Reg. No.												

Question Paper Code	12405

M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023

First Semester

M.E. - CAD/CAM

20PCDPC104 - MECHANICAL VIBRATIONS

(Regulations 2020)

Duration: 3 Hours Max. Marks: 100

PART-A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level, CO
1.	Define forced vibrations.	*2,K2,CO1*
2.	Discuss the advantages of using IRF in dynamic analysis.	*2,K1,CO1*
3.	Compare free and forced vibration.	*2,K2,CO2*
4.	Define the term transmissibility ratio in vibration isolation.	*2,K1,CO2*
5.	Outline the steps involved in modal analysis.	*2,K1,CO3*
6.	List the orthogonal properties of eigenvectors.	*2,K1,CO3*
7.	Define harmonics.	*2,K1,CO4*
8.	Write the different modes of vibration in plates.	*2,K1,CO4*
9.	How does modal analysis differ from frequency analysis?	*2,K2,CO5*
10.	List the role of vibration exciters in conducting vibration tests.	*2,K1,CO5*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

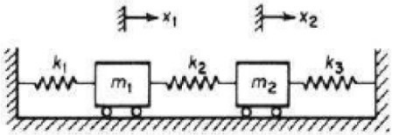
11.	a)	The following data are given for a vibratory system with viscous damping: Mass = 2.5 kg; spring constant = 3 N/mm and the amplitude decreases to 0.25 of the initial value after five consecutive cycles. Determine the damping coefficient of the damper in the system.	*13,K3,CO1*
		OR	
	b)	Demonstrate the application of Lagrange's equation to derive the equations of motion for a simple mechanical system.	*13,K3,CO1*
12.	a)	Explain the different types of Vibration isolation methods.	*13,K3,CO2*
		OR	
	b)	A 50-kg mass is subjected to the harmonic force F (t) = 1000 cos 120t N. Design an undamped isolator so that the force transmitted to the base does not exceed 5 percent of the applied force. Also, find the displacement amplitude of the mass of the system with isolation.	*13,K3,CO2*

13. a) Given a system with mass and stiffness matrices, calculate the natural frequencies and corresponding mode shapes. *13,K3,CO3*

$$[m] = \begin{bmatrix} 4 & 10 & 0 \\ 8 & 2 & 0 \\ 0 & 5 & 1 \end{bmatrix} \; and \; [k] = \begin{bmatrix} 1 & -2 & 4 \\ -4 & 4 & -4 \\ 1 & -2 & 1 \end{bmatrix}$$

OR

b) The following system shows the Three degree of freedom undamped system.Determine the first natural frequency of vibration,using Dunkerley's principle.Stiffness: $k_1=k_2=k_3=100$ N/m and mass : $m_1=m_2=m_3=10$ kg. *13,K3,CO3*



14. a) Derive the wave equation for the vibration of strings. Also discuss the boundary conditions for a vibrating string. *13,K2,CO4*

OR

b) Determine the natural frequencies of Lateral vibration of a uniform beam clamped at one end and free at the other. *13,K2,CO4*

15. a) Enumerate and briefly explain different types of vibration instruments used in industry. *13,K2,CO5*

OR

b) Explain the working of Piezo electric Transducers with output voltage control, used for Vibration measuring Instruments. *13,K2,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) An accelerometer has a suspended mass of 0.01 kg with a damped natural frequency of vibration of 150 Hz. When mounted on an engine undergoing an acceleration of 1g at an operating speed of 6000 rpm, the acceleration is recorded as by the instrument. Find the damping constant and the spring stiffness of the accelerometer. *15,K3,CO6*

OR

b) A Vibrometer having a natural frequency of 4 rad/s and is attached to a structure that performs a harmonic motion. If the difference between the maximum and the minimum recorded values is 8 mm, find the amplitude of motion of the vibrating structure when its frequency is 40 rad/s. *15,K3,CO6*