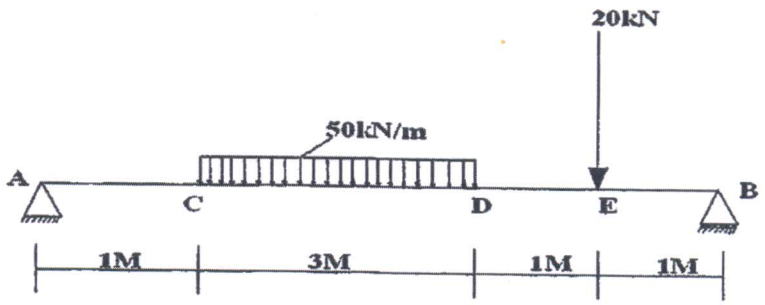

Fig. 6

5. (*a*) Show that the ratio of maximum to mean shear stress on cirular section of a beam is 1.33. [8]

(*b*) A simply supported beam of span 6 m carries UDL of 80 kN/m over the entire span. Draw the shear stress disribution diagram at support indicating all important values. Fig. 7. [8]

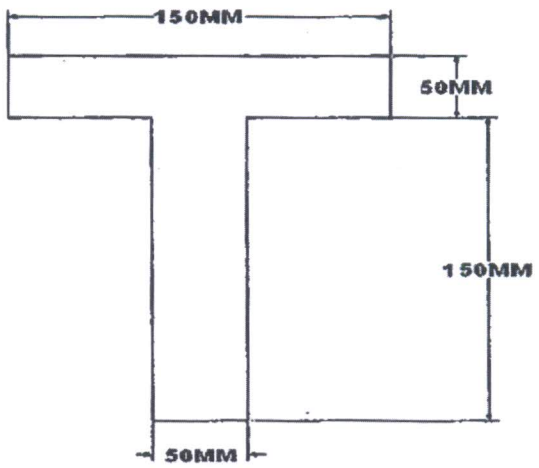

Fig. 7

Or

6. (*a*) A beam of T section 4 m long carries a UDL w per meter run thoughout its langth. The beam is simply supported at its ends. The T section is 20 × 10 × 1.2 cm i.e. web is 18.8 × 1.2 cm and flange is 10 × 1.2 cm. What is the maximum values of w so that the stress in the section does not exceed 60 MPa. [8]

(*b*) A simply supported beam 4 m span carrying UDL of 5 kN/m and permissible stress in the material of beam is 15 N/mm^2. Design the section of beam if depth to width ratio is 2. [8]

SECTION II

7. (*a*) Using equation of strain energy, derive the stress intensity due to the following types of axial loading : [8]

(*i*) Gradually applied load

(*ii*) Suddenly applied load.

(*b*) Calculate the diameter of shaft required to transmit 60 kW at 160 r.p.m., if the maximum torque is likely to exceed the mean by 30% for maximum permissible shear stress of 55 MPa. Calculate also the angle of twist for length of 1.5 m, G = 80 GPa. [10]

Or

8. (*a*) For the given state of plane strain :

$$\varepsilon_x = 60 \times 10^{-6}, \quad \varepsilon_y = 60 \times 10^{-6}, \gamma_{xy} = -50 \times 10^{-6}$$

Determine : [8]

(*i*) Principal axis of strains

(*ii*) Principal strains

(*iii*) Maximum shearing strain.

(*b*) State assumption made in the theory of torsion and derive the torsion formula. [10]

9. (*a*) Direct stess of 120 MPa (tensile) and 90 MPa (compressive) exist on two perpendicular planes at a certain point in a body. They are also accompanied by shear stress on the planes. The greater principle stress at the point due to these is 150 MPa. [8]

(*i*) Find the shear stress on these planes.

(*ii*) Find also the maximum shear stress at the point.

(*b*) A stepped shaft is subjected to couple in same direction at the changes in section and the free end is shown in Fig. The length of each section is 0.5 m and the diameter are 80 mm, 60 mm and 40 mm. If G = 80 GPA, find the angle of twist θ in degree at the free end. (Fig. 8) [8]

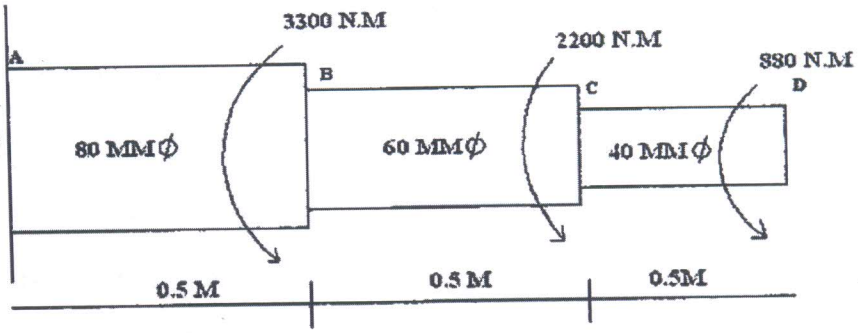

Fig. 8

Or

10. (*a*) Explain theory of elastic failure. [8]

(*b*) A shaft of 120 mm diameter transmits 300 kW power at 200 r.p.m. At a section bending moment is 8 kNm. Find the principal stresses maximum shear stress and principal plane. [8]

11. (*a*) State assumption made in Euler's theory. Sketch the deflected shape of effective length in the terms of actual length for the column with both ends fixed. [8]

(*b*) Compare the critical loads given by the Euler's and Rankine's formula for a circular column of 40 mm diameter and 2000 mm long. Take yield stress as 300 MPa. Rankine's constant $\alpha = 1/7500$ and E = 200 GPa. [8]

Or

12. (*a*) A steel flat 220 mm wide and 40 mm thick is subjected to a pull of 250 kN which is off the geometrical axis by 10 mm in the plane which bisect the thickness. Determine the maximum and minimum stress set up in the section. [8]

(*b*) Explain core of a section. Hence obtain eccentricity for hollow circular section. [8]