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BOARD DIPLOMA EXAMINATION, (C-20)

OCTOBER/NOVEMBER—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 “Simple bending” and state any two assumptions made in the theory of simple bending.
2. Sketch the shear stress distribution for any three sections.
3. State the relation among curvature, slope and deflection of a loaded beam with usual notations.
4. Mention two situations where moment area method is used.
5. Define (a) critical load, (b) safe load, and (c) slenderness ratio of a column.
6. State the stability conditions for the dam.
7. Define (a) active earth pressure and (b) passive earth pressure.
8. Distinguish between statically determinate and statically indeterminate structures.
9. List any three advantages of continuous beams over simply supported beams.
10. List three methods for determining forces in the members of statically determinate frame.

- Instructions :** (1) Answer either (a) or (b) from each question from Part—B.
(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 rectangular beam of breadth 350 mm and depth 600 mm is simply supported over a span of 6 m. Find the max. udl the beam can carry if the bending stress is limited to 18 N/mm^2 .

(OR)

- (b) A wooden simply supported beam 100 mm wide, 200 mm deep and 4 m long is carrying an udl of 20 kN/m over its entire length. Determine the max. shear stress and sketch the variation of shear stress along the depth of the beam.

- 12.** (a) A cantilever beam of span 3 m carries a point load of 24 kN at a distance of 2 m from fixed end. Find the slope and deflection at the free end and under the load, using Mohr's theorem. Take $E = 2 \times 10^5 \text{ N/mm}^2$, $I = 4 \times 10^8 \text{ mm}^4$.

(OR)

- (b) A simply supported beam of span 5 m carries two-point loads of 40 kN and 30 kN at a distance of 1 m and 3 m from left support respectively. Find the position and magnitude of maximum deflection. Take $E = 200 \text{ kN/mm}^2$, $I = 73.329 \times 10^6 \text{ mm}^4$. Use Macaulay's method.

- 13.** (a) Calculate the safe compressive load on a hollow cast iron column with one end fixed and another end hinged of 150 mm external diameter and 100 mm internal diameter and 3 m length. Use Euler's formula with a factor of safety of 3 and $E = 0.95 \times 10^5 \text{ N/mm}^2$.

(OR)

- (b) Determine the section of a cast iron hollow cylindrical columns 5 m long with ends firmly built in, if it carries an axial load of 300 kN. The ratio of internal to external dia is 3. Use factor of safety of 8. Take $f_c = 567 \text{ N/mm}^2$ and $a = 1/1600$.

14. (a) A masonry dam of trapezoidal section 8 m high, 1.5 m wide at the top and 5 m wide at the base retains water to a depth of 7.5 m, the water face of the dam being vertical. Find the maximum and minimum stress intensities at the base. The specific weight of masonry and water are 22 kN/m^3 and 9.81 kN/m^3 respectively.

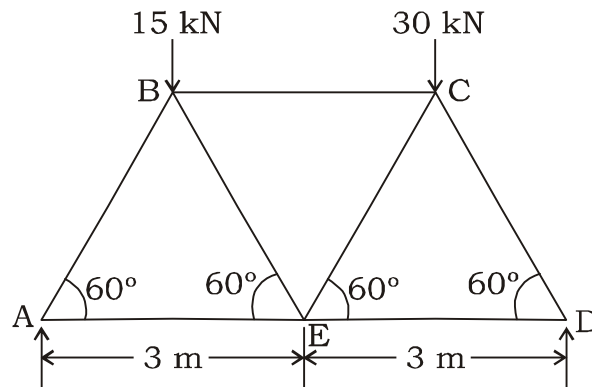
(OR)

- (b) A rectangular retaining wall 1.5 m wide and 4.5 m high retains soil up to the top level. Determine the maximum and minimum stresses at the base. Take specific weight of masonry and soil are 20 kN/m^3 and 16 kN/m^3 respectively and angle of repose of soil as 30° .

15. (a) A horizontal cantilever beam 3 m long is subjected to a UDL of 4 kN/m over its entire span is propped at free end to the level of the fixed end. Determine the prop reaction and draw shear force and bending moment diagrams.

(OR)

- (b) Determine analytically the magnitude and nature of forces in all members of the truss shown in figure.



PART—C

10×1=10

- Instructions :** (1) Question **No.16** is compulsory.
(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 trapezoidal concrete dam 10 m high has top width of 1 m and bottom width of 6 m. The face exposed to water has a slope of 1 horizontal to 10 vertical. Check the stability of the dam, when the water level coincides with top of dam.

Specific weight of concrete- 24 kN/m^3 , specific weight of water 10 kN/m^3 , coefficient of friction between bottom of the dam and the soil is 0.6.

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