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C16–C–106

6022

BOARD DIPLOMA EXAMINATION, (C–16)

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. What is couple? Write the properties of a couple.

2. Differentiate between centroid and centre of gravity.

3. A trapezoidal lamina has uniform batter on both the sides. Its top width is 500 mm, bottom width is 900 mm and height is 1000 mm. Determine the position of the centroid from its base.

4. Find the moment of inertia and radius of gyration of a circular lamina whose area of cross-section is 1200 mm^2.

5. Define the terms *(a)* stress, *(b)* modulus of rigidity and *(c)* bulk modulus.

6. The length of a railway track is 20 m at 35 °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 coefficient of thermal expansion is 0·000015/°C.

7. Define the terms *(a)* elasticity, *(b)* hardness and *(c)* toughness.

8. Draw the sketches of different supports along with their reactions.

9. A cantilever of length 5 m carries point loads of 3 kN at its free end and a uniformly distributed load of 2 kN/m over a length of 2 m from the fixed end. Draw the shear force and bending moment diagrams indicating their maximum values.

10. A singly supported beam of span L m carries a central point load of W kN. Determine the bending moment value at the centre of the span.

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. In a concurrent force system, two forces are acting on a point in two different conditions. If they act at 60°, their resultant is 24 kN and if they at right angles, their resultant is 20 kN. Determine the magnitude of two forces.

12. Find the position of centroid of an I-section with size—top flange 80 mm×20 mm, web 120 mm×20 mm and bottom flange 100 mm×20 mm.

13. Find the moment of inertia about horizontal and vertical axes passing through centroid of an inverted T-section with size of flange as 250 mm×50 mm and size of web as 50 mm×200 mm.

14. 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 attached to each flange. Determine the moment of inertia of the built-up section about horizontal and vertical axes.

For a single channel I_{xx} $6{\cdot}05\times10^6$ mm^4; I_{yy} $3{\cdot}46\times10^6$ mm^4; A 4210 mm^2 and C_{yy} 25·5 mm.

15. A circular RCC column of 300 mm diameter and 4 metres length is reinforced with 3% of reinforcement of total cross-section. The permissible stress in concrete is 4 MPa. Assuming perfect bond between concrete and steel, find out the capacity of the column. Modular ratio of the material is 18·7.

16. A steel flat 10 mm×10 mm in cross-section and 400 mm long is subjected to an axial pull of 12 kN. The elongation in length and contraction in lateral dimensions are found to be 0·4 mm and 0·0025 mm respectively. Determine the values of Poisson's ratio, Young's modulus, rigidity modulus and bulk modulus of the material.

17. A simply supported beam of 6 m span is carrying a uniformly distributed load of 4 kN/m over its right half of its span and a point load of 10 kN at midspan. Draw the shear force and bending moment diagrams and find the value of maximum bending moment.

18. A beam of length L meters carries a uniformly distributed load of w per unit length. The beam is supported on two supports at an equal distance a meters from two ends. Determine the position of the supports, if the bending moment to which the beam is subjected to is as small as possible. Draw the bending moment and shear force diagrams for the beam.

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PART—A

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. State the law of parallelogram of forces. 3

2. Locate the position of centroid with neat diagram for the following : 1+1+1=3

(a) Semi-circle

(b) Rectangle

(c) Right angled triangle with one side vertical

3. A trapezoidal lamina has uniform batter on both sides. Its top width is 250 mm, bottom width is 350 mm and height is 700 mm. Determine the position of centroid from base. 3

4. Define radius of gyration and mention its units. 2+1=3

5. A mild steel rod of 15 mm diameter and 400 mm length elongates 0·20 mm under an axial pull of 13 kN. Determine 'the Young's modulus of the material. 3

6. Define Bulk Modulus and Modulus of Rigidity? 1½+1½=3

7. A material has Young's Modulus of $1{\cdot}25\times10^5$ MPa and Poisson's ratio of 0·25, calculate Modulus of Rigidity and Bulk Modulus? 1½+1½=3

8. What are the different types of end supports? Show any two of them with neat sketch. 3

9. Define the term shear force and bending moment at a section. 1½×1½=3

10. A simply supported beam 5 m in length and carries a point load of 40 kN at centre. Calculate the maximum shear force and bending moment. 3

PART—B

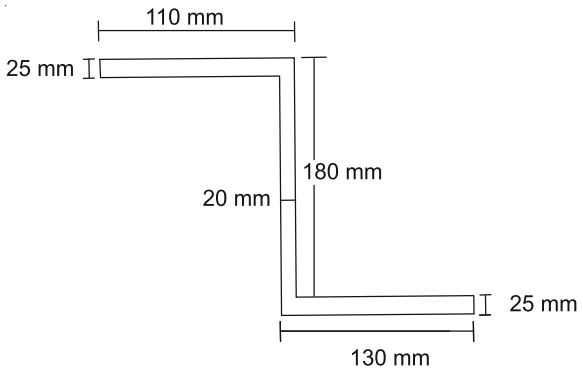
Instructions **:** (1) Answer *any* **five** questions.

(2) Each question carries **ten** marks.

(3) Answers should be comprehensive and the criteria for valuation are the content but not the length of the answer.

11. A wheel has 5 spokes which are equispaced. The forces acting in three consecutive spokes are 12 kN, 14 kN and 10 kN. Find the forces acting in the other two spokes for the wheel to be in equilibrium.

12. Find the position of centroid of the section shown in figure.

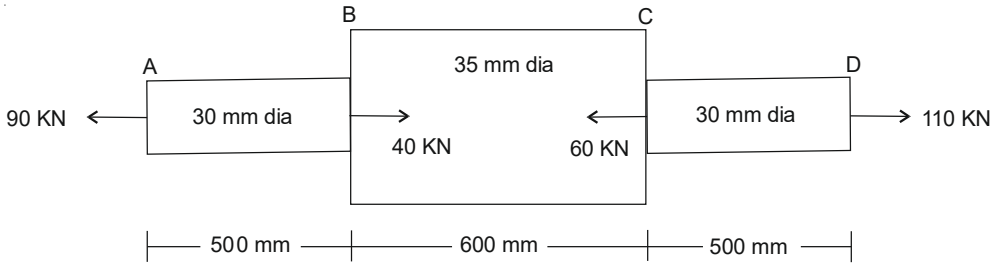


13. Find the moment of inertia of the unequal angle section of size 160 mm × 110 mm × 30 mm about centroidal axes, with its longer leg placed vertical.

14. Find the moment of inertia of an I-Section with top flange 90 mm × 15 mm, bottom flange 120 mm × 15 mm and web 15 mm × 110 mm about its centoidal axes.

15. A copper bar 40 mm in diameter is rigidly attached at both ends to the inside of steel tube of 50 mm external diameter and 5 mm thick. Find the stresses in each metal of composite section length of 1000 mm, when it is subjected to an axial load of 200 KN. Take E_s=200 GPa and E_c=100 GPa.

16. A steel bar 1·6 m long is acted upon by forces as shown in fig. Find the elongation of the Bar E = 200 GPa.



17. A cantilever beam 6 m long, carries three point loads of 20 kN, 30 kN and 60 kN at 2 m, 3 m and 5 m respectivelty from free end. Calculate shear force and bending moment and also draw SFD and BMD.

18. A simply supported beam of 7 m span carries an UDL of 20 kN per meter run over its entire span and also it carries two point loads of 5 kN and 8 kN at a distance of 3 m and 5 m from right hand support. Calculate shear force and bending moment and also draw SFD and BMD.

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