Roll No. .....

24171

B. Tech 4th Semester (Mechanical Engg.)

Examination May, 2012

STRENGTH OF MATERIALS – I

Paper : ME-206-F

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

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : (i) Attempt *five* questions in total, at least *one* question from each section.

(ii) Question No. **1** is *Compulsory*.

(iii) Each question carries equal **20** marks.

1. (a) Define strength of a material. What are the factors upon which it depends ?

(b) Differentiate between a stress and a strain, mentioning their units.

(c) The Hooke's Law holds good upto :

(i) the elastic limit

(ii) the yield point

(iii) the limit of proportionality

(iv) the ultimate point.

(d) The temperature stress is a function of :

(i) the co-efficient of Linear expansion and temperature rise.

(ii) the temperature rise and modulus of elasticity of the material.

(iii) Co-efficient of Linear expansion and modulus of elasticity of the material.

(iv) the Co-efficient of Linear expansion, temperature rise and modulus of elasticity of the material.

(e) The maximum Bending Moment in a simply supported beam of Span l and carrying a concentrated load W at mid span is :

(i) wl

(ii) $wl/2$

(iii) $wl/4$

(iv) $2wl$

(f) The max. B.M. in a simply supported beam of span l and carrying a u.d.l. of intensity w per unit length is :

(i) $wl/4$ (ii) $wl^2/4$

(iii) $wl/8$ (iv) $wl^2/8$

(g) State assumptions made while determining the equation for bending stress.

(h) Define Neutral Surface and Neutral Axis.

(i) An elastic prop is one where :

(i) the deflection is zero

(ii) the deflection is known

(iii) the B. M. is zero

(iv) the S. F. is zero.

(j) Moment area method is a method for determining :

(i) the B. M. at a point.

(ii) the S. F. at a point.

(iii) the slope at a point.

(iv) the deflection at a point.

SECTION – A

2. A bar AD (Fig. 1) is pinned at A, and supported by copper rod 40 mm^2 in area and 1.5 m long at B, also supported at C by a steel rod of 30 mm^2 in area and 1-m length. The bar AD is rigid and horizontal before applying a load of 1000 kg (9810 N) at the end D. Determine the stresses and elongations produced in copper and steel rods after the applications of above load. Take Ec = 10×10^3 kg/mm^2 (98.1 G N/m^2)

Es = 20×10^3 kg/mm^2 (196.2 G N/m^2)

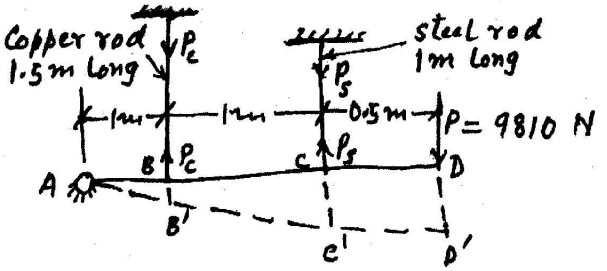

Fig. 1

3. At a point in a strained material, the principal stresses are 120 mPa tensile and 60 mPa compressive. Find the resultant stress and its direction on a plane inclined at 45° to the axis of 120 MPa stress by Mohr's circle diagram. Also determine the maximum intensity of shear stress in the material.

SECTION – B

4. Draw the S.F. and B.M. diagrams for the Cantilever shown in Fig. 2 :

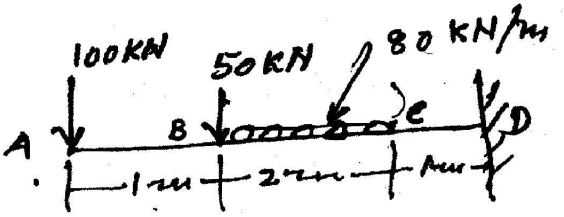

Fig. 2

5. What diameter of shaft will be required to transmit 80 kW at 80 r. p. m., if the maximum torque is 30% greater than the mean and the limit of torsional stress is to be 56 MPa. ?

SECTION – C

6. A rectangular beam 6 cm × 4 cm is 2 m long and is simply supported at the ends. It carries a load 1 KN at mid spam. Determine the maximum bending stress induced in the beam.

7. (a) (i) Differentiate between a strut and a column or a pillar or a stanchion.

(ii) Differentiate between a slender strut and a stocky strut.

(iii) fill in the blanks :

In case of slender struts the failure is usually due to the ..... and is known as ..... The buckling is caused by the inherent eccentricity of ..... and the ..... of the strut.

(iv) What do you mean by a Fixed end of a strut ?

(v) What do you mean by a Free end of a strut ?

(b) Enumerate assumptions made in the theory referring to struts which are very long as compared to lateral dimensions.

SECTION – D

8. A horizontal girder of steel having uniform section is 14 m long and is simply supported at its ends. It carries concentrated loads of 120 kN and 80 kN at two points, 3 m & 4.5 m from the two ends respectively. $I = 16 \times 10^4$ cm^4 and Es = 210 GPa. Calculate the deflection of the girder at points under the two loads.

9. A horizontal beam, built – in at each end, has a clear span of 4.5 m and carries loads of 50 kN at 1.5 m and 70 kN at 2.5 m from its left hand end. Calculate the fixing moments and the position and amount of maximum bending moment.
