Total No. of Questions—**8**] [Total No. of Printed Pages—**4+1**

Seat No.	

[5057]-2003

S.E. (Civil) (First Semester) EXAMINATION, 2016

STRENGTH OF MATERIALS

(2015 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** *or* Q. No. **7** *or* Q. No. **8**.

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

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

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

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

1. (*a*) A steel bar of variable section is subjected to forces as shown in Fig. 1. Taking EI = 205 kPa, determine the total elongation : [6]

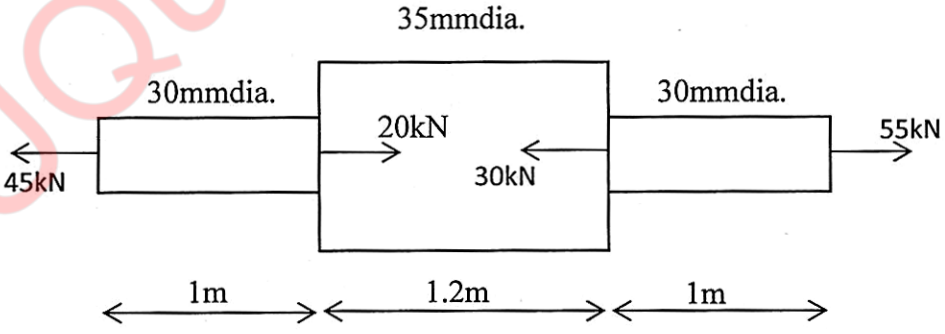

Fig. 1

P.T.O.

(*b*) A laminated wooden beam 120 mm wide and 180 mm deep is made of three 120 mm × 60 mm planks glued together to resist longitudinal shear. The beam is simply supported over a span of 2.5 m. If the allowable shearing stress in the glued joint is 0.5 MPa, find the safe udl the beam can carry. [6]

Or

2. (*a*) Determine the values of stresses in portion AB and BC of the steel bar shown in figure 2, at the temperature –45°C of the bar, knowing that a close fit exists at both the rigid supports, when the temperature is +24°C.

Take E = 200 GPa and $\alpha = 11.7 \times 10^{-6}$/°C for steel. [6]

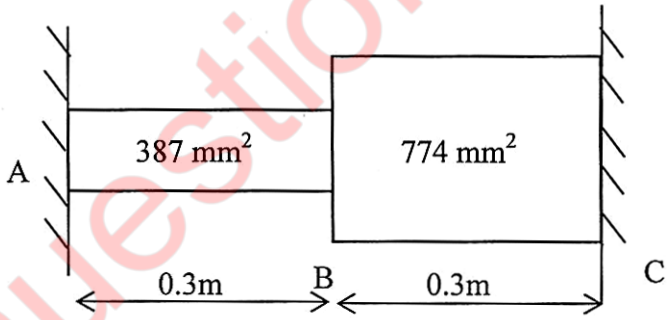

Fig. 2

(*b*) (*i*) What are the assumptions in the theory of pure bending ? [4]

(*ii*) A steel wire of 10 mm diameter is bent into a circular arc of 20 m radius. Determine the maximum stress induced in it. Take Young's modulus for steel is 200 GPa. [2]

3. (*a*) A hollow circular shaft of 6 m length and inner and outer diameters of 75 mm and 100 mm respectively is subjected to torque of 10 kN-m. If G = 80 GPa, determine the maximum shear produced and the total angle of twist. [6]

(*b*) A plane element in a body is subjected to a tensile stress of 100 MPa accompanied by shear stress of 25 MPa. [6]

Find :

(*i*) Normal and shear stress on a plane inclined at 20° with tensile stress.

(*ii*) The maximum shear stress on the plane.

Or

4. (*a*) A steel, rod 40 mm diameter and 5 m in length is suddenly subjected on an axial pull of 50 kN. Determine :

(*i*) The work done and

(*ii*) Maximum and instantaneous elongation.

