DIPLOMA VIEP MECHANICAL ENGINEERING (DMEVI)

Term-End Examination

June, 2014

BIME-021 : MECHANICS OF MATERIALS

Time : 2 hours *Maximum Marks : 70*

Note : *Answer **five** questions in **all**. Question No. **1** is **compulsory**.*

1. Choose the correct answer from the given four alternatives. **7x2=14**

(a) A Steel bar 100 mm long is subjected to a tensile stress σ. If change in length of bar is 0.05 mm, what is the value of σ ? E = 200 GPa.

(i) 200 MPa (ii) 100 MPa
(iii) 80 MPa (iv) None of these

(b) Principle stresses at a point are +100 MPa and −100 MPa, what is the maximum shear stress at the point ?

(i) 100 MPa (ii) 50 MPa
(iii) Zero (iv) None of these

(c) E for a material is 208 GPa and $\nu = 0.3$. What is modulus of rigidity G ?

(i) 160 GPa (ii) 104 GPa
(iii) 80 GPa (iv) 78 GPa

(d) For a material E = 100 GPa and G = 37.5 GPa, what is Poisson's ratio ν ?

(i) 0.25 (ii) 0.30
(iii) 0.33 (iv) 0.35

(e) A mild steel beam is subjected to a bending moment such that a stress of 100 MPa is developed in a layer at a distance of 10 cm from neutral layer. If E = 200 GPa. What is the radius of curvature of beam ?

(i) 400 m (ii) 200 m

(iii) 100 m (iv) None of these

(f) The hoop stress is also known as :

(i) Longitudinal stress

(ii) Circumferential stress

(iii) Bending stress

(iv) Compressive stress

(g) The strain energy stored per unit volume in a cube subjected to a stress intensity σ on its all sides with bulk modulus k is :

(i) $\frac{\sigma}{2k}$ (ii) $\frac{\sigma}{2k^2}$

(iii) $\frac{\sigma^2}{2k}$ (iv) $\frac{\sigma^2}{k^2}$

2. A steeped circular bar 150 mm long with diameters 20 mm, 15 mm and 10 mm along lengths AB = 40 mm, BC = 45 mm, CD = 65 mm respectively is subjected to various forces at sections 14

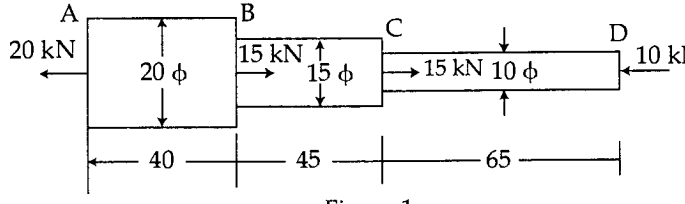

Figure 1

A, B, C and D as shown in Figure 1. Determine the change in length of bar if E = 200 kN/mm^2.

3. Figure 2 shows a triangular element of a stressed body. Normal and shear stresses on two perpendicular planes BC and AC are as shown in the figure. Determine normal and shear stresses on inclined plane AB, inclined at an angle of 30° to the plane BC. **14**

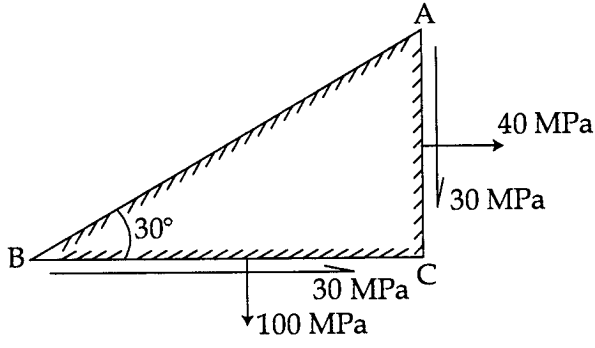

Figure 2

4. A bar 25 mm diameter is subjected to a pull of 60 kN. The measured extension over a gauge length of 250 mm is 0.15 mm and change in diameter is 0.004 mm. Calculate the modulus of elasticity, modulus of rigidity and Poisson's ratio. **14**

5. A beam of circular section of diameter d is supported over a span of 8 m. A load of 2 kN is applied at a distance of 3 m from one end. Determine diameter of the section if maximum stress developed in beam section is 90 MPa. **14**

6. The diameter of a shaft is 20 cm. Find the safe maximum torque which can be transmitted by the shaft if the permissible shear stress in the shaft material be 4000 N/cm^2 and permissible angle of twist is 0.2 degree per meter length. **14**
Take $G = 80 \times 10^5$ N/cm^2, if the shaft rotates at 320 rpm, what maximum power can be transmitted by the shaft ?