C14-M-305

4253

BOARD DIPLOMA EXAMINATION, (C-14)

MARCH/APRIL—2016

DME—THIRD 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.

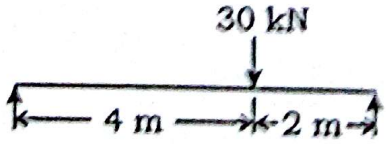
1. A steel rod of 20 mm diameter and 600 mm long is subjected to an axial pull of 40 kN. Determine the elongation of rod. $E = 2 \times 10^5$ N/mm^2.

2. A rod of 2 m long rigidly fixed at a temperature of 30 °C. Find the stress induced in the rod, if temperature raised at 120 °C.

   Take $E = 2 \times 10^5$ N/mm^2 and $\alpha = 16 \times 10^{-6}$ per °C.

3. An axial pull of 50 kN is suddenly applied to steel rod of 2 m long and 30 mm diameter. Calculate the strain energy that can be absorbed. $E = 200$ kN / mm^2.

4. Draw shear force and bending moment diagram for simply supported beam :



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(38)

5. Define the terms *(a)* reactions and *(b)* point of contra flexure.

6. A rectangular beam of 80 mm × 40 mm is 3 m long and simply supported at its end and it carries a load of 2 kN at midpoint. Calculate the maximum bending stress induced in the beam.

7. Define the terms *(a)* bending stress and *(b)* neutral axis.

8. List out any three applications of springs.

9. A solid circular shaft running at 500 r.p.m. transmit power of 350 kW. Calculate suitable diameter of the shaft, if the maximum shear stress is 100 N/mm^2.

10. A gas cylinder of internal diameter 1·5 m is 30 mm thick. Find the safe pressure of gas in the cylinder, if the tensile stress in the cylinder is not to exceed 100 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. The following results are obtained from a tensile test on mild steel specimen :

Diameter of specimen = 16 mm
Guage length = 80 mm
Extension at a load of 75 kN is 0·15 mm
Load at yield point = 90 kN
Maximum load = 130 kN
Length at fracture = 106 mm
Diameter of neck = 9·8 mm

Calculate—

(a) young's modulus of elasticity;

(b) ultimate stress;

(c) working stress, if factor of safety is 3;

(d) percentage of elongation and percentage of reduction area.

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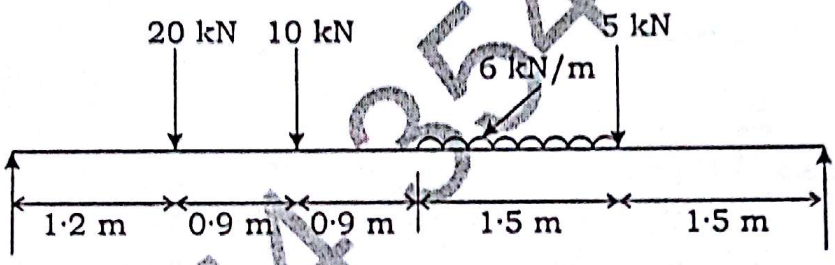
12. A steel bar of 22 mm diameter and 1·25 m long is freely suspended from a roof and is provided with collar at other end. The maximum permissible stress is 300 N/mm^2. Find—

(a) maximum load which can fall from a height of 50 mm;

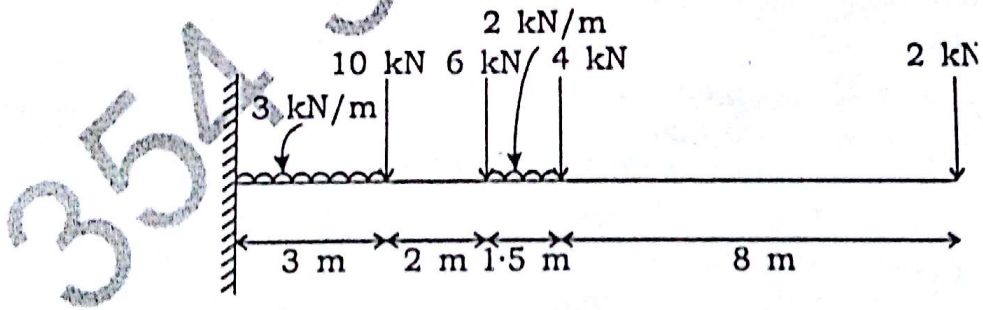
(b) maximum height from which a 600 N load can fall on collar. $E = 2 \times 10^5$ N/mm^2

13. In a tensile test on a steel tube of external diameter 18 mm, 12 mm bore, an axial load of 1·7 kW produced an elongation of 0·0045 mm in a length of 75 mm, while the outer diameter suffered a compression of 0·00032 mm. Calculate the values of $\frac{1}{m}$, E, G and K.

14. Draw shear force and bending moment diagram of given simply supported beam :



15. Draw shear force and bending moment diagram of given cantilever beam :



16. (a) Derive an equation $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$.

(b) Steel strip of thickness 5 mm is coiled on a drum of 1·5 mm diameter. Calculate the maximum stress produced by the coiling. $E = 2 \times 10^5$ N/mm^2.

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17. A hollow shaft is to have outside diameter D and inside diameter is $D/2$. Calculate the minimum value of D, if it transmits 147·2 kW at 150 RPM with working shear stress of 42 N/mm^2. The maximum torque is 35% greater than mean torque. Calculate the angle of twist in a length of 10 times that of external diameter. $G = 0 \cdot 8 \times 10^5$ N/mm^2.

18. A boiler shell is to be made of 10 mm thick plate having limiting tensile stress of 105 N/mm^2. If the efficiencies of the longitudinal and circumferential joints are 70% and 30% respectively, determine the permissible intensity of internal pressure when the shell diameter is 1·5 m.

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