Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

ME Semester –I Examination Feb. - 2012

Subject code: 712002N **Date: 13/02/2012**
Subject Name: Structural Dynamics
Time: 10.30 am – 01.00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Explain in detail the Reyleigh'y method for finding out the natural frequency for the structure.	**07**
	(b)	Derive the mass matrix for the beam element having mass of M kg/m and length of L.	**07**
Q.2	**(a)**	A single spring mass unit has mass of 1000 kg, damping constant of 200 N-sec/m and spring constant of 3000 N/m. Calculate the equation of the motion of the mass when the mass is given initial displacement of 10mm and initial velocity of 2 m/sec. Also calculate the time required to reduce it's amplitude to 0.01 % of the original amplitude.	**07**
	(b)	Discuss in detail the damped mass system having mass M, damping ratio C and stiffness constant K. Also give real life examples of over damped and under damped systems.	**07**
		OR	
	(b)	Discuss in detail the various methods of finding out the damping ratio by experimental work.	**07**
Q.3	**(a)**	For a rigid beam as shown in the figure.1, derive the equation of the steady state motion of the beam. The beam has the unit mass as 100 kg/m.	**10**
	(b)	Discuss the normality of the mode shapes giving the mathematical proof for the same.	**04**
		OR	
Q.3	**(a)**	A simple supported beam is having span of 10m and loaded by a dynamic load of 20*sin(2t) kN at the mid point of the beam. If the unit mass of the beam is 200 kg/m and the flexural rigidity of the beam is 200kN-m^2, obtain the equation of the motion of the mid point of the beam. Assume the displacement function $\psi(x)=\sin(\pi x/10)$.	**10**
	(b)	Derive the differential equation for the compound pendulum having lever of mass 50kg, lever arm of 0.5m and bob of mass 100kg. Hence calculate the natural time period for the same.	**04**
Q.4		A multi degree freedom system is as shown in the figure.2. If the 100kg mass is displaced to right by 10mm and left to vibrate, calculate the equation of the motion of the masses.	**14**
		OR	

Q.4 A multi degree freedom system is as shown in the figure.2. If the 200kg mass is acted upon by a force of 100*sin(2t) N, calculate the equation of the steady state motion for the masses. **14**

Q.5 **(a)** A single spring mass system has mass of 200kg and spring stiffness of 5kN/m is loaded by an impulsive load as shown in the figure.3. Calculate the equation of the motion after the total time period of the impulse. **10**

(b) Discuss how a multi storey building can be converted in to a multi spring mass model. Also give various examples for the same. **04**

OR

Q.5 **(a)** A single spring mass system has mass of 500kg and spring stiffness of 10kN/m is loaded by a periodic load for which one period is as shown in the figure.4. Calculate the equation of the motion after the total time period of the impulse. **10**

(b) A bar having mass 1000kg and length 0.6m is hanged by two springs having stiffness of 200N/m and 100N/m. These springs are separated by 400mm from each other in such a way that the centre of mass is at midpoint of the springs. Derive the differential equations of motion. **04**

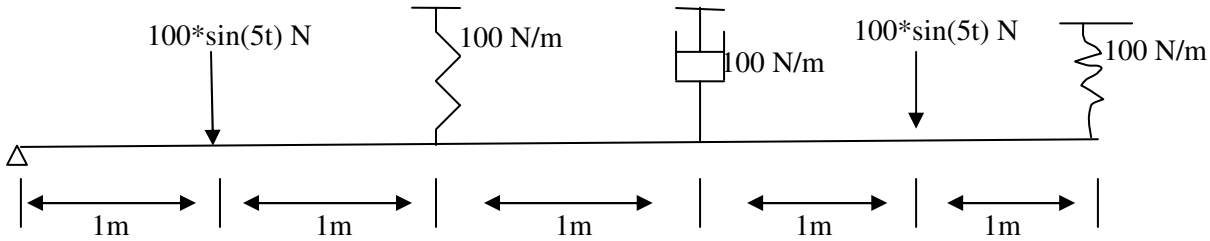

Figure.1

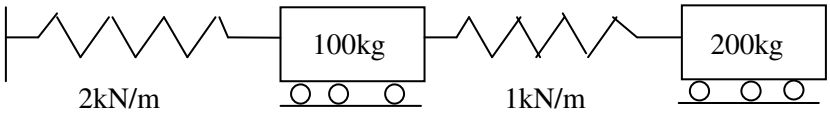

Figure.2

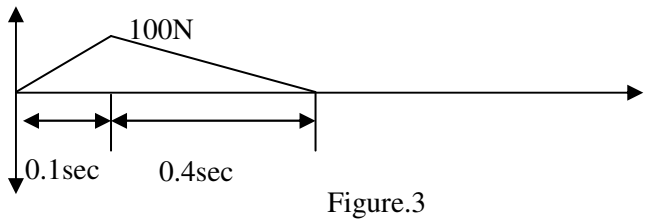

Figure.3

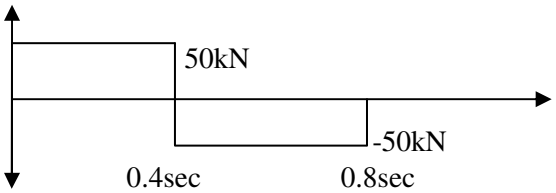

Figure.4

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