C20-C–302

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BOARD DIPLOMA EXAMINATION, (C-20)

JUNE/JULY—2022

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. State the equation of 'Simple bending' with usual notations.

2. Calculate the 'maximum shear stress' for a rectangular section 200 mm × 300 mm subjected to a shear force of 130 kN.

3. Draw the deflected shape of *(a)* simply supported beam, *(b)* cantilever beam and *(c)* fixed beam.

4. A cantilever beam of span 5 m carries an u.d.l. of 8 kN/m, find the deflection at free end. Take $E = 200$ kN/mm^2 and $I = 360 \times 10^6$ mm^4.

5. State the 'Euler's equation' for crippling load with usual notations.

6. Write any three conditions of stability of a dam.

7. Define the 'minimum base width' of a retaining wall.

8. A propped cantilever beam of span 3·0 m is subjected to an u.d.l. of 15 kN/m over the entire span. If prop is provided at free end, find the prop reaction.

9. State the equation for 'maximum deflection' of a fixed beam subjected to central point load.

10. Classify the frames using the number of members and number of joints.

PART—B

8×5=40

Instructions : (1) Answer **either** *(a)* **or** *(b)* of 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)* Calculate 'maximum shear stress' and 'maximum bending stress' for a simply supported beam of span 6 m carrying an u.d.l. of 20 kN/m over a length of 3 m from the left end and a point load of 30 kN acting at a distance of 1·5 m from the right end. The cross-section of the beam is a rectangle of 300 mm wide and 500 mm deep.

(OR)

(b) A beam of I-section, 300 mm deep, 120 mm wide, web thickness is 10 mm, flanges thickness is 15 mm. It is subjected to a shear force of 150 kN. Calculate the shear stress at the salient points of the beam cross-section and sketch the shear stress distribution diagram.

12. *(a)* A simply supported beam of span 8 m is subjected to an u.d.l. of 10 kN/m over its entire length along with a central concentrated load of 30 kN. If the moment of inertia is $873{\cdot}8 \times 10^6$ mm^4, calculate the maximum slope and deflections developed in the beam. Take E = 200 kN/mm^2.

(OR)

(b) Two concentrated loads of 25 kN and 40 kN are placed on a simply supported beam of span 5 m at a distance of 2 m and 4 m from the left support respectively. Determine the position and amount of maximum deflection using Macaulay's method. Take E = 210 kN/m^2 and I = 73·329 × 10^6 mm^4.

13. *(a)* A cast iron column of hollow circular section of external diameter 300 mm and thickness of metal 30 mm, has to transmit an axial compressive load P. The column is 6 m long with both ends hinged. The factor of safety is 5. Determine the value of P. Given the Rankine's constants are f_c = 550 N/mm^2 and α = 1/1600.

(OR)

(b) In an experimental determination of the buckling load for 10 mm diameter mild steel pin-ended struts, the following values were obtained :

(i) Length = 500 mm, load = 7·6 kN

(ii) Length = 200 mm, Load = 22·0 kN

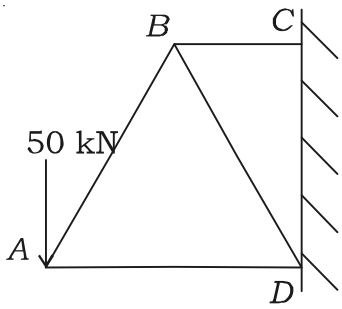
From these observations, determine the two constant in the Rankine's formula.

14. *(a)* A trapezoidal concrete dam 5 m wide at top, 8 m wide at bottom and 15 m high with its vertical face on water retaining side, retains water to a height of 13 m. Check the stability of the dam for overturning, sliding and tensile stress at the base. Take specific weight of concrete = 24 kN/m^3 and specific weight of water = 10 kN/m^3, coefficient of friction between dam material and soil is 0·65.

(OR)

(b) A masonry retaining wall of trapezoidal section is 10 m high and retains soil in level with the top. The width at the top is 2·5 m and the earth retaining face is vertical. Find the minimum base width required, such that the stresses at the base are wholly compressive. Calculate the maximum normal stress at the base. Density of masonry is 22 kN/m^3, unit weight of soil = 18 kN/m^3, angle of repose of the soil = 30°.

15. *(a)* Determine the member forces of the cantilever truss shown in the figure below and tabulate the results using method of joints. $AB = BD = DA = 5$ m.



(OR)

(b) Explain the procedure to find the member forces of a frame by method of joints.

PART—C 10×1=10

Instructions : (1) Answer the following question.

(2) The question carries **ten** marks.

(3) Answer should be comprehensive and criterion for valuation is the content but not the length of the answer.

16. Analyze the fixed beam of span 8m, subjected to a central point load of 40 kN. Use the moment area method. Draw 'SFD and BMD', also locate the 'points of contra-flexure', if any exists.

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