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BIME-021

DIPLOMA – VIEP – MECHANICAL ENGINEERING (DMEVI)

Term-End Examination

01006 **June, 2015**

BIME-021 : MECHANICS OF MATERIALS

Time : 2 hours *Maximum Marks : 70*

Note : *Answer any **five** questions in all. Question no. **1** is **compulsory**. Attempt any **four** questions from questions no. 2 to 7. All questions carry equal marks.*

1. Choose the correct answer from the given choices for the following questions : *7×2=14*

(a) Necking forms for ductile material when tested in tension at

(i) Breaking stress

(ii) Ultimate stress

(iii) Yield stress

(iv) Elastic stress

(b) Principal planes are those planes which have

(i) Maximum shear stress

(ii) Minimum shear stress

(iii) No shear stress

(iv) Maximum bending stress

(c) Neutral axis is an axis where

(i) The compressive stress is maximum

(ii) Tensile stress is maximum

(iii) No stress is observed

(iv) All the above

(d) If a cantilever carries a point load at the free end, then the maximum deflection is given by

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

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

(iii) $\frac{Wl^3}{10EI}$

(iv) $\frac{Wl^3}{12EI}$

(e) To treat a pressure vessel as a thin vessel the ratio of diameter to thickness must be

(i) greater than 30

(ii) greater than 100

(iii) lesser than 30

(iv) greater than 1

(f) If τ is the proof shear stress and G is the modulus of rigidity, then the modulus of shear resilience is

(i) $\frac{\tau^2}{4G}$

(ii) $\frac{\tau^2}{6G}$

(iii) $\frac{\tau^2}{2G}$

(iv) $\frac{\tau^2}{10G}$

(g) Equivalent length of a column, when one end is fixed and the other end is free, and the length of column is L, is given by

(i) L

(ii) L/2

(iii) 3L

(iv) 2L

2. (a) Prove that the Poisson's ratio cannot be greater than 0·50. 7

(b) A bar of 20 mm diameter is subjected to a pull of 50 kN. The measured extension over a gauge length of 20 cm is 0·1 mm and the change in diameter is 0·0035 mm. Calculate the Poisson's ratio and value of the modulus of elasticity E and bulk modulus k. 7

3. (a) A cylindrical shell 90 cm long, 15 cm internal diameter, having thickness 8 mm is filled with a fluid at atmospheric pressure. If an additional 20 cm^3 of fluid is pumped into the cylinder, find

(i) Pressure exerted by the fluid on the cylinder.

(ii) Hoop stress induced : E = 200 GPa. Poisson's ratio = 0·30. 7

(b) Explain the maximum principal stress theory and the material for which it is applicable. 7

4. (a) Write the assumptions made in Theory of Simple Bending. 7

(b) A hollow shaft of diameter ratio 3/5 is required to transmit a power of 800 kW at 110 rpm. Maximum shear stress is not to exceed 63 MPa and twist in a length of 3 m is not to exceed 1·4 degrees. Calculate the minimum outer diameter of the shaft. 7

5. (a) A steel specimen of 1·5 cm^2 cross-sectional area stretches 0·005 cm over a 5 cm gauge length under an axial load of 30 kN. Calculate the strain energy stored in the specimen at this point. If the load at elastic limit is 50 kN, calculate the elongation at elastic limit and the proof resilience. 7

(b) Explain the assumptions made in Euler's theory of Buckling of columns. 7

6. (a) Derive the formula for slope and deflection of a simply supported beam carrying central point load using Moment area method. 7

(b) A steel ring of 20 cm mean diameter has a rectangular cross-section 5 cm in the radial direction and 3 cm perpendicular to the radial direction. If the maximum tensile stress is limited to 120 MPa, determine the tensile load that the ring can carry. 7

7. (a) Stresses at a point on a specimen are σ_x = 20 MPa, σ_y = 10 MPa, τ_{xy} = 25 MPa. Find the values of maximum and minimum principal stresses and their position. 7

(b) Calculate the crippling load by Rankine's method for a strut of 225 mm having outer and inner diameter of 37·5 mm and 32·5 mm respectively. Yield stress is 315 MPa and $a = \frac{1}{7500}$. 7