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C09–C–106

3016

BOARD DIPLOMA EXAMINATION, (C–09)

OCT/NOV—2016

DCE—FIRST YEAR EXAMINATION

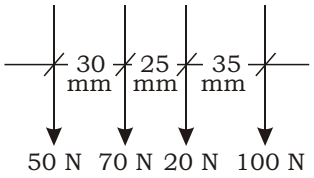
ENGINEERING MECHANICS

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. Find the resultant of the forces shown in the figure below and its position with respect to extreme left force :



2. State the Lami's theorem.

3. Give the position of centroid of the following sections :

(a) Square

(b) Triangle

(c) Semicircle

4. Define moment of inertia and state its units.

5. A steel rod 40 mm in diameter is 2 m long. Find the maximum instantaneous stress and instantaneous elongation induced when as axial pull of 80 kN is suddenly applied to it. Take $E \quad 2 \quad 10^5$ N/mm^2.

6. A wooden strut 8 m long, 80 mm thick and 120 mm wide is subjected to an axial push of 45 kN. If the value of E is 10 kN/mm^2, find the length of the strut after loading it.

7. The length of a rail in a railway track is 30 m at 25 °C. Determine the temperature stress developed in the rail at 65 °C, if there is no allowance for expansion. Take E 2 10^5 N/mm^2 and 0·000012/°C.

8. Draw the sketches of the following :
(a) Continuous beam
(b) Overhanging beam
(c) Simply supported beam

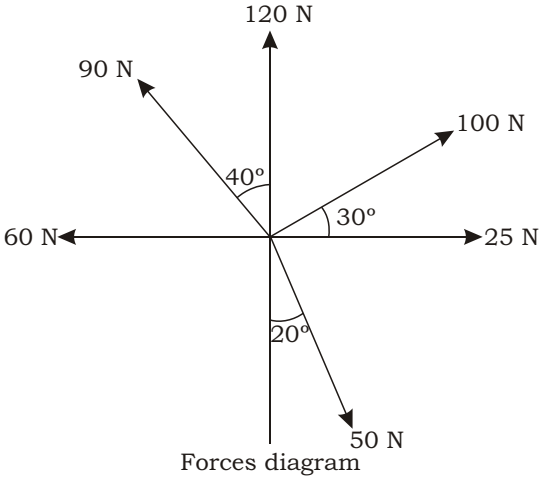
9. Define a beam. Draw the sketches of a cantilever and fixed beam.

10. Draw the sketches of a cantilever beam of 4 m length with a central point load of 9 kN and UDL of 5 kN/m over the right-half portion. Also find the reaction at fixed end.

PART—B 10×5=50

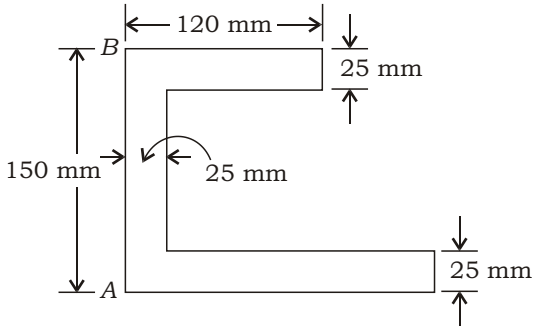
Instructions : (1) Answer *any* **five** questions.
(2) Each question carries **ten** marks.
(3) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11. Find the resultant of given force diagram :



Forces diagram

12. Locate the centroid of the area shown in the figure below with respect to the face AB :

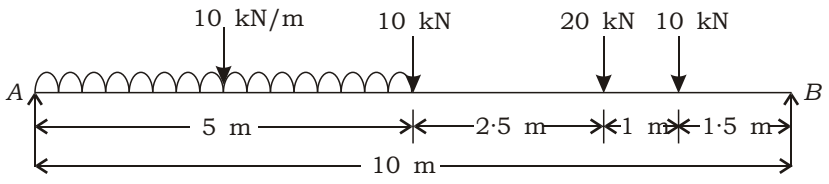


13. A built-up section consists of two channels ISLC 300 placed back-to-back at 100 mm clear distance with two cover plates 300 mm×20 mm, one on each flange. Determine the moments of inertia of the section about horizontal and vertical centroidal axes. For a single channel I_{xx} 6·05×10^6 mm^4; I_{yy} 3·46×10^6 mm^4; C_{yy} 25·5 mm.

14. A rectangular bar 50 mm wide and 20 mm thick is 3 m long. It is subjected to an axial pull of 50 kN. If the change in length is 1·5 mm and decrease in thickness is 0·0014 mm, determine the four elastic constants.

15. A bar 400 mm long is 60 mm square in section for 150 mm of its length, 30 mm diameter for 100 mm length and 50 mm diameter for the remaining length. If a tensile force of 120 kN is applied to the bar, calculate the maximum and minimum stresses produced in it and the total elongation. Assume uniform distribution of load over the cross-section and E for the material is 2 10^5 MPa.

16. Determine the reactions and construct the shear force and bending moment diagrams for the simply supported beam loaded as shown in the figure below. Also determine the position and magnitude of maximum bending moment :



17. Write the relationship between the rate of loading, shear force and bending moment, giving a neat sketch.

18. *(a)* Find the CG of a semicircular section from the base having outer and inner diameters of 200 mm and 600 mm respectively.

(b) Find the moment of inertia of a T-section having flange 150 mm×50 mm and web 50 mm×150 mm about centroidal *Y-Y* axis.

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