7021

BOARD DIPLOMA EXAMINATION, (C-20)

MAY—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. List the applications of engineering mechanics.

2. Explain the essential characteristics of a force.

3. State *(a)* triangular law of forces and *(b)* parallelogram law of forces.

4. Locate the position of centroid of the following figures with a neat sketch :

(a) Triangle

(b) Semicircle

(c) Half parabola

5. State parallel axis theorem with a neat sketch.

6. A mild steel rod of 10 mm diameter and 300 mm length is subjected to an axial pull of 10 kN and elongates 0.18 mm. Determine Young's modulus of the material.

7. Calculate the strain energy that can be stored in a steel bar 2 m long 40 mm wide and 25 mm thick when it is subjected to a tensile load of 90 kN. Take E = 200 GPa.

8. Define *(a)* hardness, *(b)* fatigue and *(c)* creep.

9. A simply supported beam of span 5 m carries a uniformly distributed load of 8 kN/m over the left-hand half of the span and a concentrated load of 15 kN at a distance of 1.5 m from the right-hand support. Find the reactions at the supports.

10. List different types of beams with sketches.

PART—B

8×5=40

Instructions : (1) Answer **all** 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)* Determine the magnitude and direction of the resultant of two forces 50 N and 60 N act at an angle of 60° with each other by parallelogram law of forces.

(OR)

(b) Coplanar concurrent forces of 100 N, 200 N, 300 N and 400 N are acting at a point in the East, North-East, North-West and South-West direction respectively. Find the magnitude and direction of resultant force for the system of forces.

12. *(a)* Find the centroid of an unequal angle 200 mm × 150 mm × 20 mm with its longer leg vertical and upward.

(OR)

(b) Find the centroid of I-section with its top flange 50 mm × 10 mm, web 10 mm × 50 mm and bottom flange 100 mm × 10 mm.

13. *(a)* Calculate the polar moment of inertia of a hollow circular section with external diameter 50 mm and internal diameter 40 mm.

(OR)

(b) Find the moment of inertia about X-X axis and Y-Y axis and determine the least radius of gyration of a rectangular section 60 mm wide and 120 mm deep.

14. *(a)* A load of 50 kN is suddenly applied on a bar 2.5 m long and 1200 mm^2 in cross-section. Calculate the maximum instantaneous stress produced and strain energy stored in the bar if E = 200 GPa.

(OR)

(b) A mild steel bar of 500 mm^2 is rigidly connected to a copper bar of cross-section area 400 mm^2 to form a composite section. Both the bars are of 2 m length. Calculate the stresses induced in each metal when the temperature of composite section is raised from 20 °C to 120 °C.

Take $\alpha_s = 12 \times 10^{-6}$/°C $\quad\quad$ $\alpha_c = 18 \times 10^{-6}$/°C

E_s = 210 GPa $\quad\quad$ E_c = 100 GPa

15. *(a)* A cantilever 4 m long carries a UDL of 2 kN/m for 1 m from fixed end and 4 kN/m for 1 m from free end. Draw SF and BM diagrams. Calculate SF and BM at 1.5 m from free end.

(OR)

(b) A simply supported beam of span 6 m carries a UDL of 2 kN/m over a span of 1.5 m from left-hand support of the beam and a concentrated load of 4 kN at a distance of 2 m from right support. Draw the SF and BM diagrams. Also find the value of maximum BM.

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 beam of 8 m length is simply supported at 6 m from left end. It carries a UDL of 5 kN/m over the supported length of 6 m and a concentrated load of 10 kN at the right extreme end. Sketch the SF and BM diagrams. Locate the point of contraflexture and determine the position and magnitude of max. BM.

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