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Brainware University
398, Ramkrishnapur Road, Barasat
Kolkata, West Bengal-700125



BRAINWARE UNIVERSITY

Term End Examination 2025-2026

Programme – Dip.CE-2024

Course Name – Theory of Structure

Course Code - DCE40112

(Semester IV)

Full Marks : 60

Time : 2:30 Hours

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question)

1 x 15=15

1. Choose the correct alternative from the following :

- (i) Select the member subjected mainly to compressive load.
 - a) Beam
 - b) Column
 - c) Tie
 - d) Shaft
- (ii) Select the phenomenon responsible for failure of long columns.
 - a) Crushing
 - b) Shearing
 - c) Buckling
 - d) Torsion
- (iii) Choose the formula for Euler's buckling load.
 - a) $\pi^2 EI/L^2$
 - b) WL/A
 - c) $\sigma \times A$
 - d) EI/L
- (iv) Select the load acting along the centroidal axis.
 - a) Transverse load
 - b) Axial load
 - c) Eccentric load
 - d) Torsional load
- (v) Select the maximum eccentricity allowed to avoid tension.
 - a) $L/2$
 - b) $L/4$
 - c) $b/6$
 - d) $d/2$
- (vi) Choose the formula for direct stress.
 - a) $\sigma = My/I$
 - b) $\sigma = V/A$
 - c) $\sigma = P/A$
 - d) $\sigma = P \times e$
- (vii) Select the meaning of slope of a beam.
 - a) Vertical displacement
 - b) Rotation of beam section
 - c) Curvature
 - d) Bending stress
- (viii) Select the shape of BMD for UDL on entire span.
 - a) Straight line
 - b) Triangle
 - c) Parabola
 - d) Rectangle

- (ix) Choose the slope at mid-span of simply supported beam under symmetrical loading.
- Maximum
 - Zero
 - Infinite
 - Negative
- (x) Select the meaning of fixity in a beam.
- Restriction of deflection
 - Restriction of rotation
 - Increase in span
 - Increase in load
- (xi) Select the beam having zero end rotation.
- Simply supported
 - Cantilever
 - Fixed beam
 - Overhanging beam
- (xii) Choose the bending moment at end supports of continuous beam.
- Zero
 - Positive
 - Negative
 - Infinite
- (xiii) Select the purpose of moment distribution method.
- Analysis of determinate beams
 - Analysis of indeterminate structures
 - Design of beams
 - Plastic analysis
- (xiv) Select what fixed end moments depend on.
- Support condition
 - Load and span
 - Distribution factor
 - Stiffness
- (xv) Choose the value of carry over moment when near end is released.
- Same
 - Half
 - Zero
 - Double

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Group-B

(Short Answer Type Questions)

3 x 5=15

- State the definition of slenderness ratio. (3)
- State the meaning of a fixed beam. (3)
- State the meaning of point of contraflexure in beams. (3)
- A wooden beam 140 mm wide and 240 mm deep has a span of 4 m. Determine the load that can be placed at its centre to cause a deflection of 10 mm. Take $E=6 \text{ GPa}$. (3)
- Analyze the effect of increase in slenderness ratio on column strength. (3)

OR

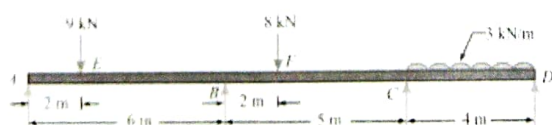
- Analyze the role of end conditions in Euler buckling behavior. (3)

Group-C

(Long Answer Type Questions)

5 x 6=30

- State the limitations of Euler's theory of columns. (5)
- Analyze the differences between Euler's and Rankine's column theories. (5)
- Apply moment distribution method to determine end moments of a two-span continuous beam under UDL. (5)
- Estimate the maximum length of a steel rod of 50 mm diameter, used as a column with both ends fixed and carrying a load of 25 kN. Load factor of safety $\gamma=3$, $\alpha=1/7500$, $f_c = 320 \text{ N/mm}^2$. (5)
- A continuous beam ABCD, simply supported at A, B, C, D, has spans AB = 6 m, BC = 5 m, CD = 4 m. It is loaded as follows (5)



Estimate the moments over the beam, draw bending moment and shear force diagrams.

12. A mild steel tube 4 m long, 3 cm internal diameter and 4 mm thick is used as a strut with both ends hinged. Find the collapsing load. Calculate the crippling load if (i) both ends are built in. (ii) one end is built-in and one end is free.

OR

A rolled steel joist ISMB 300 is to be used as a column of 3 metres length with both ends fixed. (5) Calculate the safe axial load on the column. Take factor of safety 3, $f_c = 320 \text{ N/mm}^2$, $\alpha = 1/7500$. Properties of the column section: Area $A = 5626 \text{ mm}^2$, $I_{xx} = 8.603 \times 10^7 \text{ mm}^4$, $I_{yy} = 4.539 \times 10^7 \text{ mm}^4$

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