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C09–M–403

3503

BOARD DIPLOMA EXAMINATION, (C–09)

OCT/NOV—2017

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. List out three elastic constants and write down the relation between them.

2. A steel rod of 2 m long is fixed rigidly at the end and heated through a temperature of 100 °C. Find the stress induced in the rod, if $_s$ 12 10^{-6} per °C and E_s 2 10^5 N / mm^2. What is the expansion prevented?

3. A steel rod of 30 mm diameter is 3 m long. If it is subject to an axial pull of 80 kN suddenly applied to it, find the maximum instantaneous stress and elongation produce. Take, E 200 kN/ mm^2.

4. Define *(a)* shear force and *(b)* point of contraflexure.

5. Draw shear force and bending moment diagrams for a simply supported beam with a point load at its centre.

6. Write any three assumptions made in the theory of simple bending.

7. A cantilever of length 3 m carries a point load of 40 kN at free end. Find the slope and deflection of the cantilever at free end. Assume I 8 10^7 mm^4 and E 2 1 10^5 N/mm^2.

8. State any three requirements of a material used for shafts.

9. Define the following terms related to a coil spring :

(a) Spring index

(b) Stiffness

10. A thin cylindrical pressure vessel of 600 mm diameter is subjected to an internal pressure of 2 N/mm^2. If the longitudinal stress for the material is 15 N/mm^2, calculate the thickness of the vessel.

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 compound bar consisting of a circular rod of steel of diameter 20 mm is rigidly fitted into a copper tube of internal diameter 20 mm and thickness 5 mm. If the bar is subjected to a tensile load of 100 kN, find the stresses induced in each material and elongation of the compound bar if its length is 1 m. Take, E for steel = 200 GN/m^2 and E for copper = 100 GN/m^2.

12. A mild steel bar has a diameter of 20 mm and is 300 mm long. A tensile load of 64 kN is applied longitudinally. Calculate the elongation of the bar, the change in diameter and change in volume. Take modulus of elasticity of steel, E 2 10^5 N/mm^2 and Poisson's ratio as 0·25.

13. An MS bar of length 2 m has a diameter of 50 mm and hangs vertically. A load of 20 kN falls on a collar attached to the lower end. Find the maximum stress when—

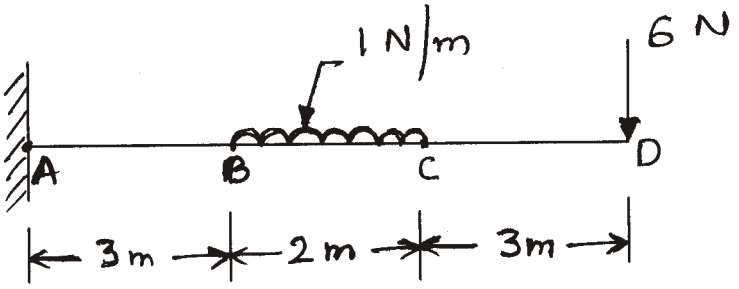
(a) height of fall is 100 mm;

(b) load is applied suddenly without impact;

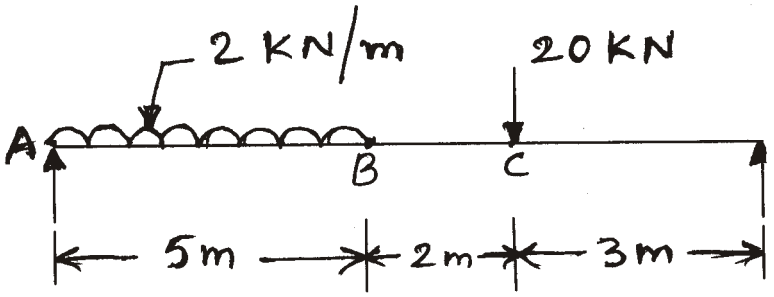
(c) the load is applied gradually.

Assume, E 2 10^5 N/mm^2.

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



15. Draw shear force and bending moment diagrams for a simply supported beam shown in the figure below :



16. A cantilever of 2 m long is loaded with a point load of 800 N at the free end and a distributed load of 3 kN/m over 1·2 m from the fixed end. If the section is rectangular with 75 mm 150 mm deep, calculate the slope and deflection at the free end. Take, E 1 1 10^5 N/mm^2.

17. A ship propeller shaft is to transmit 5 MW at 2 rev/sec. The permissible stress of the shaft material is limited to 60 N/mm^2 and the maximum torque being 1:3 times the mean torque. Determine—

(a) the required diameter of the shaft, if a solid shaft is used;

(b) the internal and external diameters of hollow shaft, if it is used for the same purpose and the ratio of internal diameter to the external diameter is 3 : 4.

18. *(a)* A close-coiled helical spring of 100 mm mean diameter is made of 10 mm diameter rod and has 18 turns. The spring carries an axial load of 190 N. Determine the —

(i) shear stress;

(ii) deflection in spring when carrying this load.

Assume modulus of rigidity of material of spring, G 0 8 10^5 N/mm^2.

(b) A thin cylindrical shell has a thickness of 18 mm. The diameter of shell is 400 mm and its length is 1·75 m. Determine the maximum internal pressure that can be applied if the longitudinal stress is limited to 26 N/mm^2 and the circumferential stress is not to exceed 40 N/mm^2.

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