QP Code: R252B065 Reg. No | | | | | | | | | | | AY 24

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

M.Tech. (Second Semester) Regular Examinations, July – 2025

24MSEPC12002 – Structural Dynamics

(Structural Engineering)

Time: 3 hrs Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions		CO #	Blooms Level
a.	Define Degree of Freedom.	CO1	K2
b.	Differentiate free and forced vibration.	CO2	K2
c.	Define stiffness matrix.	CO3	K2
d.	List the approximate methods used to find the mode shapes and frequencies.	CO4	K2
e.	Classify the general differential equation of a beam subjected to external vibration	CO5	K2

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions		Marks	CO #	Blooms Level
2. a.	An SDOF system consists of a mass of 20kg, and a spring of stiffness 2200kN/m and dashpot with a damping coefficient of 60Ns/m and is subjected to a force of F = 200sin5t. Find its steady state response and peak amplitude. Find the maximum bending moment and shear force in the column if the column is infinitely rigid.	10	CO1	K2
	(OR)			
b.	A machine of mass one tonne is acted upon by an external force of 2450 N at a frequency of 1500 rpm. To reduce the effects of vibration, isolator of rubber having a static deflection of 2mm under the machine load and an estimated damping factor = 0.2 are used. Determine 1. The force transmitted to the foundation 2. The amplitude of vibration of the machine	10	CO1	K3
3.a.	A vibrating system consisting of a weight of 1000kN and a spring stiffness of 80kN/m is viscously damped so that the ratio of two consecutives amplitude is 1 to 0.85. Determine: (i) Natural frequency (ii) Damping ratio	10	CO2	K2
	(OR)			
b.	Explain in detail about the free and forced vibration of two degree of freedom systems.	10	CO2	K2
4.a.	The Stiffness and mass matrices of a vibrating system is given below. Determine its fundamental frequency and Mode shapes.	10	CO3	K3

$$[M] = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2.5 \end{bmatrix}$$

$$[K] = \begin{bmatrix} 600 & -600 & 0 \\ -600 & 1800 & -1200 \\ 0 & -1200 & 3000 \end{bmatrix}$$

	(OR)			
b.	Determine the mode shapes and nodal frequencies of a three storey building by modal super position method. The storey masses are M_1=360 kg, M_2=250kg, M_3= 150kg and storey stiffness are K_1= 3000kN/m, K_2= 2000kN/m and K_3=1000kN/m.	10	CO3	K3
5.a.	Construct the step by step procedure involved in the mode superposition technique for a 3 DOF system.	10	CO4	K3
	(OR)			
b.	Derive the equation of motion for flexural beam subjected to forced vibration	10	CO4	K2
6.a.	Express in detail the equation of motion by Virtual work method.	5	CO5	K2
b.	Formulate the equation of motion by conservation of energy method.	5	CO5	K2
	(OR)			
c.	Determine the first two natural frequencies of uniform cantilever beam by Rayleigh – Ritz method. Assume $\varphi(x) = C_1x^2 + C_2x^3$	10	CO5	K2

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