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C20-C–105

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BOARD DIPLOMA EXAMINATION, (C-20)

OCTOBER / NOVEMBER—2023

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. State the fundamental quantities and their units in S.I.system.

2. Define force and state the characteristics of force.

3. Define *(a)* Moment of a force *(b)* Coplanar force and (c) Like parallel forces.

4. Locate the centroid of an angle section 150×150×20 mm.

5. Calculate I_{xx} and I_{yy} of a hollow rectangular section 200×300 mm and thickness 15 mm.

6. Define : *(a)* Malleability *(b)* Hardness and *(c)* Ductility.

7. A bar of 8 mm dia, 1·2 m long is subjected to an axial pull. If the change in length is 3 mm and change in diameter is 0·005 mm, find Poisson's ratio.

8. A bar of 5m long is subjected to a rise in temperature of 50°C. If E = 210G Pa and $a = 12 \times 10^{-6} / °C$, find the expansion of the bar and stress in the bar if expansion is prevented.

9. Define : (a) Shear force

(b) Bending moment

(c) Point of Contraflexture.

10. A simply supported beam of span 3m is carrying a UDL of 4kN/m over entire span. Draw SFD and BMD and indicate the values.

PART—B

8×5=40

Instructions : (1) Answer either *(a)* or *(b)* from each questions.

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

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

11. *(a)* Find the magnitude and direction of resultant of the following system of concurrent forces :

Forces : 20kN due North

18kN acting at 30° West of North

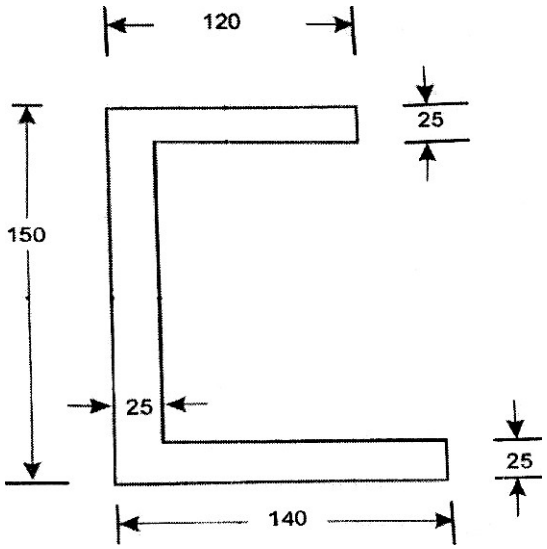
12kN due SW

15kN due S 60° E

(OR)

(b) A wheel has 5 spokes which are equispaced . The forces acting in 3 consecutive spokes are 25 kN, 30 kN and 20 kN. Find the forces in other two spokes if the wheel is in equilibrium.

12. *(a)* Locate the centroid of the following section.



(OR)

(b) A semicircular part is removed from a trapezium as shown in Fig-1. Locate the centroid of the remaining area (hatched area).

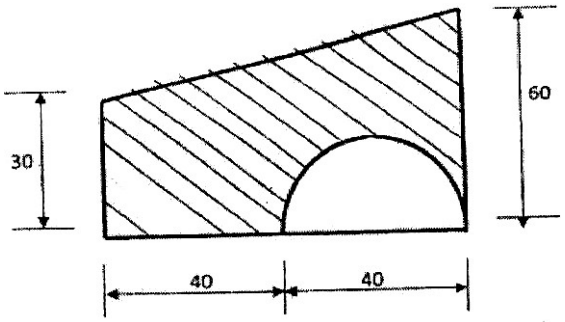
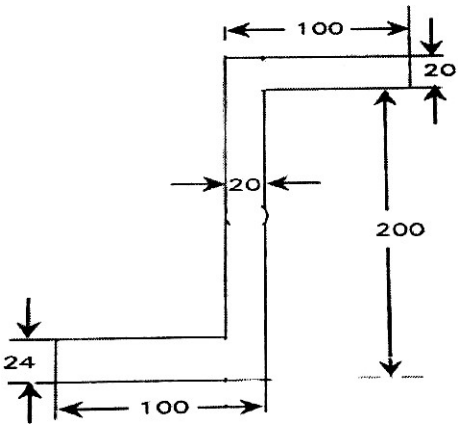


Fig-1

13. *(a)* Calculate I_{xx} and I_{yy} for the following section.



(OR)

(b) Two ILSC300 sections are placed back to back at a clear distance of 100 mm. They are connected by a cover plate of 300 × 20 mm, one at top and one at bottom. Find I_{xx} and I_{yy} of the built up section. Properties of ISLC300 are Area = 4210 mm^2, I_{xx} = 6·05 × $10^7 mm^4$, I_{yy} = 3·46 × $10^6 mm^4$, C_{YY} = 25·5 mm and Flange width = 100 mm.

14. *(a)* A steel bar 1·8 m long is acted upon by forces as shown in fig-2. Find the elongation of the bar. E = 2×10^5 N/mm^2.

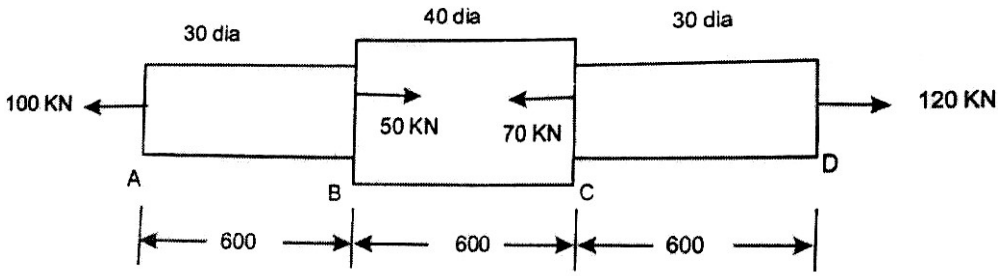


Fig-2

(OR)

(b) A mild steel flat 150 mm wide × 20 mm thick and 6m long is subjected to an axial pull of 300 kN. If E = 200 kN/mm^2 and Poisson's ratio is 0·26, calculate the change in length, width, thickness and volume of the flat. Also calculate bulk modulus for the material.

15. *(a)* A cantilever beam of span 5m carries a UDL of 3kN/m over a length of 2m starting from the free end. It also supports two point loads 4 kN and 5 kN at 1 m and 3 m from fixed end. Draw SFD and BMD.

(OR)

(b) A simply supported beam 8m span carries a point load 4kN each at 2 m from left support and 2m from right support. It also carries a UDL of 2kN/m between the point loads. Draw SFD and BMD and calculate max B.M. for the beam.

PART—C

10×1=10

Instructions : (1) Answer the following question.

(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. A body of weight W falls through a height of 19 mm onto a collar rigidly attached to a vertical bar 2·5 m long and 20mm × 30 mm cross-section. If the instantaneous elongation in the bar is 2mm, determine the value of W.What is the strain energy stored in the bar. Take E = 200 GPa.

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