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C09–C–106

# 3016

## BOARD DIPLOMA EXAMINATION, (C–09)

## 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.** Define force. List the characteristics of the force. 1+4×½=3

**2.** Define the moment of the force. Mention its units. List the types of moments. 1+1+1=3

**3.** Give the position of centroid of the following sections : 1+1+1=3

*(a)* Triangle

*(b)* Trapezium (sloping on both sides)

*(c)* Quarter circle

**4.** Find the radius of gyration of a triangle whose base is 40 mm and height is 60 mm about an axis passing through center of gravity and parallel to base. 3

**5.** Define the following terms : 1+1+1=3

*(a)* Ultimate stress

*(b)* Working stress

*(c)* Young's modulus

**6.** Define the following terms : 1+1+1=3

*(a)* Strain energy

*(b)* Proof resilience

*(c)* Modulus of resilience

**7.** A hallow steel column has to carry an axial load of 3·3 MN. The ultimate stress of steel is 282 $N/mm^2$. Assuming a factor of safety 2 for steel, determine the external and internal diameters required for the column section, if the ratio of internal diameter to external diameter is to be 0·5. 1½+1½=3

**8.** List any three types of beams with neat sketches. 1+1+1=3

**9.** Explain the term 'point of contraflexure' with a suitable example (sketch). 1½+1½=3

**10.** A cantilever beam *AB*, 2 m long carries a uniformly distributed load of 1·5 kN/m over a length of 1·6 m from the free end. Draw shear force and bending moment diagrams for the beam. 1½+1½=3

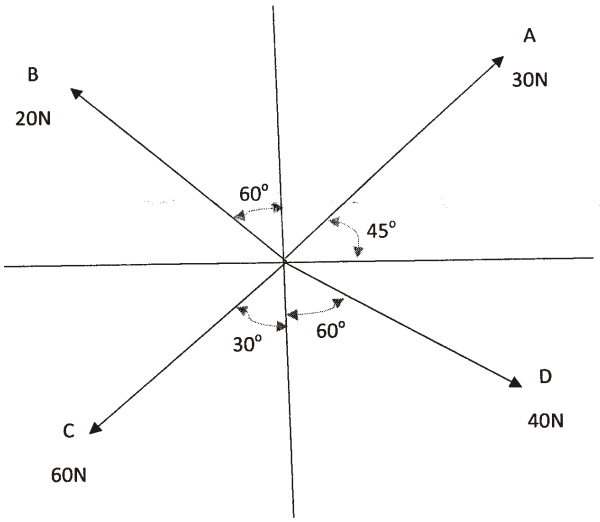
## PART—B 10×5=50

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

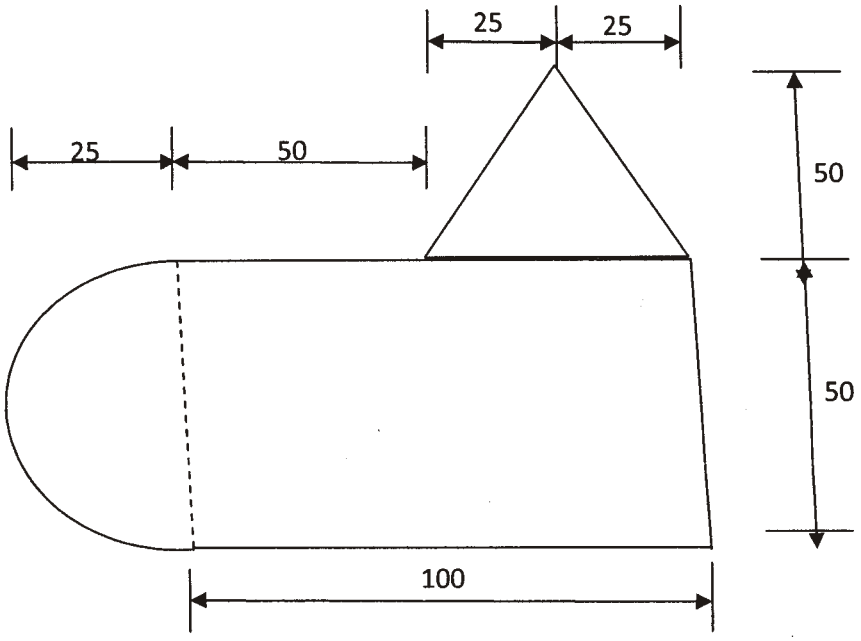
(2) Each question carries **ten** marks.

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

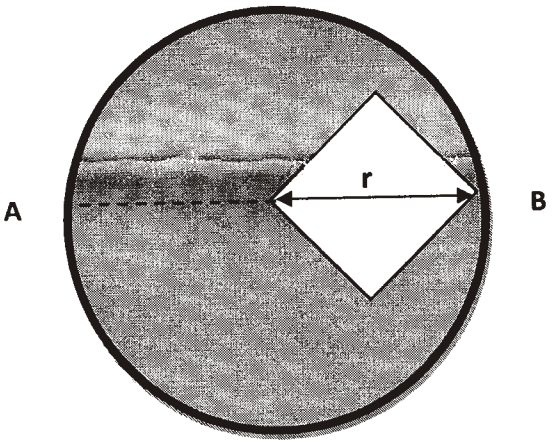
**11.** Find the magnitude and direction of the resultant of the system of co-planar forces as shown in figure : 10



