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C20-C–105

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BOARD DIPLOMA EXAMINATION, (C-20)

JUNE/JULY—2022

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 and supplementary quantities and write their units in SI system.

2. Define couple and write the charecteristics of couple.

3. Find the magnitude and direction of two forces 40 N and 60 N acting at a point with an included angle of 40° between them. The 60 N force is horizontal.

4. Find the position of centroid of one side vertical trapezoidal section of top width 2 m; base width 8 m and height 9 m from vertical face.

5. Find MI of a rectangular section 200 mm width and 400 mm depth about the base.

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6. State the different mechanical properties of materials.

7. Define proof resilience and modulus of resilience.

8. Write any three relationships among elastic constants.

9. A cantilever 4 m long carries a uniformly distributed load of 8 kN/m over entire span. Draw the shear force and bending moment diagrams for the above loading system.

10. What are the different types of end supports?

PART—B

8×5=40

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

(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)* Four forces acting at a point are in equilibrium, three of them are 200 N due S, 400 N due N-E and 500 N at 30° east of south. Find analytically the magnitude and direction of fourth force.

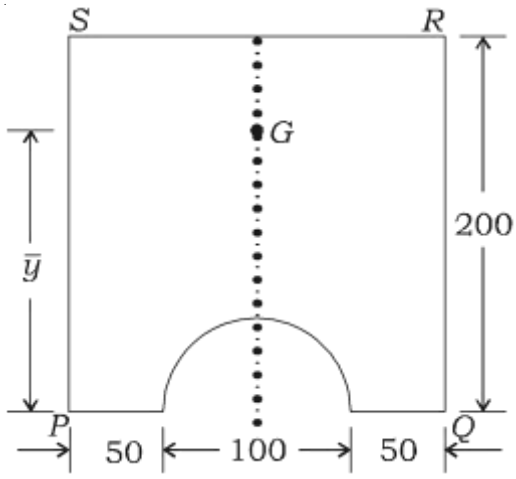
(OR)

(b) A body of weight 1000 N is suspended by two strings of 4 meters and 3 meters length attached at the same horizontal level 5 meters apart. Calculate forces in the strings.

12. *(a)* Find the CG of an I-section with top flange 100 mm × 20 mm, web 30 mm × 200 mm and bottom flange 300 mm × 40 mm.

* (OR)

(b) A semi-circular portion of 50 mm radius is cut-out from a square plate *PQRS* of 200 mm as shown in below figure. Find the distance of centroid of the remaining area from the side *PQ*.



13. *(a)* A column section consists of two channels ISLC 250 placed back to back. Determine the clear distance between two channels if the compound section has $I_{xx} = I_{yy}$. For each channel A = 3565 mm^2 I_{xx} = 3688 × 10^4 mm^4, I_{yy} = 298 × 10^4 mm^4 distance of CG from outer side of web C_{yy} = 27 mm.

(OR)

(b) Determine I_{xx} and I_{yy} of the cross-section of cast-iron beam about its centroidal axis shown in the below figure with radius of semi-circle is 5 cm. Take all dimensions in cm.

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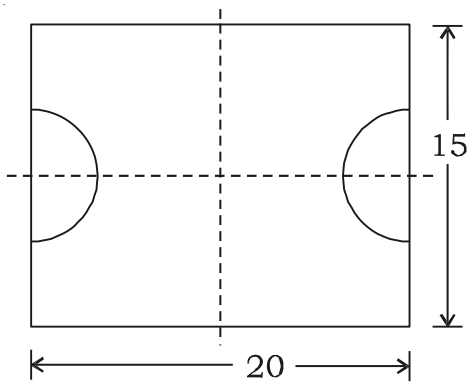

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14. *(a)* A bar of 10 mm × 10 mm size and 400 mm long is subjected to an axial pull of 12 kN. The elongation in length and contraction in lateral dimensions are found to be 0·4 mm and 0·0025 mm respectively. Determine the Poisons ratio, Young's modulus modulus of rigidity and bulk modulus of material.

(OR)

(b) An RCC column 500 mm × 450 mm in section is provided with 06 nos. of 40 mm diameter bars. The column carries an axial, load of 600 kN. Find the stresses in concrete and steel and also calculate the loads shared by concrete and steel if m = 15.

15. *(a)* A cantilever of span 6 m carries point loads of 3 kN, 5 kN and 4 kN at a distance of 2 m, 4 m and 5 m respectively from its free end. In addition, it also carries a UDL of 4 kN/m over a length of 2 m from its free end. Draw SF and BM diagrams.

(OR)

(b) A beam of length 12 m is supported by two supports at 2 m from left end and another at 2 m from right end. It carries a UDL of 10 kN/m over its entire length. It is also, loaded with a point load of 20 kN placed at 5 m from left support and another point load of 4 kN placed at right face end. Draw the SFD and BMD and also determine the position and magnitudes of maximum hogging and sagging moment.

PART—C

10×1=10

Instructions : (1) Question number 16 is compulsory and carries ten marks.

16. A steel bar of 400 mm length and 50 mm × 50 mm cross-sectional dimension is subjected to an axial Pull of 300 kN in the direction of its length. Calculate volumetric strain and change in volume if Poission's ratio 0·25 and Young's modulus 2×10^5 N/mm^2 for steel.

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