No. of Printed Pages : 5 **BIME-021**

DIPLOMA IN MECHANICAL ENGINEERING (DMEVI)

Term-End Examination 00252

December, 2011

BIME-021 : MECHANICS OF MATERIALS

Time : 2 hours *Maximum Marks : 70*

Note : *Attempt **five** questions in all. Question **1** is **compulsory.** Assume suitable missing data if any. **All** questions have **equal** marks. Scientific non programable calculator is **allowed.***

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

   (a) The modulus of elasticity in terms of bulk modulus and modulus of rigidity is :

   (i) $\frac{9\,KG}{3\,K + G}$ (ii) $\frac{9\,KG}{K + 3G}$

   (iii) $\frac{3\,K + G}{9\,KG}$ (iv) $\frac{K + 3G}{9\,KG}$

   (b) Strain energy stored in a body due to a suddenly applied load compared to when applied gradually is :

   (i) twice (ii) four times

   (iii) eight times (iv) half

...

(c) Ratio of maximum to average shear stress in a rectangular section is :

(i) 1.2 (ii) 1.5

(iii) 2 (iv) 2.5

(d) The flexural rigidity of a beam is :

(i) $\frac{E}{I}$ (ii) EI

(iii) $\frac{I}{E}$ (iv) $E^2 I$

(e) Maximum shear stress in a hollow shaft subjected to a torsional moment is at the :

(i) Middle of thickness

(ii) at the inner surface of the shaft

(iii) at the outer surface of the shaft

(iv) none of the above

(f) Euler buckling load for one end fixed and the other hinged is given by :

(i) $\frac{\pi^2 E I}{l^2}$ (ii) $\frac{2\pi^2 E I}{l^2}$

(iii) $\frac{4\pi^2 E I}{l^2}$ (iv) $\frac{\pi^2 E I}{4 l^2}$

(g) The initial hoop stress in a thin cylinder when it is wound with a wire under tension will be :

(i) zero (ii) tensile

(iii) compressive (iv) bending

2. (a) A square steel rod of dimensions 50mm × 50mm × 150mm is subjected to an axial load of 250 kN. Determine the decrease in length of the bar if. 8

(i) the lateral strain is fully prevented by applying external uniform pressure on the rectangular surfaces.

(ii) only one third of the lateral strain is prevented by the external pressure.

(b) Derive the relation between Young's modulus and modulus of rigidity. 6

3. (a) The stresses on two perpendicular planes through a point in a body are 30 MPa and 15 MPa both tensile along with shear stress of 25 MPa. Find : 8

(i) the magnitude and direction of principal stresses.

(ii) the planes of max. shear and value of maximum shear.

(b) Explain in brief fatigue and creep failure. 6

4. (a) Derive Lame's equations for thick shells. Also mention the assumptions made. 8

(b) Wall thickness of a cylindrical shell of 800 mm internal diameter and 2 m long is 10 mm. If the shell is subjected to an internal pressure of 1.5 MPa, find : 6

(i) the maximum shear stress induced

(ii) the change in the dimensions of the shell.

Take E=205 GPa and ν =0.3

5. (a) Derive the relations to find the deflection and slope of a simply supported beam subjected to a uniformly distributed load over whole span. 8

(b) A rectangular beam 200 mm deep and 300 mm wide is simply supported over a span of 8 m. What uniformly distributed load per meter the beam may carry if the bending stress is not to exceed 120 N/mm^2 ? 6

6. (a) A weight of 10 kN falls by 30 mm on a collar rigidly attached to a vertical bar 4 m long and 1000 mm^2 in cross-section. Find instantaneous expansion of the bar. Take E = 210 GPa. 8

(b) Explain in brief proof resilience, yield stress, Hooke's Law. 6

7. (a) A rectangular beam 100 mm wide and 250 mm deep is subjected to a maximum shear force of 50 kN. Determine : 6

(i) Average shear stress

(ii) Maximum shear stress

(iii) Shear stress at a distance of 25 mm above the neutral axis.

(b) Determine the diameter of a solid shaft which will transmit 300 KW at 250 rpm. The max. shear stress should not exceed 30 N/mm^2 and twist should not be more than 1° in a shaft length of 2 m. 8

Take $G=1 \times 10^5 N/mm^2$.