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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Second Semester, M. Tech - Civil Engineering (MCAD)

Semester End Examination; October - 2022

Structural Stability Analysis - Classical and FE Approach

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Idealize the concepts of beam column structural behaviour, stability of column and compute Euler's critical load for different boundary conditions.

CO2: Comprehend the energy method, bars on elastic foundations, successive approximation method for stability analysis.

CO3: Comprehend finite element method n stability analysis to simple plane truss and 2D beams and frames.

CO4: Grasp concept of lateral buckling of beams, tensional buckling of beams and buckling of rectangular plate type structures.

Note: I) *Answer any **FIVE** full questions, selecting **ONE** full question from each unit.*

II) *Any **THREE** units will have internal choice and remaining **TWO** unit questions are compulsory.*

III) *Each unit carries 20 marks. Use of IS1893-2016 is permitted, missing data if any may be suitably assume.*

Q. No.	Questions	Marks	BLs	COs	POs
	UNIT - I	**20**			
1 a.	Derive the equation of deflection for a pinned-pinned beam column subjected to an Eccentric concentrated load 'Q' and an axial load 'P' .Hence deduce the maximum deflection for the beam column due to central concentrated load.	20	L3	CO1	PO1,3,2
	OR				
1 d.	Using the 4^{th} order differential equation obtain first two critical loads for : i) Fixed-free column ii) Fixed-fixed column	20	L3	CO1	PO1,3,2
	UNIT - II	**20**			
2 a.	Determine the critical load for a cantilever column subjected to uniformly distributed axial load.	20	L3	CO2	PO1,3,2
	OR				
2 d.	Determine the critical load for a pinned-pinned column subject to an axial load by assuming a parabolic profile, to start with using the method of successive approximation.	20	L3	CO2	PO1,3,2

Contd… 2

	UNIT - III	**20**			
3 a.	Using the cubic Hermitian polynomial, derive the shape functions for two-noded Euler's-Bernoulli's beam element. Take two d.o.f per node (one translation and one rotation). Also determine $[Ke]_{ij}$ and $[Kg]_{ij}$ for i = 2 and j = 2, 3, 4.	20	L3	CO3	PO1,3,5
	OR				
3 d.	Determine the critical load for a fixed column discretising into two elements. Compare the answer with the closed form solution. Take total column length = 2 m and EI = 2 N-m^2.	20	L3	CO3	PO1,3,5
	UNIT - IV	**20**			
4 a.	Determine the critical moment for the simply supported I–beam subjected to pure bending against lateral buckling.	20	L3	CO4	PO3,4,5
	UNIT - V	**20**			
5 a.	Derive the expression for the critical load for simply-supported rectangular plate subjected to in-plane load N_x in one direction.	20	L3	CO4	PO3,4,5

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