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Reg. No. : | | | | | | | | | | |

Question Paper Code: 51U04

M.E. DEGREE EXAMINATION, APRIL 2019

First Semester

Structural Engineering

15PSE104 - STABILITY OF STRUCTURES

(Wood chart and Stability functions table may be permitted)

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 1= 5 Marks)

1. Effective Length of a fixed – fixed column is CO1- R

   (a) 0.707 L (b) L/2 (c) 2L (d) L

2. In _____ method equilibrium will be established by Law of conservation of Energy. CO2 -R

   (a) Energy (b) Rayleigh ritz (c) Galerkin's (d) Finite difference

3. A member subjected to axial load and bending is called as _____ CO3- R

   (a) Beam (b) Column (c) Slab (d) Beam-Column

4. Critical load of a portal frame for very high values of girder stiffness and it can sway is CO4 -R

   (a) P_E (b) ¼ P_E (c) $2P_E$ (d) $4P_E$

5. In Buckling Analysis of Thin Plates _____ is negligible CO5- R

   (a) Normal Stress (b) Normal Strain (c) Shear Strain (d) All the above

PART – B (5 x 3= 15 Marks)

6. Derive the general governing higher order differential equation of columns. CO1-App

7. What is known as Difference ratio? CO2-U

8. What is the amplification factor for deflection in beam-Column? CO3-U

9. Define: Stability functions and Rotation functions. CO4-U

10. Write the general governing differential equation for buckling of rectangular plates. CO5-U

PART – C (5 x 16= 80Marks)

11.	(a)	By Equilibrium approach determine the buckling load of a column whose bottom support is hinged and top support is elastically restrained by a beam.	CO1- App	(16)
		Or		
	(b)	Determine the buckling load of a fixed- hinged column using higher order differential equation.	CO1- App	(16)
12.	(a)	Using Finite Difference method, determine the buckling load of a fixed-hinged column. Obtain solutions with the column divided into two, three and four segments and extrapolate these results using Richardson's method.	CO2- App	(16)
		Or		
	(b)	Using Finite Difference method, determine the buckling load of a hinged-hinged column. Obtain solutions with the column divided into two, three and four segments and extrapolate these results using Richardson's method.	CO2- App	(16)
13.	(a)	Derive the slope deflection equation for a beam – column.	CO3-App	(16)
		Or		
	(b)	Using Equilibrium approach find the maximum deflection of a simply supported beam – column which consists of a transverse load Q at the centre and an axial force P at both ends.	CO3-App	(16)
14.	(a)	Find the critical load of a portal frame whose both bottom supports are fixed. Axial load 'P' is acting at top of left column only. EI & *l* are same for all the members of the portal frame and there is no sway in the frame. For $\alpha_n = -2$ $\phi = 2.55$; For $\alpha_n = -6$ $\phi = 3.1$; For $\alpha_n = -3.5$ $\phi = 2.8$	CO4 -App	(16)
		Or		
	(b)	Compute the critical loads corresponding to the two non-sway modes of a portal frame whose both bottom supports are fixed. Axial load 'P' is acting at top of both columns. EI & *l* are same for all the members of the portal frame. For $\alpha_n = -7$ $\phi = 3.13$; For $\alpha_n = -2$ $\phi = 2.55$; For $\alpha_n = -6$ $\phi = 3.1$; For $\alpha_n = -3.5$ $\phi = 2.8$	CO4 -App	(16)

15. (a) Using Equilibrium approach determine the critical load of a simply supported rectangular plate — CO4 - App — (16)

Or

(b) Derive the general governing differential equation for buckling of thin plates subjected to biaxial tensile force along with shear. — CO5-App — (16)