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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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