* 3 5 0 3 *

C09–M–403

3503

BOARD DIPLOMA EXAMINATION, (C–09)

OCT/NOV—2014

DME—FOURTH SEMESTER EXAMINATION

STRENGTH OF MATERIALS

Time : 3 hours] [*Total Marks* : 80

PART—A 3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answers should be brief and straight to the point and shall not exceed *five* simple sentences.

1. A metal bar, 200 mm long and cross-sectional area 25 mm^2, carries an axial load of 5 kN which produces an extension of 0·2 mm. Find the stress in the bar and the modulus of elasticity of the metal.

2. Define the following terms :

(a) Longitudinal strain

(b) Lateral strain

(c) Poisson's ratio

3. Write the formulae for strain energy for the following modes of loading :

(a) Gradually applied load

(b) Suddenly applied load

(c) Falling or impact load

4. Define *(a)* bending moment and *(b)* point of cotraflexure.

5. Draw shear force and bending moment diagrams of cantilever with uniformly distributed load on its entire span.

6. Define *(a)* neutral layer *(b)* radius of curvature.

7. Write simple bending equation and mention the units of any three terms involved.

8. A solid shaft of 20 mm diameter transmits power at 750 r.p.m. The maximum shear stress in the shaft is 80 N/mm^2. Determine the power transmitted by the shaft.

9. List out various types of spring.

10. Calculate the hoop and longitudinal stresses in the material of a thin cylindrical shell of 3 m diameter and 30 mm thick subjected to an internal pressure of 1·2 N/mm^2.

PART—B

10×5=50

Instructions : (1) Answer *any* **five** questions.

(2) Each question carries **ten** marks.

(3) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11. A bar 300 mm long is 50 mm diameter for 120 mm of its length, 30 mm diameter for the next 100 mm length and 40 mm diameter for the remaining length. It is subjected to a tensile load of 100 kN. Calculate the maximum and minimum stresses produced in it and the total elongation. Take modulus of elasticity of the material of the bar, $E = 2 \times 10^5$ N/mm^2.

12. A cylindrical bar is 25 mm diameter of 1·25 m long. During tensile test, it is found that, the linear strain is 4 times the lateral strain. Calculate the shear modulus, bulk modulus and change in volume, if the bar is elongated by 0·06 mm under an axial load of 50 kN.

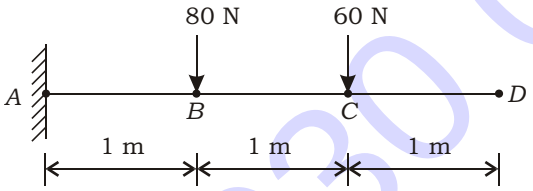
13. A bar of 3 m long and 50 mm diameter hangs vertically, has a collar attached at the lower end. Find the maximum stress induced when—

(i) a weight of 250 N falls from 120 mm on the collar;

(ii) a weight of 2500 N falls from 10 mm on the collar.

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

14. Draw shear force and bending moment diagrams for the cantilever shown in the figure :



15. A beam of length 1·2 m is simply supported at its ends and carries two point loads of 3·5 kN and 4 kN at distances of 0·4 m and 0·8 m from the left end support. Draw shear force and bending moment diagrams.

16. *(a)* A steel strip of thickness 4 mm is coiled on a drum of 1·4 m diameter. Calculate the maximum stress produced by the coiling. Take modulus of elasticity of steel, $E = 2 \times 10^5$ N/mm^2.

(b) A timber beam of rectangular section 100 mm wide and 250 mm deep, supports over a span of 5 m. Find the magnitude of central point load it can carry, if the maximum permissible deflection is 5 mm. Take modulus of elasticity of timber, $E = 1 \times 10^4$ N/mm^2.

17. Select a suitable diameter of solid shaft to transmit 110 kW of power at 240 r.p.m. If the allowable shear stress is not to exceed 75 N/mm^2 and twist is not to exceed 1° in a length of 3 m. Take modulus of rigidity of shaft material, $G = 0{\cdot}8 \times 10^5$ N/mm^2.

18. *(a)* A helical spring 150 mm mean diameter is required to absorb 30 kJ of energy with maximum shear stress of 450 N/mm^2. Find the diameter of the steel rod and number of coils, if maximum amount of compression is 160 mm.

(b) A cylindrical steel vessel 300 mm in diameter with a wall thickness of 15 mm, is subjected to an internal pressure of 3·5 N/mm^2. Calculate *(i)* longitudinal stresses in steel and *(ii)* hoop stress.

★ ★ ★