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BIME-021

DIPLOMA – VIEP – MECHANICAL ENGINEERING (DMEVI)

Term-End Examination

00210

June, 2016

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. Assume missing data, if any, suitably.*

1. Answer the following questions by choosing the best one out of the given four options : *7×2=14*

(a) Bulk Modulus is measured in terms of

(i) N/m

(ii) N/m^2

(iii) Nm/s

(iv) Ns/m^2

(b) When a wire is stretched to double in length, the longitudinal strain produced in it is

(i) 0·5

(ii) 1·0

(iii) 1·5

(iv) 2·0

(c) For a hollow shaft of external and internal diameters 10 cm and 5 cm respectively, the torsional section modulus will be approximately

(i) 184 cm^3

(ii) 275 cm^3

(iii) 368 cm^3

(iv) 536 cm^3

(d) For a thin cylinder, the ratio of thickness to internal diameter is in the order of

(i) 1/10

(ii) 1/20

(iii) 1/30

(iv) 1/40

(e) The strain energy stored in a body due to external loading, within the elastic limit, is known as

(i) Malleability

(ii) Ductility

(iii) Toughness

(iv) Resilience

(f) Complementary shear stresses are

(i) equal both in magnitude and sign

(ii) equal in magnitude but opposite in sign

(iii) unequal in magnitude but for same sign

(iv) equal in magnitude but direction may be same or opposite

(g) A steel wire is cut to half of its original length. The maximum load which the cable can support would

(i) get reduced to half the value

(ii) become two fold

(iii) remain unchanged

(iv) Data insufficient to give any comment

2. (a) Find the Young's modulus of a brass rod of diameter 25 mm and of length 250 mm which is subjected to a tensile load of 50 kN, when the extension of the rod is equal to 0·3 mm. *6*

(b) Explain different theories of elastic failure in brief. *8*

3. (a) A tensile load of 60 kN is gradually applied to a circular bar of 4 cm diameter and 5 m length. If the value of $E = 2{\cdot}0 \times 10^5$ N/mm^2, determine the

(i) stretch in the rod,

(ii) stress in the rod, and

(iii) strain energy absorbed by the rod. *8*

(b) What is 'toughness' of the material ? Also differentiate between Resilience, Proof Resilience and Modulus of Resilience. *6*

4. (a) Derive flexural formula for bending of beams. *8*

(b) Calculate the maximum stress induced in a cast-iron pipe of external diameter 40 mm, of internal diameter 20 mm, and of length 4 m, when the pipe is supported at its ends and carries a point load of 80 N at its centre. *6*

5. (a) Find out the circumferential and longitudinal stresses induced in thin cylinders, under internal pressure. *6*

(b) A cylinder of internal diameter 0·5 m contains air at a pressure of 7 N/mm^2 (gauge). If the maximum permissible stress induced in the material is 80 N/mm^2, find the thickness of the cylinder. *8*

6. (a) Find out the crippling load of column in the following cases : *8*

(i) One end fixed and one end free

(ii) One end fixed and one end hinged

(b) A column of timber section 15 cm × 20 cm is 6 metres long, both ends being fixed. If the Young's modulus of the timber is 17·5 kN/mm^2, determine the

(i) crippling load, and

(ii) safe load for the column if factor of safety = 3. *6*

7. (a) What are the assumptions made in derivation of the torsion formula ? Also write the expression derived for torsion, mentioning different terms of it. *6*

(b) In a hollow circular shaft of outer and inner diameters of 20 cm and 10 cm respectively, the shear stress is not to exceed 40 N/mm^2. Find the maximum torque which the shaft can safely transmit. *8*
