DIPLOMA IN MECHANICAL ENGINEERING (DMEVI)

Term-End Examination 02055

June, 2012

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 calculator is **allowed**.*

1. (a) The ratio of Bulk modulus to Young's modulus for a poisson's ratio of 0.25 will be : **7x2=14**

(i) $\frac{1}{3}$ (ii) $\frac{2}{3}$

(iii) 1 (iv) $\frac{3}{2}$

(b) When a body is subjected to direct tensile stress (σ) in one plane, then normal stress on an oblique section of the body inclined at an angle θ to the normal of the section is :

(i) $\sigma \cos \theta$ (ii) $\sigma \cos^2 \theta$

(iii) $\sigma \sin \theta$ (iv) $\sigma \sin^2 \theta$

(c) A beam is fixed at one end and free at the other end is called :

(i) Simply supported beam

(ii) Fixed beam

(iii) Over hanging beam

(iv) Cantilever beam

(d) The neutral axis of the cross section of a beam is that axis at which the bending stress is :

(i) Zero (ii) Minimum

(iii) Maximum (iv) Infinity

(e) When a thin cylindrical shell is subjected to an internal pressure, the volumetric strain is :

(i) $2\epsilon_1 - \epsilon_2$ (ii) $2\epsilon_1 + \epsilon_2$

(iii) $2\epsilon_2 - \epsilon_1$ (iv) $2\epsilon_2 + \epsilon_1$

Where ϵ_1 = Hoop strain $\epsilon_2 \rightarrow$ longitudinal strain

(f) The maximum deflection of a cantilever beam of length l with a uniformly distributed load of w per unit length is -

(i) $\frac{Wl^3}{3EI}$ (ii) $\frac{Wl^3}{8EI}$

(iii) $\frac{Wl^3}{16EI}$ (iv) $\frac{Wl^3}{48EI}$

Where W = wl

(g) The total strain energy stored in a body is called proof resilience (True/False)

2. (a) A steel wire 2m long and 3mm in diameter is extended by 0.75mm when a weight W is suspended from the wire. If the same weight is suspended from a brass wire, 2.5m long and 2mm in diameter, it is elongated by 4.64mm. 8

Determine the modulus of elasticity of Brass if that of steel be $2.0 \times 10^5 N/mm^2$

(b) Draw stress-strain Diagram for Ductile materials and explain its salient features. 6

3. (a) Show that in a strained material subjected to two - dimensional stress, the sum of the normal components of stresses on any two mutually perpendicular plane is constant 6

(b) A short metallic column of $500mm^2$ cross-sectional area carries an axial compressive load of 100 KN. For a plane inclined at 60° with the direction of load, calculate : 8

(i) Normal stress
(ii) Tangential stress
(iii) Resultant stress
(iv) Maximum shear stress

4. (a) Explain section modulus and neutral axis. 4

(b) Determine the dimensions of joist of a timber for span 8m to carry a brick wall 200mm thick and 5m high. If the density of brick work is $1850kg/m^3$ and the maximum permissible stress is limited to $7.5 MN/m^2$. Given that the depth of joist is twice the width. 10

5. (a) A beam AB of length l simply supported at the ends carries a point load W at a distance from the left end. **10**

Show that - Deflection under the load is

$$-\frac{Wa^2b^2}{3EIl}.$$

Where E = Young modulus, I = Moment of Inertia.

(b) Explain the Parallel Axis theorem. **4**

6. (a) Derive the Torsion equation for circular shaft. What are the assumptions made in the derivation ? **7**

(b) A cylindrical shell 3m long which is closed at the ends has an internal diameter of 1m and a wall thickness of 15mm. Calculate the circumferential and longitudinal stresses induced and also change in the dimensions of the shell if it is subjected to an internal pressure of 1.5 MN/m^2 **7**

Take E = 200GN/m^2 and $\frac{1}{m} = 0.3$

7. (a) What is strain energy ? Derive the expression for strain energy under the Impact load. **7**

(b) Derive the expression of Euler's Formla when both ends of the column are hinge or pinned. **7**

8. Write the short note at ***any four*** : **4x3.5=14**

(a) Maximum Principal Stress theory

(b) Shear Stress Distribution

(c) Moment of resistance

(d) Moment Aera Method

(e) Lame's equation for stresses

(f) Euler's Formula