Total No. of Questions—**8**] [Total No. of Printed Pages—**6**

Seat No.	

[5352]-102

S.E. (Civil) (I Sem.) EXAMINATION, 2018

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*) Figures to the right indicate full marks.

(*iii*) Use of electronic pocket calculator is allowed.

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

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

1. (*a*) A steel bar 22 mm in diameter 3 m long is subjected to an axial pull of 60 kN. If E = 2×10^5 N/mm^2 & m = 4. Calculate the : [6]

(1) Change in length

(2) Change in diameter

(3) Change in volume.

(*b*) The cross-section of a beam is shown in figure the beam is made of material with permissible stress in compression & tension equal to 100 MPa & 140 MPa respectively. Calculate

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the moment of resistance of the cross-section, when subjected to a moment causing compression at the top & tension at the bottom : [6]

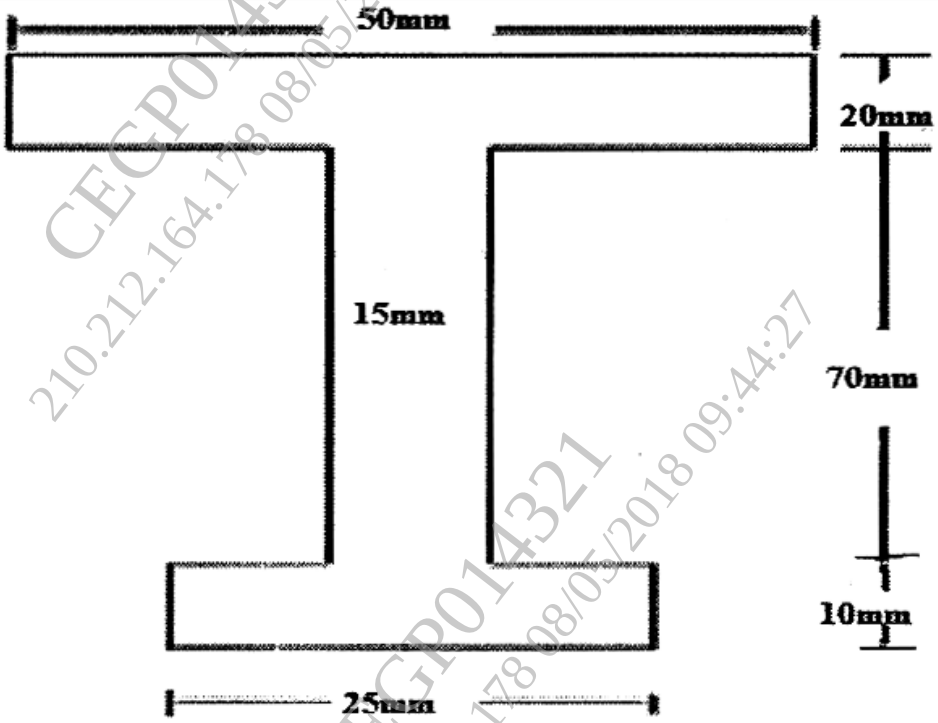

Fig. 1

Or

2. (*a*) A steel tube of 4.5 cm external diameter & 3 mm thickness encloses centrally a solid copper bar of 3 cm diameter. The bar & tube are rigidly connected together at the ends at a temperature of 30°C. Find the stress in each metal when heated to 180°C.

Take α_s = 1.08 × 10^{-5} °C, α_c = 1.7 × 10^{-5} °C, Es = 210 GPa, Ec = 110 GPa. [6]

(*b*) A beam of rectangular section $b \times d$ in size is carrying sagging bending moment of 40 kNm about XX-axis. Determine the dimension of the section if maximum bending stress is not exceed 105 N/mm^2. Take ratio $d = 1.5b$. [6]

3. (*a*) A solid steel shaft has to transmit l20 kW at 140 rpm. Taking allowable shear stress as 80 MPa. Find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceed the mean by 20%. [6]

(*b*) An element in a strained body is subjected to a compressive stress of 100 MPa & a clockwise shear stress 25 MPa on the same plane. Calculate the values of normal & shear stresses on the plane inclined at 25° with compressive stress. Also calculate the value of maximum shear stress in the element. [6]

Or

4. (*a*) A bar 10 mm in diameter & 500 mm long is hung vertically & a collar is attached at the lower end. A weight of 500 N falls through a height of 200 mm on the collar. Calculate the maximum instantaneous stress elongation & the strain energy in the bar. E = 2 × 10^5 N/mm^2. [6]

(*b*) State assumption made in the theory of torsion. Derive the relationship of torsion formula $\frac{T}{J} = \frac{G\theta}{L} = \frac{\tau}{R}$. [6]

5. (*a*) Draw the shear force & bending moment diagrams for the beam as shown in Fig. Indicate on the diagram the values of shear force & bending moment at significant points. Find & show the location & magnitude of the maximum bending moment. Refer Fig. 2. [7]

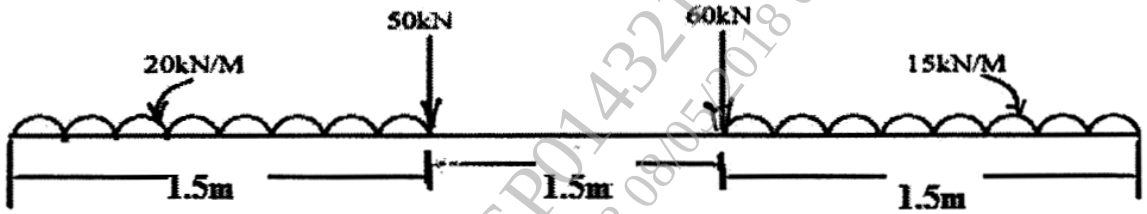

Fig. 2

(*b*) The Fig. 3 shows SFD for a beam. Mention the type of beam given and draw BMD and the loading diagram for the beam. [6]

