C **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 53U01

M.E. DEGREE EXAMINATION, APRIL 2019

Third Semester

Structural Engineering

15PSE301 – STRUCTURAL DYNAMICS

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 1= 5 Marks)

1. If ω is forcing frequency and ω_n is the natural frequency then resonance occurs when CO1- R

   (a) $\omega>\omega_n$ (b) $\omega=\omega_n$ (c) $\omega_n>\omega$ (d) $\omega\neq\omega_n$

2. The number of natural frequencies in a 2-DOF system will be CO2 -R

   (a) Only one (b) α (c) Two (d) As required

3. An n-degree of system will have CO3- R

   (a) n+1 coordinates (b) n-1 coordinates (c) n coordinates (d) 2n coordinates

4. If Φ is the mode shape, when an end is free it may be assumed: CO4 -R

   (a) $\Phi = 0$ (b) $\Phi^{iv} = 0$ and $\Phi^{iii} = 0$ (c) $\Phi^{ii} = 0$ and $\Phi^{iii} = 0$ (d) $\Phi^{i} = 0$

5. Principle of mode superposition applies only when the system is CO5- R

   (a) Linear (b) Nonlinear (c) Dynamic (d) Static

PART – B (5 x 3= 15Marks)

6. What is D'Alembert principle? CO1-U

7. Define Natural frequency and Mode shape and explain the relation between them. CO2-U

8. Explain the purpose of introducing normal (or generalized) coordinates in Mode Superposition method. CO3-U

9. Write two basic differences between discrete systems and continuous systems. CO4-U

10. List at least three situations under which a dynamic system becomes nonlinear. CO5-U

PART – C (5 x 16= 80 Marks)

11. (a) A platform of weight 18kN is being supported by 4 equal columns which are damped to the foundation. Experimentally it has been computed that a static force 5 kN applied horizontally to the platform produces a displacement of 2.5mm.It is estimated that the damping in the structure is of the order of 5% of critical damping .Compute the following
(a) un damped natural frequency
(b) damping coefficient
(c) logarithmic decrement
(d) no. of cycles and the time required for amplitude of motion to be reduced from and initial value of 2.5mm to 0.25mm. CO1- App (16)

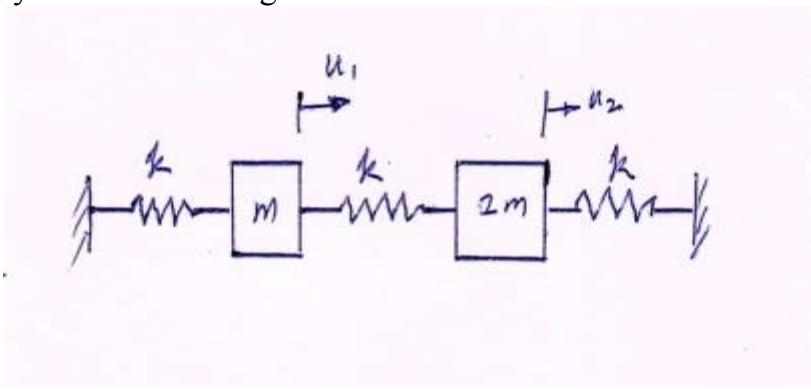
Or

(b) Derive the general expression for displacement U of an overdamped system. CO1- App (16)

12. (a) Derive the equations of motion for forced vibration of an undamped system. Also indicate the solution to this equation CO2-App (16)

Or

(b) Find the natural frequencies and modes of vibration for the system shown in fig. CO2-App (16)



13. (a) Explain orthogonality of mode vectors and prove it with respect to mass and stiffness. CO3-U (16)

Or

(b) Explain the coupled state of equations of motion and demonstrate how they are uncoupled. CO3-U (16)

14.	(a)	Derive the frequency equation of beam of length L with both ends fixed.	CO4-App	(16)
		Or		
	(b)	Derive the frequency equation of beam of length L with one end fixed and the other end simply supported	CO4-App	(16)
15.	(a)	Describe Nonlinear vibration with examples and explain the Nonlinear model used to solve nonlinear vibration problems in general.	CO5-U	(16)
		Or		
	(b)	Describe a nonlinear vibration model and explain the approach to its solution including step-by-step integration.	CO5-U	(16)