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C16–C–106

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BOARD DIPLOMA EXAMINATION, (C–16)

OCT/NOV—2017

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. Two forces act at an angle of 120°. The bigger force is 60 kN and the resultant is perpendicular to the smaller one. Find the smaller force.

2. State the need for finding the centroid and centre of gravity for various engineering applications.

3. Determine the centre of gravity of the remaining portion of a circular sheet metal of radius 50 mm, when a hole of 25 mm radius of circle is cut from the right side horizontal axis of the 50 mm radius circle.

4. For a square lamina of side 12 mm, calculate the moment of inertia about an axis parallel to the base at a distance of 10 mm from the base.

5. Define the terms *(a)* longitudinal strain, *(b)* lateral strain and *(c)* factor of safety.

6. A steel rod 20 mm in diameter and 200 mm long is heated through 100 K and at the same time subjected to a pull P. If the total extension of the rod is 0·3 mm, what should be the magnitude of pull P? Take $\alpha = 12 \times 10^{-6}$/K and Young's modulus $E = 215$ kN/mm^2.

7. The value of Bulk modulus for steel is $1 \cdot 5 \times 10^5$ N/mm^2 and its Young's modulus is $2 \cdot 1 \times 10^5$ N/mm^2. Find the modulus of rigidity.

8. Write the relationship between rate of loading, shear force and bending moment.

9. A simple supported beam of span 6 m carries a uniformly distributed load of 10 kN/m over the left hand half of the span and a concentrated load of 20 kN at a distance of 1 m from the right hand support. Find the reaction at the supports.

10. A cantilever 4 meters long carries a uniformly distributed load of 8 kN/m over a length of 2·5 m from free end. Draw the shear force and bending moment diagrams for the above loading system.

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

12. A masonry dam is trapezoidal in section with one face vertical. The top width is a m, bottom width is b m and the height is h m. Find the position of centroid from the vertical face of the dam.

13. Calculate the moment of inertia about its centroidal axes of an un-equal angle section of size 150 mm × 100 mm × 10 mm with its longer leg placed vertical.

14. Find the radius of gyration about centroidal axes for a built-up section made of one ISHB 450 mm × 250 mm and a flat plate 300 mm × 20 mm is placed one at top and one at bottom.

The properties of the I-section :

Area of the I-section = 11789 mm^2

$I_{xx} = 40350 \times 10^4$ mm^4

$I_{yy} = 3045$ mm^4

15. A tie bar is to carry a pull of 14 kN not showing more than 0·12 mm extension over a gauge length of 200 mm. The ultimate tensile strength of the material of the bar should not exceed 500 N/mm^2 with a factor of safety of 2·5. Young's modulus of the material of the bar is 210×10^3 N/mm^2. Determine the minimum area of cross-section required to satisfy both the conditions.

16. An unknown weight falls through 10 mm on a collar rigidly attached to the lower end of vertical bar; 3 m long and 36 mm^2 in section. If the maximum instantaneous extension is known to be 2 mm, what are the corresponding stress and value of the unknown weight? Take $E = 2 \times 10^5$ N/mm^2.

17. A simply supported beam of span 8 meters carries a uniformly distributed load of 20 kN/m in the right half of the beam and a concentrated load of 40 kN at a distance of 2 m from left support. Draw the shear force and bending moment diagram. Also show the maximum bending moment.

18. A beam of length 12 m is supported by two supports at 2 m from left end and another at 2 m from right end. It carries a uniformly distributed load of 10 kN/m over its 12 m length. It is also loaded with a point load of 20 kN placed at 5 meters from left support and another point laod of 4 kN placed at right face end. Draw the shear force diagram and bending moment diagram. Also determine the position and magnitudes of maximum hogging and sagging moments.

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