7209

BOARD DIPLOMA EXAMINATION, (C-20)

OCTOBER/NOVEMBER—2023
DAA – THIRD SEMESTER 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. Write the units for the following in SI system :

   (a) Bending moment

   (b) Volume

   (c) Length

2. With the help of a neat sketch, state the 'polygon law of forces'.

3. State the conditions of equilibrium.

4. Two forces act an angle of 120°. The one force is 60 kN and the resultant is perpendicular to the other one. Find the other force.

5. Define *(a)* centroid and *(b)* axis of symmetry.

6. Sketch and show the position of centroid of a trapezium with equal sloping on both sides.

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7. Determine the radius of gyration of a solid circular section of diameter 120 mm.

8. Define the terms *(a)* linear strain and *(b)* lateral strain.

9. Draw the stress-strain diagram for a mild steel specimen subjected to a tensile force and indicate all the salient points.

10. A steel rod 20 mm in diameter and 500 mm long is subjected to an axial pull of 30 kN. Determine *(a)* the intensity of stress and *(b)* the strain. Take $E = 2 \times 10^5$ N/mm^2.
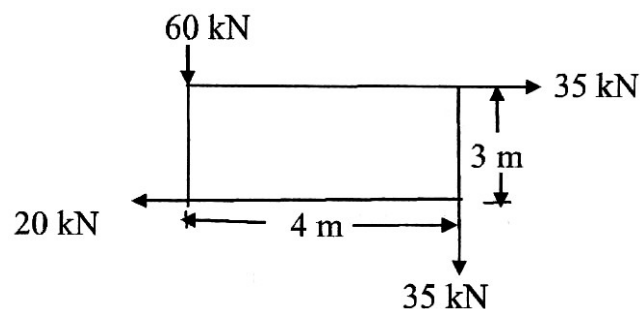
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PART—B
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8×5=40

Instructions :   (1) Answer **all** questions.

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

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

11. *(a)* A system of forces are acting at the corners of a rectangular block as shown below. Determine the magnitude and direction of the resultant force.

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(OR)
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(b) Four men pull a tree in the East, South-East, South-West and North-West directions with forces 20 kN, 30 kN, 15 kN and 35 kN respectively. Find the resultant and its direction.
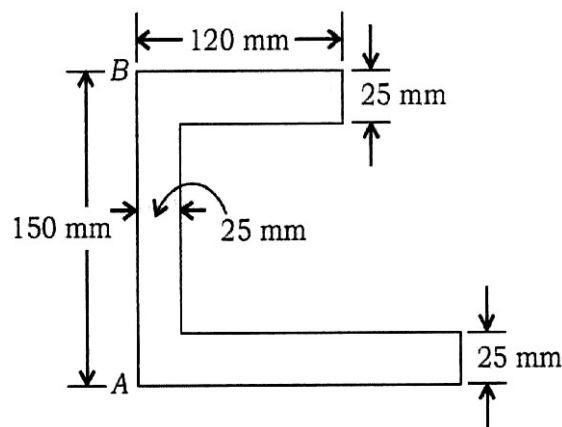
12. *(a)* In a circular sheet of 100 mm radius, a hole of 30 mm radius is made as shown in below figure. Determine the position of centroid (*x*) of the remaining sheet from S.
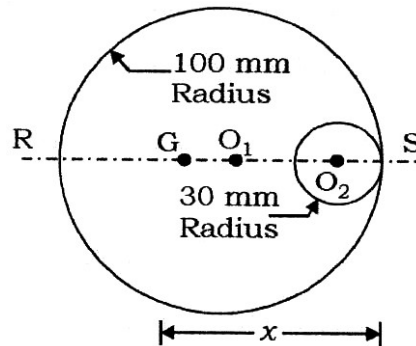
(OR)

(b) Give one example each for sections symmetrical about *(a)* both *X* and *Y* axis, *(b) X* axis only and *(c) Y* axis only with the help of sketches.

13. *(a)* Find the moment of inertia of section shown in figure below :

(OR)

*(b)* Determine the moment of inertia about the centroidal axes and polar moment of inertia of a hollow circular section of external diameter is 120 mm and thickness 20 mm.

14. *(a)* A bar of 25 mm diameter and 600 mm long is subjected to a pull of 50 kN. The change in diameter and length was observed to be 4×10^{-3} mm and 0·30 mm. Calculate *(a)* Young's modulus, *(b)* Poisson's ratio, *(c)* modulus of rigidity and *(d)* factor of safety if ultimate stress = 204 N/mm^2.

(OR)

(b) Define *(a)* ultimate stress, *(b)* working stress, *(c)* safe load and *(d)* factor of safety.

15. *(a)* A steel bar 380 mm long is acted upon by forces as shown below. Find the total elongation of the bar. Take $E = 210$ GPa.
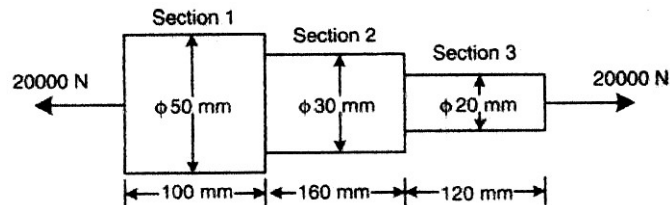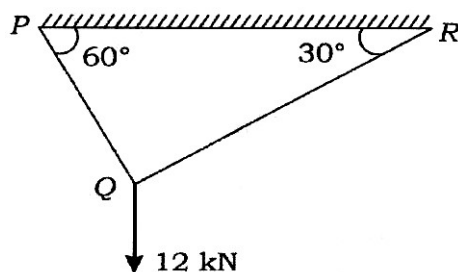

(OR)

(b) A steel flat 150 mm wide, 16 mm thick and 6000 mm long carries an axial pull of 30 kN. Find the extension in length, contraction in width and thickness under the pull. The Poisson's ratio is 0·3 and $E = 200$ GPa.

PART—C

10×1=10

Instructions : (1) Question number **16** is compulsory.

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

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

16. State Lami's theorem and calculate the forces in members *PQ* and *QR* of the frame shown below.   2+8=10

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