No. of Printed Pages : 6

BIME-021

DIPLOMA – VIEP – MECHANICAL ENGINEERING (DMEVI)

Term-End Examination

December, 2014

01175

BIME-021 : MECHANICS OF MATERIALS

Time : 2 hours *Maximum Marks : 70*

Note : *Answer* ***five*** *questions in all. Question no.* ***1*** *is* ***compulsory****. Use of calculator is permitted.*

1. Choose the correct answer from the given four alternatives. *7×2=14*

(a) Major principal stress at a point is 120 MPa. Radius of Mohr's stress circle is 70 MPa. What is the minor principal stress at the point ?

(i) 70 MPa

(ii) 40 MPa

(iii) 20 MPa

(iv) – 20 MPa

(b) Principal stresses at a point are 100 MPa and 50 MPa. A plane is inclined to the plane of major principal stress by angle θ. If normal stress on this point is 75 MPa, what is the angle of inclination θ ?

(i) 90°

(ii) 67·5°

(iii) 45°

(iv) 22·5°

(c) For a material K = 170 GPa and ν = 0·3. Young's modulus E of the material is

(i) 200 GPa

(ii) 204 GPa

(iii) 208 GPa

(iv) None of these

(d) A beam of rectangular section of breadth 10 cm and depth 20 cm is subjected to a bending moment of 20 kNm. Stress developed at a distance of 10 cm from top face in beam section is

(i) 120 MPa

(ii) 80 MPa

(iii) 30 MPa

(iv) None of these

(e) A beam of I section, depth 20 cm, flange thickness 1 cm is subjected to a bending moment M. Maximum stress in I section is 100 MPa. What is the stress developed at the inner edge of the flange ?

(i) 110 MPa

(ii) 100 MPa

(iii) 90 MPa

(iv) 50 MPa

(f) For a thin spherical shell

(i) hoop stress is two times the longitudinal stress.

(ii) longitudinal stress is two times the hoop stress.

(iii) hoop stress is equal to one-half of the longitudinal stress.

(iv) hoop stress and longitudinal stresses are equal.

(g) The maximum strain energy stored in a body at the elastic limit is called

(i) resilience

(ii) modulus of resilience

(iii) proof resilience

(iv) None of these

2. Determine the stress in all the three sections and total deformation of the steel rod shown in Figure 1. Cross-sectional area = 10 cm^2, E = 200 GN/m^2. *14*

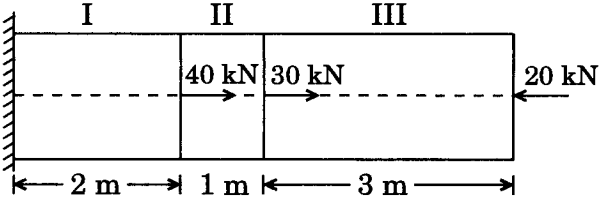

Figure 1

3. At a point in a strained material, stresses on plane BC are – 100 MPa (normal stress), 20 MPa (shear stress), on a perpendicular plane AC, stresses are + 60 MPa (normal stress) and 20 MPa (shear stress), as shown in Figure 2.

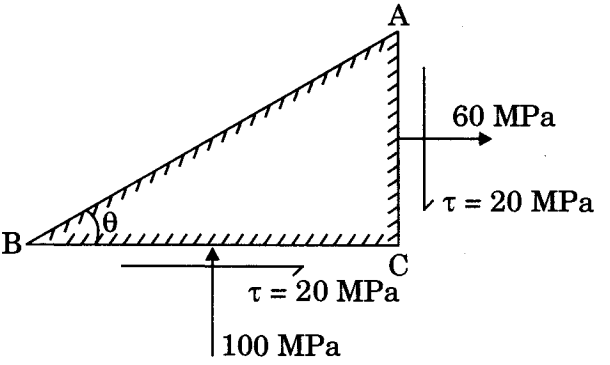

Figure 2

Determine

(a) Principal stresses

(b) Principal angles

(c) Maximum shear stresses

(d) Angles of planes carrying maximum shear stress with respect to plane BC. *14*

4. A bar of steel 20 mm diameter is subjected to a pull of 40 kN. If E = 200 kN/mm^2, what is change in length over 200 mm gauge length ? If ν = 0·3, what is the change in diameter ? *14*

5. If the cross-sectional area of a beam is T section as shown in Figure 3, find the maximum bending stress developed in beam section, if M = 90 kNm. *14*

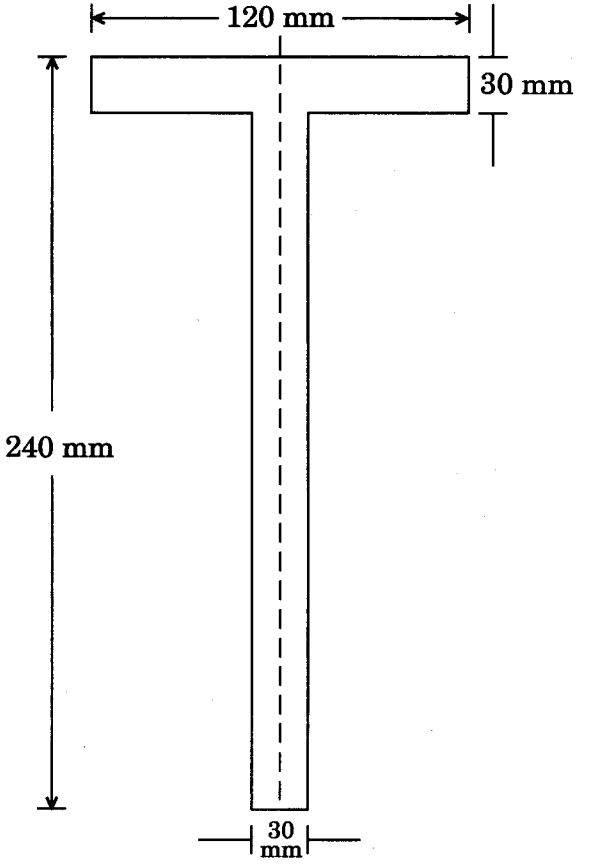

Figure 3

6. A circular steel shaft of 30 mm diameter is subjected to a torque of 0·56 kNm. *14*

Determine

(a) maximum shear stress developed in shaft.

(b) angular twist over 0·2 m length.

(c) shear stress at a point which is at a radius of 10 mm.

Given $G = 82 \times 10^3$ N/mm^2.