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Question Paper Code : 11288

M.E./M.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Second Semester

Structural Engineering

ST 5202 — STABILITY OF STRUCTURES

(Regulation 2017)

Time : Three hours Maximum : 100 marks

Use of Stability Chart / Table is permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate between short column and slender column.
2. "Stability problems are eigen value problems" – Is this statement True of False? – Justify.
3. What do you mean by a beam – column?
4. What is symmetric and anti-symmetric buckling in Frames?
5. Differentiate between uniform torsion and non-uniform torsion.
6. State the effect of lateral bucking on beam members.
7. Write down the governing Differential Equation for buckling of plates.
8. Compare plate buckling behaviour with that of column.
9. What do you mean by post buckling behaviour?
10. Draw the load-deflection curve of an imperfect column.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Obtain the fourth–order differential equation for buckling of columns, stating the assumptions made. (5)

(ii) Hence obtain the buckling load for a column with both ends fixed. (8)

Or

(b) Determine the critical load of a column with one end fixed and the other free if it is subjected to an axial load P. The M.I. of the member varies linearly from '3I' at the fixed end to 'I' at the free end. (13)

12. (a) Obtain expressions for the maximum deflection and maximum moment of a beam column whose ends are simply supported and is loaded as shown in Fig.1

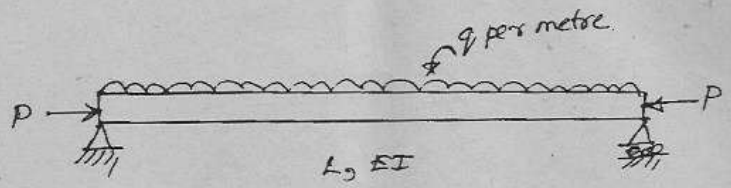

Fig.1

Or

(b) Determine the critical load of the frame shown in Fig.2. Take I for beams and columns as 0.4×10^{-4} mm^4 and E = 200 GPa.

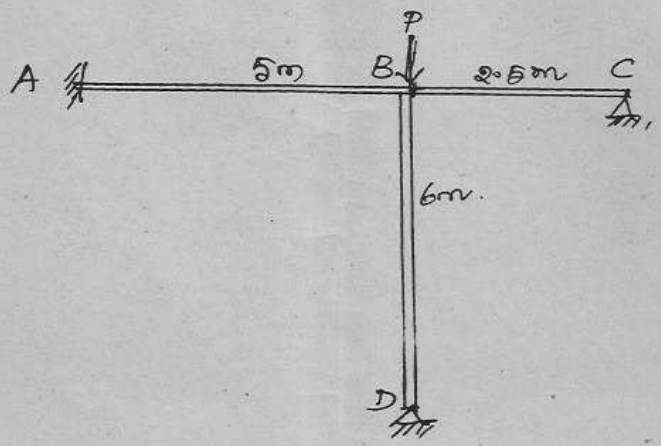

Fig.2

13. (a) Determine the torsional buckling load of a symmetrical I section, Given: Flange width = 100 mm, Web = 200 mm (overall), Uniform thickness = 2.5 m, E = 100 GPa, G = 40 GPa.

Or

(b) A cantilever rectangular beam of Uniform Section and length 'L' is subjected to a lateral load at the end through the centroid of the section. Find its buckling load.

14. (a) A square plate simply supported on all its edges is axially compressed to N_x per unit length along X-direction only. Find the critical buckling load.

Or

(b) Write down the step by step procedure involved to find the buckling load of a rectangular plate with two edges simple supported (opposite) and other two edges clamped using Energy Approach.

15. (a) Obtain expressions for deflection at mid-height of an eccentrically loaded column in the elastic and inelastic states.

Or

(b) (i) Explain Shanley's model for inelastic behaviour of columns. (7)

(ii) Briefly discuss and comment on the behaviour of inelastic buckling of columns with that of plates. (6)

PART C — (1 × 15 = 15 marks)

16. (a) Using Energy approach, determine an approximate value for the critical load of the column shown in Fig.3.

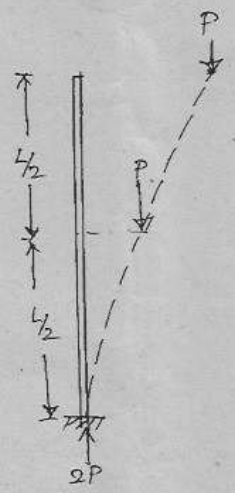

Fig.3

Or

(b) Determine the critical load of the frame shown in Fig.4 for symmetric buckling. Take EI and L to be constant for all the members.

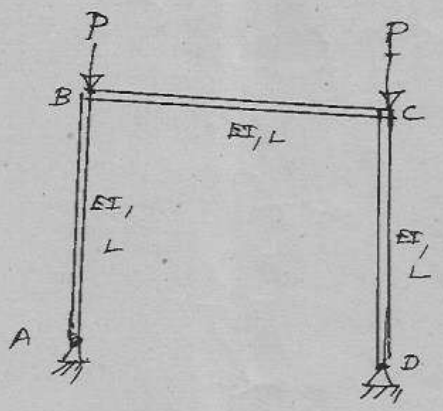

Fig.4