C14–C–105

4019

BOARD DIPLOMA EXAMINATION, (C–14)

SEPTEMBER/OCTOBER - 2020

DCE—FIRST YEAR EXAMINATION

ENGINEERING MECHANICS

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. Define the following terms :

(a) Dynamics

(b) Statics

(c) Kinematics

2. Define force and mention any two characteristics of force.

3. State 'parallelogram law of forces'.

4. Distinguish between centre of gravity and centroid.

5. Locate the position of centroid of the figure trapezium.

6. Find the moment of inertia of hollow circular section whose external diameter is 60 mm and internal diameter is 50 mm about centroidal axis.

7. Define the following terms :

(a) Polar moment of inertia

(b) Radius of gyration

8. State Hooke's law and define the term Young's modulus.

9. Define the following terms :

(a) Modulus of rigidity

(b) Bulk modulus

10. The length of railway track is 30 m at 60 °C. Calculate the stress in the rails at 20 °C, if no allowance is made for contraction. Take, $E = 210\ \text{GN/m}^2$, $\alpha = 0 \cdot 000012$ per °C.

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)* State Lami's theorem.

(b) A body of weight 1000 N is suspended by two strings of 4 m and 3 m lengths attached at the same horizontal level 5 m apart. Calculate the forces in the strings.

12. Find the magnitude and direction of resultant force for the following forces acting at a point :

(a) 30 kN due north-east

(b) 40 kN at 60° east of south

(c) 60 kN at 60° south of west

(d) 20 kN at 60° west of north

13. Find the centroid of the unequal angle 200 mm × 150 mm × 12 mm with its longer leg vertically upwards.

14. Find the moment of inertia of an I-section about its centroid axes with its top flange 60 mm × 10 mm, bottom flange 120 mm × 10 mm and web 80 mm × 100 mm.

15. *(a)* State *(i)* parallel axis theorem and *(ii)* perpendicular axis theorem.

(b) For a square lamina of sides 12 mm, calculate the moment of inertia about an axis parallel to base and at a distance of 10 mm above the base.

16. The following observations were made during a tension test on mild steel bar of 20 mm diameter :

Gauge length = 200 mm
Extension at 31·4 kN load = 0·1 mm
Yield load = 88 kN
Total extension = 54 mm

Calculate Young's modulus, yield stress and percentage elongation.

17. A reinforced concrete column 300 mm × 300 mm in section is provided with 8 bars of 20 mm in dia. The column carries an axial load of 600 kN. Find the stress in concrete and steel and also calculate the loads shared by concrete and steel. Take, $m = 15$.

18. A load of 50 kN is suddenly applied on a bar 2 m long and 1000 mm^2 in cross-section. What is the maximum instantaneous stress produced? What strain energy is stored, if $E = 200$ GPa?

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