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BIME-021

DIPLOMA – VIEP – MECHANICAL ENGINEERING (DMEVI)

Term-End Examination

December, 2015

BIME-021 : MECHANICS OF MATERIALS

Time : 2 hours *Maximum Marks : 70*

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

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

(a) Poisson's ratio is defined as

(i) Lateral strain / Linear strain

(ii) Lateral strain × Linear strain

(iii) Linear strain / Lateral strain

(iv) Lateral strain – Linear strain

(b) The angle between principal planes is

(i) 90°

(ii) 180°

(iii) 60°

(iv) 45°

(c) Rankine's formula for long column considers

(i) only crippling load

(ii) only direct compressive load

(iii) Both crippling and compressive loads

(iv) None of the above

(d) Failure of the components due to cyclic loading is known as

(i) Impact failure

(ii) Creep failure

(iii) Fatigue failure

(iv) Torsional failure

(e) A cylinder is known as a thick cylinder, if the ratio of mean diameter to thickness is

(i) Less than 20

(ii) Less than 30

(iii) Equal to 45

(iv) Greater than 100

(f) The maximum strain energy stored in the body per unit volume is known as

(i) Strain energy

(ii) Proof load

(iii) Proof resilience

(iv) Modulus of resilience

(g) Formula for deflection at the mid-span of a simply supported beam carrying a point load at the centre is given by

(i) $\frac{Wl^3}{48\ EI}$

(ii) $\frac{Wl^3}{16\ EI}$

(iii) $\frac{Wl^3}{96\ EI}$

(iv) $\frac{Wl^3}{100\ EI}$

2. (a) Explain the stress – strain diagram for the ductile material with a suitable sketch. 7

(b) Write a brief note on maximum shear stress theory and distortion energy theory. 7

3. (a) Normal stresses at a point measured along two axes on a specimen are 80 MPa tension and 50 MPa compression. It is accompanied by a shear stress of 30 MPa. Determine the maximum direct stress and shear stress on the material. 7

(b) A square of 8 cm × 8 cm cross-section is 6 m long. It is subjected to a tensile load of 250 kN. If E = 210 GPa and Poisson's ratio = 0·25, determine the change in volume and Bulk modulus. 7

4. (a) A beam of I-section 50 cm deep and 19 cm wide, has flanges 2·5 cm thick and web 1·5 cm thick. It carries a shearing force of 400 kN at a section. Calculate the maximum intensity of shear stress in the section if the moment of inertia is 64,500 cm^4. 7

(b) Derive the relation between Young's modulus and modulus of rigidity. 7

5. (a) A cantilever beam is subjected to a UDL throughout the span. Derive the equation for maximum slope and deflection by area moment method. 7

(b) Prove that a hollow shaft of the same weight and material as that of a solid shaft can resist more torque. 7

6. (a) Explain Euler's theory of Buckling of columns. 7

(b) A cylinder of 15 cm internal diameter and 20 cm external diameter is subjected to a liquid pressure from inside. There is also a compressive load of 200 kN applied at the ends of the cylinder. Find the greatest pressure of the liquid so that the maximum stresses in the material may not exceed 42 MPa. 7

7. (a) Explain the failure of the material due to fatigue and creep. 7

(b) Derive the equation for strain energy due to impact loading. 7