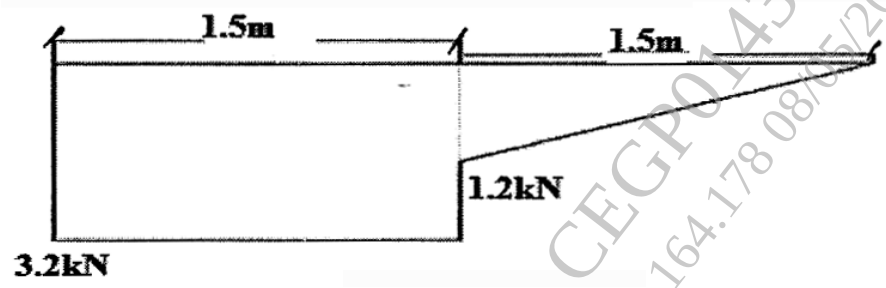

Fig. 3

Or

6. (*a*) Draw SFD & BMD for the beam shown in Fig. 4 indicating all important values. [6]

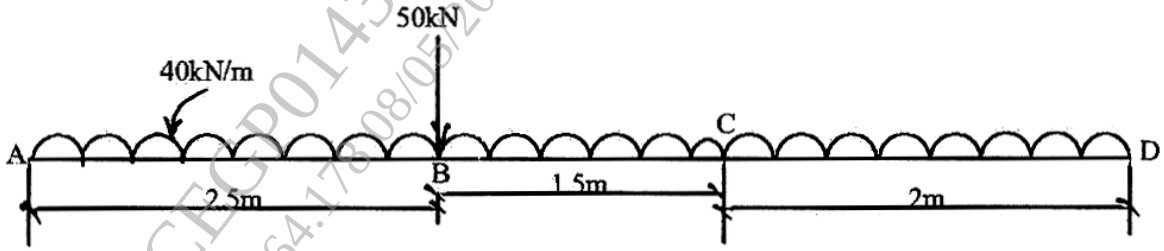

Fig. 4

(*b*) Draw SFD & BMD for the beam shown in figure mark the position of the maximum bending moment & determine its value. Refer Fig. 5. [7]

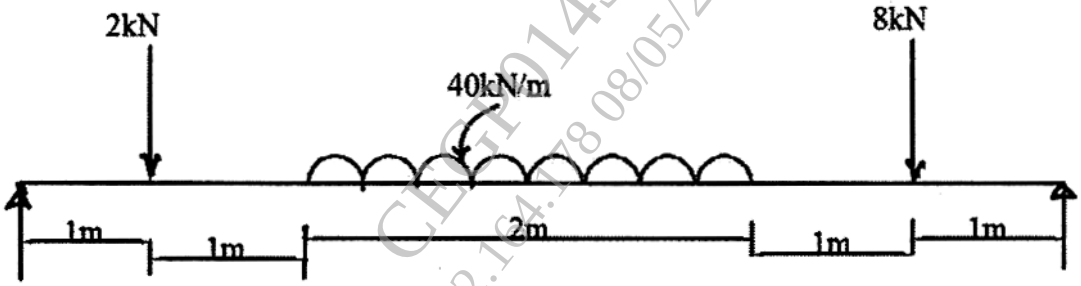

Fig. 5

7. (*a*) State the assumption made in Euler's theory & derives the expression for the critical load for a column pinned at both end. [6]

(*b*) A solid circular column is 4 m long with both ends fixed. Design the section by taking yield stress = 550 N/mm^2, safe axial load = 500 kN & FOS = 2.5, E = 100 kN/mm^2 by using Euler's equation. [7]

Or

8. (*a*) A hollow circular column made up of steel has external diameter 150 mm & internal diameter 125 mm. The length of column is 3 m with both ends fixed. Calculate the buckling load $\sigma_c = 500$ N/mm^2 & $\alpha = \frac{1}{1600}$. [7]

(*b*) Find the maximum eccentricity of the load 800 kN from geometrical axis along longer side for the strut of hollow rectangular section as shown in Fig. 6. Find maximum & minimum stresses induced in the section. [6]

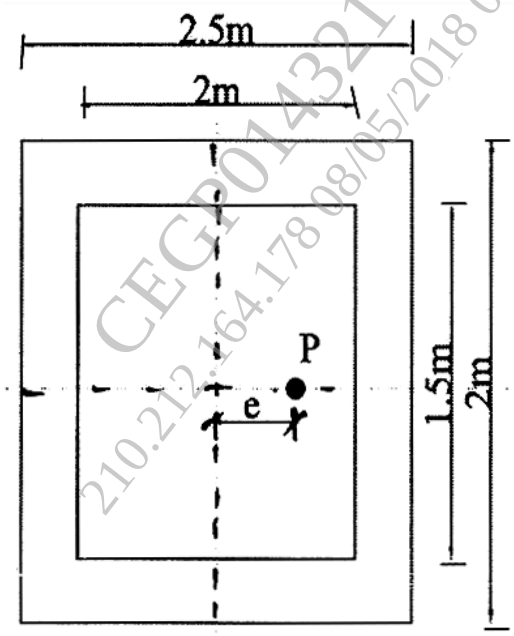

Fig. 6