BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/2024)

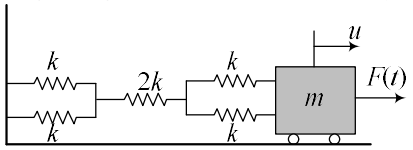
CLASS: B.Tech. **SEMESTER: VII**
BRANCH: Civil **SESSION: MO/2024**

SUBJECT: CE412 STRUCTURAL DYNAMICS

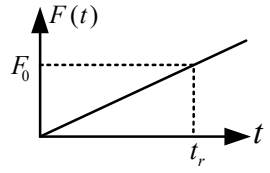
TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

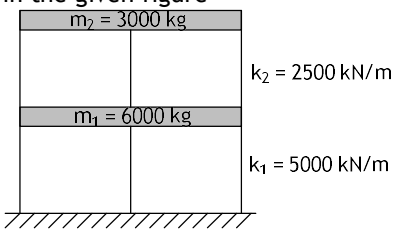
			CO	BL
Q.1(a)	Define time-period and fundamental frequency.	[2]	1	2
Q.1(b)	With the help of free body diagram derive the equation of motion for the following single degree of freedom (SDOF) system.	[3]	1	3



Q.2(a)	For a system with damping ratio ξ=0.05, determine the number of free vibration cycles required to reduce the displacement amplitude to 10% of the initial amplitude. The initial velocity is zero.	[2]	1	3
Q.2(b)	A 1 m long diving board with a driver of mass 50 kg standing at its tip oscillates with frequency of 3 Hz. Find the modulus of rigidity (EI) for the board.	[3]	1	3
Q.3	A machine of mass W= 200 kg is mounted at the center of a simply supported steel beam of length 5 m. A piston that moves up and down in the machine produces a harmonic force of magnitude 8000 N at a frequency of 80 rad/s. Neglecting the weight of the beam and assuming 5% of the critical damping determines the amplitude of the motion of the machine, the force transmitted to the beam supports, and the corresponding phase angle. Modulus of elasticity (E) and moment of inertia (I) of the beam are E = 200 GPa, I = 10416.667 cm4	[5]	1	4
Q.4	Using Duhamel's integral, determine the response of an undamped SDoF system having mass 'm' and stiffness 'k' subjected to a ramp force shown in the figure	[5]	1	3



Q.5	Determine the natural frequencies and mode shapes of the two-storey structure shown in the given figure	[5]	2	3



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