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C14–C–105

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BOARD DIPLOMA EXAMINATION, (C–14)

OCT/NOV—2016

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 terms *(a)* mechanics, *(b)* dynamics and *(c)* statics.

2. By resolving the force of 100 N acting at an angle of 30° with the horizontal, find its horizontal and vertical components.

3. Draw neat sketches of any three types of beams.

4. Define the terms *(a)* centroid and *(b)* centre of gravity.

5. Locate the centre of gravity for a T-section of top flange 100 m × 20 mm and web 80 mm × 20 mm.

6. The moment of inertia of a square about its base is 400 mm^4. Find the values of I_{xx}, I_{yy} and I_{zz} for the square.

7. Determine the polar moment of inertia of a hollow circular section of internal diameter 100 mm and thickness 10 mm.

8. Define the terms *(a)* stress, *(b)* working stress and *(c)* factor of safety.

9. The length of a steel rod is 2 meters at 30 °C. What will be the length of the rod when the temperature is raised to 100 °C, if it is free to expand? Take, the coefficient of thermal expansion of steel as 12 10 ^{6}/°C.

10. Define the terms *(a)* elasticity, *(b)* stiffness and *(c)* hardness.

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)* A weight of 800 N is suspended by two strings of 4 m and 3 m lengths, attached at the same horizontal level, 5 m apart. Find the tensions in the strings. 5

(b) Find two forces, one horizontal and the other inclined at 60° to the vertical, whose resultant is a vertical force of 100 N. 5

12. A simply supported beam of span 10 m is loaded with 3 point loads of 20 kN, 6 kN and 2 kN placed at 2 m, 4 m and 6 m respectively from the left support. In addition it also carries a udl of 5 kN/m in a length of 4 m from the right support towards left. Determine the support reactions for the beam. 5+5

13. Find the position of centre of gravity of an unequl angle section of size 150 mm × 100 mm × 20 mm with its longer leg vertical and shorter leg horizontal and placed at the bottom. 5+5

14. Calculate the values of I_{xx} and I_{yy} for an I-section with the following dimensions : 6+4

Top flange = 120 mm × 12 mm
Web = 12 mm × 160 mm
Bottom flange = 200 mm ×12 mm

15. A built-up section consists of two channels ISLC 300 placed back-to-back at 100 mm clear distance, with a cover plate 300 mm × 20 mm connected one to each flange. Determine the radius of gyration of the section about the horizontal and vertical centroidal axes :

For each channel

A 4210 mm^2

I_{xx} 60 5 $10^6 mm^4$

I_{yy} 3 46 $10^6 mm^4$

Distance of CG from back of web—25 5 mm.

16. A steel bar of rectangular section 25 mm × 10 mm and 3 m long has to transmit an axial pull of P kN. If the tensile stress in the material is not to exceed 150 MPa and the elongation is limited to 1·2 mm, determine the maximum value of P, satisfying both the conditions. Take, E 200 GPa.

17. A cylindrical bar is 20 mm in diameter and 1·2 m long. During a tension test it is found that the longitudinal strain is 4 times the lateral strain. Calculate the shear modulus and bulk modulus, if the bar elongates by 0·06 mm under an axial tensile load of 50 kN.

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

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