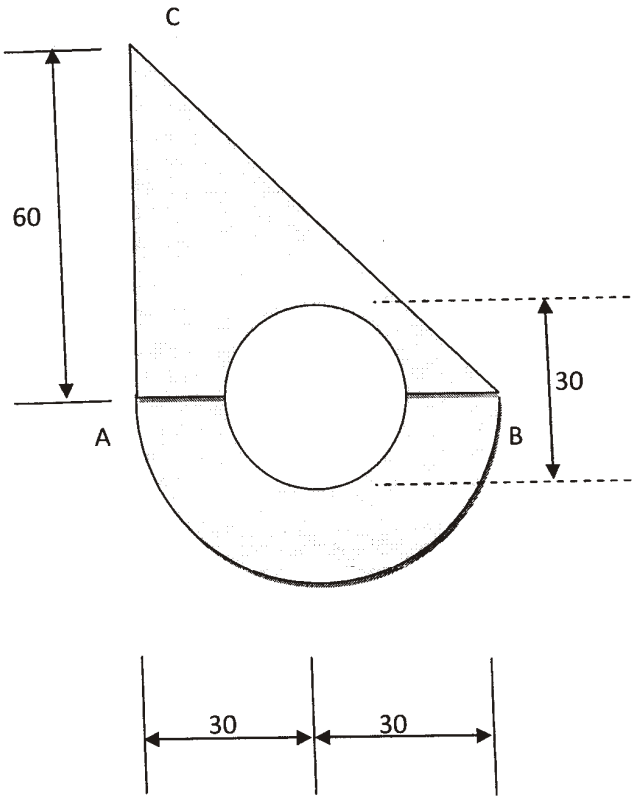
**12.** A uniform lamina shown in figure. consists of a rectangle, a circle and a triangle. Determine the centroid of the lamina. All dimensions are in mm : 10



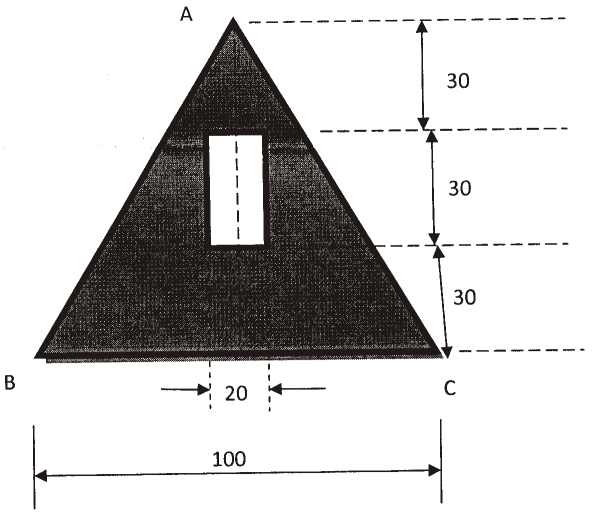

**13.** *(a)* A square hole is punched out of circular lamina, the diagonal of the square being the radius of the circle as shown in figure. Find the centroid of the remainder, if *r* is the radius of the circle : 5+5=10



(b) Find the moment of inertia of the lamina with a circular hole of 30 mm diameter about the axis *AB* as shown in figure :




**14.** A rectangular hole is made in a triangular section as shown in figure. Determine the moment of inertia of the section about *X-X* axis passing its centre of gravity : 10



**15.** The following observations were made during a tension test on a mild steel bar of 20 mm : 2+2+2+2+2=10

Diameter of gauge length = 300 mm
Extension at a load of 30 kN = 0·1 mm
Yield point = 80 kN
Ultimate load = 130 kN
Total extension = 50 mm
Diameter of rod at failure = 14·1 mm

Calculate—

*(a)* Young's modulus;

*(b)* yield stress;

*(c)* ultimate stress;

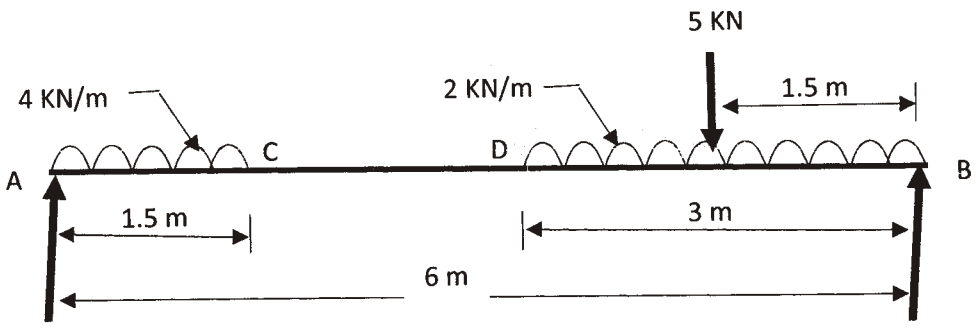
*(d)* percentage of elongation;

*(e)* percentage of reduction in area.

**16.** A mild steel bar 25 mm diameter and 400 mm long is encased in a brass tube whose external diameter is 50 mm and 8 mm thick. The composite bar is heated through 55 °C. Calculate the stresses induced in each metal. Take—

$_s$ 12 $10^{-6}$/°C
$E_s$ 200 GPa
$_b$ 19 $10^{-6}$/°C
$E_b$ 100 GPa 5+5=10

**17.** A simply supported beam *AB*, 6 m long is loaded as shown in figure. Construct the shear force and bending moment diagrams for the beam and find the position and value of maximum bending moment : 10



**18.** A beam, 6 m long is simply supported at the ends, and carries a uniformly distributed load of 15 kN/m (including its own weight) and three concentrated loads of 10 kN, 20 kN and 30 kN acting respectively at the left quarter point, center point and right quarter point. Draw the SF and BM diagrams and determine the maximum bending moment. 10

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