No. of Printed Pages : 6 **BIME-021**

DIPLOMA IN MECHANICAL ENGINEERING (DMEVI)

Term-End Examination

00553

June, 2011

BIME-021 : MECHANICS OF MATERIALS

Time : 2 hours *Maximum Marks : 70*

Note : *Attempt **five** questions in all. Question No. **1** is **compulsory.** All questions carry **equal** marks. Scientific non programable calculator is allowed.*

1. Select the correct answer for following questions : **7x2=14**

(a) The ratio of modulus of elasticity to modulus of rigidity for a Poisson's ratio of 0.25 would be

(i) 2.5 (ii) 2.0

(iii) 3.0 (iv) 2.75

(b) If l be the length and D be the diameter of a cylindrical rod, then volumetric strain of the rod is equal to :

(i) strain of length plus strain of diameter

(ii) strain of diameter

(iii) strain of length + 2 strain of diameter

(iv) strain of length

(c) The normal stress on an oblique plane at an angle θ to the cross - section of a body which is subjected to a direct tensile stress (σ) is equal to :

(i) $\frac{\sigma}{2} \text{Sin } 2\theta$ (ii) $\sigma \text{ Cos } \theta$

(iii) $\sigma \text{ Cos}^2 \theta$ (iv) $\sigma \text{ Sin}^2 \theta$

(d) If a beam is fixed at both its ends, it is called a :

(i) fixed beam

(ii) built - in beam

(iii) encastered beam

(iv) any one of the above

(e) A solid circular shaft of diameter D carries an axial load W. If the same load is applied axially on a hollow circular shaft of inner diameter as $\frac{D}{2}$, the ratio of stresses in a solid shaft to that of hollow shaft would be :

(i) $\frac{1}{2}$ (ii) $\frac{1}{4}$

(iii) $\frac{4}{3}$ (iv) $\frac{3}{4}$

(f) Kernel or core of a section is the figure within which load may be applied so as :

(i) to produce tensile stress at one end and compressive stress at the other end

(ii) to produce tensile stress at both the ends of the section

(iii) to produce tensile stress in middle of section

(iv) not to produce tensile stress any where in the section

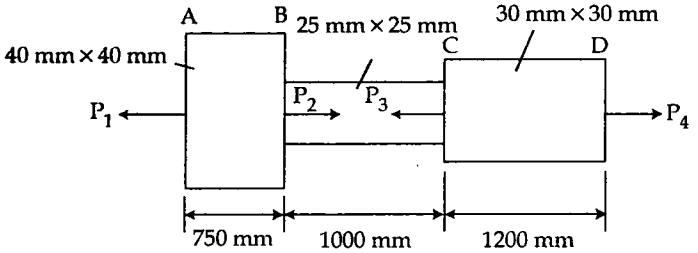
(g) A water main 1 m in diameter contains a fluid having pressure 1 N/mm^2. If the maximum permissible tensile stress in the metal is 20 N/mm^2, the thickness of the metal required would be

(i) 2 cm (ii) 2.5 cm

(iii) 1 cm (iv) 0.5 cm

2. (a) A member ABCD is subjected to point loads P_1, P_2, P_3 and P_4 as shown in figure : **6**

(i) Calculate the force P_3 necessary for equilibrium if $P_1 = 120$ KN, $P_2 = 220$ KN and $P_4 = 160$ KN. Also determine the net change in the length of member. Take $E = 200$ GN/m^2



(b) Draw stress - strain diagram for mild steel. Explain its salient features. 8

3. (a) The principal stresses at a point across two perpendicular planes are 75 MN/m^2 (tensile) and 35 MN/m^2 (tensile). Find the normal, tangential and resultant stresses and obliquity angle of resultant on a plane at 20° with the major principal plane. 8

(b) A wooden beam 100 mm wide and 150 mm deep is simply supported over a span of 4 meters. If shear force at a section of the beam is 4500 N, find the shear stress at a distance of 25 mm above the neutral axis. 6

4. (a) What do you mean by simple bending ? What are the assumptions made in the theory of simple bending ? 6

(b) A steel plate of width 60 mm and of thickness 10 mm is bent into a circular arc of radius 10 m. Determine the maximum stress induced and the bending moment which will produce the maximum stress. 8

5. (a) A beam of length 6 m is simply supported at its ends and carries two point loads of 48 KN at a distance of 1 m and 3 m respectively from the left support. Find : **10**

(i) deflection under each load,

(ii) maximum deflection, and

(iii) the point at which maximum deflection occurs.

Given $E = 2 \times 10^5$ N/mm^2 and $I = 85 \times 10^6$ mm^4

(b) Explain section modulus and neutral axis. **4**

6. (a) Derive an expression for the shear stress produced in a circular shaft which is subjected to torsion. What are the assumptions made in the derivation ? **6**

(b) A cylindrical thin drum 80 cm in diameter and 3 m long has a shell thickness of 1 cm. If the drum is subjected to an internal pressure of 2.5 N/mm^2, determine : **8**

(i) change in diameter

(ii) change in length and

(iii) change in volume

7. (a) A column of timber section 15 cm × 20 cm is 6 meter long both ends being fixed. If the Young's modulus for timber is 17.5 KN/mm^2, determine, **10**

   (i) Crippling load

   (ii) Safe load for the column if factor of safety is 3.

   (b) Define slenderness ratio. State the limitations of Euler's formula. **4**