



c09-c-303

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BOARD DIPLOMA EXAMINATION, (C-09)

MARCH/APRIL—2014

DCE—THIRD SEMESTER EXAMINATION

**STRENGTH OF MATERIALS 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. A circular beam of 100 mm diameter is subjected to a shear force of 5 kN. Calculate the maximum shear stress and draw the variation of shear stress along the depth of the beam.
2. Draw the shear stress distribution diagram over a symmetric I-section of overall size ($B \times D$) and size of web ($b \times d$).
3. Define stiffness of the beam and flexural rigidity.
4. Obtain the degree of redundancy of a fixed beam subjected to vertical loading only.
5. A cantilever of 2 m long carries a load of 350 kN at its free end. Find the deflection at the free end, if $E = 200 \text{ GN/m}^2$ and $I = 210 \times 10^6 \text{ mm}^4$. Use moment area method.
6. Write the values of equivalent length (l) for different end conditions of a column of actual length = L .
7. Differentiate short and long columns in any three aspects.
8. Differentiate between a dam and a retaining wall in any three aspects.

- * 9. Name the various methods which are employed in finding out the forces in a frame.
10. Define polar moment of inertia, polar modulus and state their units.

PART—B

10×5=50

Instructions : (1) Answer *any five* questions.

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

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

11. A cast iron beam of I-section with top flange 150 mm×10 mm, bottom flange 200 mm×20 mm and web 270 mm×10 mm is simply supported over a span of 6 m. If the permissible stresses are 110 N/mm^2 in compression and 28 N/mm^2 in tension, what uniformly distributed load can be safely applied on the beam?
12. (a) Calculate the width and depth of the strongest beam that can be cut from a log of wood of 400 mm diameter. 4
- (b) Two beams are made of same material, same length and same weight; cross section of one beam is solid circular while that of the other is hollow circular with a diameter ratio of 1.5:1. Compare their strengths. 6
13. (a) A cantilever beam of span 5 m carrying a UDL of w/m . The section of the beam is 100 mm×200 mm and the value of E of the beam material is $2 \times 10^4 \text{ mm}^4$. Determine the value of w if the maximum deflection is 8 mm. Also find the maximum slope under the load. 6
- (b) In the above problem, if the beam is simply supported over the same span and carrying the UDL as obtained above, find the maximum slope and deflection. 4
- * 14. A simply supported beam of 3 m span carries two point loads of 80 kN and 120 kN at a distance of 1 m and 2.4 m respectively from RHS. Find the Macaulay's method (a) the deflection under loads and (b) position and magnitude of maximum deflection. Take $I = 16 \times 10^4 \text{ mm}^4$ and $E = 210 \text{ kN/mm}^2$ and $E = 210 \text{ kN/mm}^2$.

* 15. (a) A regular I-section 300 mm×150 mm×15 mm is used as a column of 5 m long with both ends fixed. Find Euler's crippling load, if $E = 210 \text{ kN/mm}^2$.

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(b) A hollow circular column of 300 mm external diameter and 50 mm thick is of 6 m long with one end fixed and other end hinged. Find the safe load carried by the column with a factor of safety of 4. Take $f_c = 0.56 \text{ kN/mm}^2$ and $a = \frac{1}{1600}$.

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16. A braced jib of crane is built up of 4 nos. of 60 mm×60 mm angles forming a square of 400 mm overall. If the length of the jib is 12 m and ends are fixed, calculate the safe axial load using Rankine's formula taking a factor of safety of 4. For each angle, sectional area = 929 mm^2 , $I_{xx} = I_{yy} = 56 \times 10^4 \text{ mm}^4$, $C_{xx} = C_{yy} = 21.6 \text{ mm}$. Rankine's constant $f_c = 330 \text{ MPa}$ and $a = \frac{1}{7500}$.

17. A trapezoidal masonry retaining wall is 12 m high and 2 m wide at top and 5 m wide at bottom with a vertical face retained earth up to its top. Specific weight of masonry and earth are 22 kN/m^3 and 18 kN/m^3 . Angle of repose of soil = 32° . Check the stability of the wall if the allowable pressure on soil is 300 kN/m^2 , coefficient of friction between masonry and the earth is 0.6.

18. Determine the forces in all the members of the truss shown in the figure below, by method of joints. Also, prepare the force table :


