C20-C–302

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BOARD DIPLOMA EXAMINATION, (C-20)

MAY—2023

DCE - THIRD SEMESTER EXAMINATION

MECHANICS OF SOLIDS AND THEORY OF STRUCTURES

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. Define "Section Modulus" and find out the section modulus of *(a)* hollow square section of outer side 'S_o' inner side 'S_i' and *(b)* rectangular section of size $B \times D$.

2. Define simple bending and list any four assumptions made in the theory of simple bending.

3. A concentrated load of 10 kN is acting at the free end of a cantilever beam of span 3 m. Determine the value of flexural rigidity of beam section if the maximum slope is 3 mm.

4. Define the terms *(a)* elastic curve, *(b)* slope and *(c)* deflection in a loaded beam.

5. Define the terms *(a)* least radius of gyration, *(b)* safe load and *(c)* factor of safety.

6. Define the terms *(a)* angle of repose of soil, *(b)* angle of surcharge and *(c)* active earth pressure.

7. State Middle third rule.

8. State any three merits and three demerits of fixed beams over simply supported beam of similar load and span.

9. A cantilever beam of span 3 m, subjected to a UDL of 20 kN/m throughout the span is propped at the free end. Calculate prop reaction.

10. List any three methods used to determine the forces in the members of a frame.

PART—B

8×5=40

Instructions : (1) Answer *any* **five** 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)* Sketch the variation of bending stress across the cross section at mid span of a T-beam (flange 300 mm × 30 mm and web 40 mm × 500 mm), if it is used as a simply supported beam of span 5 m and carries a uniformly distributed load of 10 kN/m over the entire length.

(OR)

(b) A simply supported beam made of a built-up I-section, 300 mm over all depth and 150 mm wide has flanges 10 mm thick and web 15 mm thick is carrying a UDL of 20 kN/m over its entire span. Find the maximum permissible span that can be allowed if the maximum shear stress is limited to 50 N/mm^2.

12. *(a)* Calculate the maximum slope and deflection using Mohr's theorem for a cantilever beam 4 m long and carries two-point loads of 50 kN and 100 kN acting at 2 m and 4 m from fixed end. The cross section of the beam is 230 mm × 380 mm and E = 210 kN/mm^2.

(OR)

(b) A simply supported beam of span 5 m carries a UDL of 40 kN/m over its entire span. Determine the dimensions of the beam cross-section, if the central deflection is limited to 20 mm. Assume the depth to width ratio of the beam as 2. E = 200 kN/mm^2.

13. *(a)* A hollow cylindrical column, 230 mm external diameter and 30 mm thick, is 5 m long and fixed at both ends. If $E = 200 \times 10^4$ N/mm^2, determine the ratio of crippling loads given by Rankine's and Euler's formula. Taking f_c = 550 N/mm^2 and $\alpha = 1/1600$.

(OR)

(b) A stanchion is made up of an ISMB 300 mm × 150 mm with two plates 210 mm × 15 mm one at top flange and one at bottom flange, used as a column 6 m long with both ends hinged. Calculate safe load on the column using Rankine's formula with factor of safety 3, f_c = 320 N/mm^2, α = 1/7500. For given ISMB : I_{xx} = 73·329 × 10^6 mm^4, I_{yy} = 3·762 × 10^6 mm^4, A = 4060 mm^2.

14. *(a)* A trapezoidal masonry dam 3 m wide at top, 12 m wide at bottom has 20 m high with its water face vertical. A free board of 2 m is to be provided. Find the maximum and minimum stresses developed at base. Take specific weight of masonry is 18 kN/m^3 and specific weight of water=10 kN/m^3. Also check for the stability of the dam. Assume μ = 0·5.

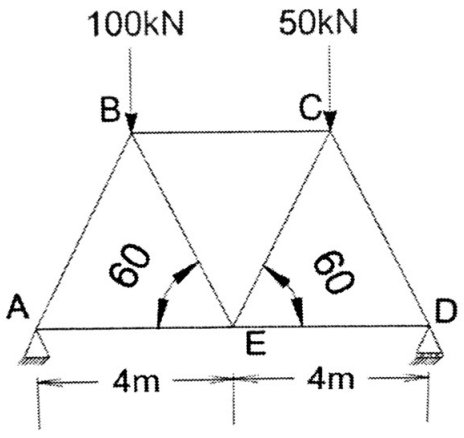
(OR)

(b) A concrete retaining wall of trapezoidal section is 8 m high has top width 2 m and retains soil in level with the top. The soil face is vertical. Find minimum base width required such that the stresses at base are wholly compressive. Take density of concrete is 24 kN/m^3, unit weight of soil is 15 kN/m^3, angle of repose of the soil is 45°.

15. *(a)* A simply supported beam of span 6m is acted upon by two concentrated loads 50 kN and 80 kN at 2 m and 4 m respectively from left hand support. Determine the fixed end moments and draw the shear force and bending moment diagrams.

(OR)

(b) Find the magnitude and nature of forces in all the members of the truss shown below :



[*Contd...*

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 simply supported beam of span 5 m is carrying a UDL of 50 kN/m over the entire span. Determine how much percentage of maximum positive bending moment is reduced when the same beam is used with both ends fixed?

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