



c20-c-105

7021

BOARD DIPLOMA EXAMINATION, (C-20)

SEPTEMBER/OCTOBER—2021

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. Name the SI unit and symbol for the following quantities :
 - (a) Force
 - (b) Stress
 - (c) Moment of inertia
2. State the conditions of equilibrium of a rigid body subjected to a number of co-planar forces.
3. State (a) Varignon's principle of moments and (b) Characteristics of couple.
4. Locate the position of centroid of the following figures with a neat sketch :
 - (a) Rectangle
 - (b) Triangle
 - (c) Semi circle

5. Explain (a) parallel axis theorem and (b) perpendicular axis theorem.
6. Write any three relationships among elastic constants.
7. Calculate the strain energy that can be stored in a steel bar 2 m long and 500 mm^2 cross-sectional area subjected to a tensile stress of 50 N/mm^2 . Take $E = 2 \times 10^5 \text{ N/mm}^2$.
8. Define the following terms :
 - (a) Hooke's law
 - (b) Young's modulus
9. A simply supported beam of span 6 m carries a uniformly distributed load of 10 kN/m over the left hand half of the span and a concentrated load of 20 kN at a distance of 1 m from the right hand support .Find the reaction at the supports.
10. List different types of beams with sketches.

PART—B

8×5=40

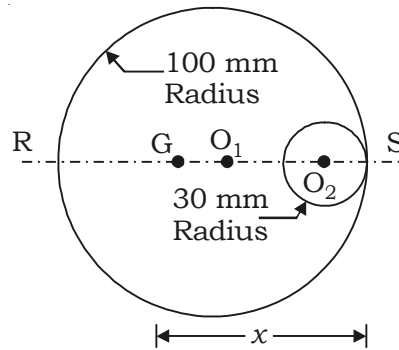
- Instructions :**
- (1) Answer either (a) **or** (b) from each question.
 - (2) Each question carries **eight** marks.
 - (3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. (a) A pole is supported by a wire which exerts a pull of 720 kN at the top of the pole .If the wire makes an angle of 40° with the pole, then find the horizontal and vertical components of the pull.

OR

- (b) Find the magnitude and direction of resultant force for the following forces acting at a point
 - (i) 200 N inclined at 30° to north of east
 - (ii) 250 N towards north
 - (iii) 300 N towards north 45° west
 - (iv) 350 N inclined at 40° to south of west

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 of the remaining sheet from S.



OR

- (b) A masonry dam is trapezoidal in section with one face vertical. The top width is 4 m, bottom width is 10 m and height 12 m. Find the position of centroid from base.

13. (a) The moment of inertia of an isoscles triangle with a base of 150 mm about its base is $1250 \times 10^6 \text{ mm}^4$. Find the side of triangle.

OR

- (b) Determine the radius of gyration of a solid circular section of a diameter 100 mm.

14. (a) A load of 80 kN is suddenly applied on a bar 4 m long and 1000 mm^2 in cross-section. Calculate the maximum instantaneous stress produced and strain energy stored in the bar if $E = 200 \text{ GPa}$.

OR

- (b) 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 $\alpha_S = 12 \times 10^{-6} / ^\circ\text{C}$

$\alpha_B = 19 \times 10^{-6} / ^\circ\text{C}$

$E_S = 200 \text{ GPa}$

$E_B = 100 \text{ GPa}$

15. (a) A cantilever 5 m long carries three point loads of 20 kN, 30 kN and 40 kN at 1 m, 2.5 m and 4 m respectively from free end. Draw SF and BM diagrams. Calculate SF and BM at 4.5 m from free end.

OR

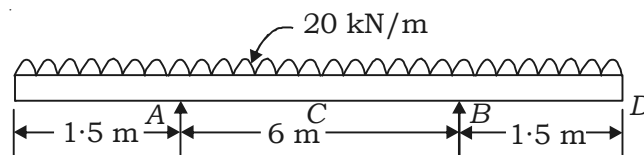
- (b) A simply supported beam of span 8 m carries a UDL of 20 kN/m in the right half of the beam and a concentrated load of 40 kN at a distance of 2 m from left support. Draw the SF and BM diagrams. Also show the maximum BM.

PART—C

10×1=10

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

16. Draw SFD and BMD for the following double over hang beam shown in figure.



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