Take E = 200 GPa. [6]

(*b*) A solid shaft 100 mm in diameter is subjected simultaneously to an axial compressive force of 600 kN and to the torque the twist the shaft through an angle of 1.5° in a length of 8 m. If modulus of rigidity G = 80 Gpa, determine the principal stress and maximum shear stress in the shaft. [6]

5. (*a*) A simply supported beam loaded and supported as shown in figure 3. Plot SFD and BMD for the beam. [6]

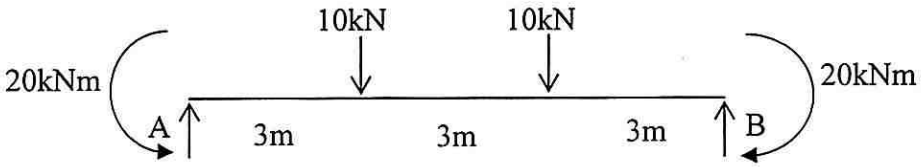

Fig. 3

(*b*) The BMD of a beam of span 12 m is as shown in figure 4. Construct loading diagram from BMD. [7]

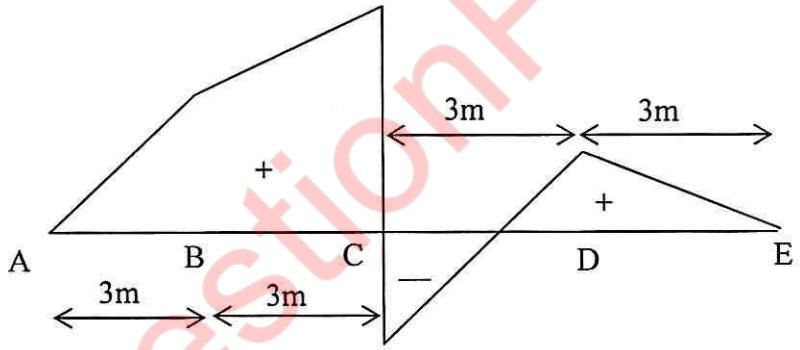

Fig. 4

Or

6. (*a*) Draw SFD and BMD for a beam shown in figure 5. [6]

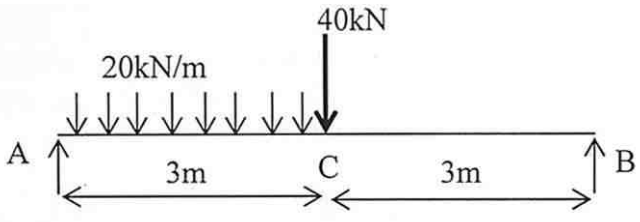

Fig. 5

(*b*) A simply supported beam 8 m long carries three point loads at 100 kN, 150 kN and 200 kN at 2 m, 5 m and 7 m from left roller support. The self weight of the beam is 25 kN/m. The right end support is hinged. Draw S.F. and B.M. diagram for the beam. [7]

7. (*a*) If the limit of proportionality of steel is 250 MPa and modulus of elasticity 200 GPa. Determine the slenderness ratio at which the Euler's formula for a fixed ended column can be used. [6]

(*b*) A rectangular strut 150 mm × 120 mm thick. It carries a load of 180 kN at an eccentricity of 10 mm in a plane bisecting the thickness. Find the maximum and minimum intensity of stress in the section. Also find permissible eccentricity for no tension condition. [7]

Or

8. (*a*) Calculate the critical load for a strut which is made up of a bar circular in section, 1.2 long and which is hinged at one end and fixed at the other end. The same bar when freely supported at its ends gives the central deflection of 3 mm, when a load of 100 N is placed at its centre. Also find the safe load taking factor of safety equal to 3. [7]

(*b*) Explain core of a section. Hence obtain core of section for rectangular column of size 120 mm × 120 mm. [6]