Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER 2012

Subject code: 712002N **Date: 09-01-2013**

Subject Name: Structural Dynamics

Time: 02.30 pm – 05.00 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)**	Discuss various types of damping present in the structures. Also explain the meaning of logarithmic decrement.	**07**
	(b)	For a beam element derive the consistent mass matrix in terms of mass per unit length and span of the beam.	**07**
Q.2	**(a)**	A single spring mass unit has mass of 5000 kg, damping constant of 1200 N-sec/m and spring constant of 500 N/m. Calculate the equation of the motion of the mass when the mass is given initial displacement of 20mm and initial velocity of 3 m/sec. Also calculate the initial amplitude of the motion and amplitude of the motion after 10 cycles.	**07**
	(b)	Discuss in detail the damped forced vibrations. Derive the equation of the motion for the system having initial displacement x_0 and initial velocity v_0.	**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 use of mode shapes in the analysis of multi degree freedom system. Also prove that the mode shapes are normal to each other.	**04**
		OR	
Q.3		A fixed beam is having span of 8m 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 300 kg/m and the flexural rigidity of the beam is 3000kN-m^2, obtain the equation of the motion of the mid point of the beam. Assume the displacement function $\psi(x)=16(x/L)^2-32(x/L)^3+32(x/L)^4$.	**14**
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 50*sin(3t) N towards right of the mass, calculate the equation of the steady state motion for the masses.	**14**
Q.5	**(a)**	A single spring mass system has mass of 250kg and spring stiffness of 10kN/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 single spring mass system has mass of 100kg, damping ratio 10% and spring stiffness of 20kN/m is loaded by a periodic load for which one period is as shown in the figure.4. Calculate the equation of the steady state of the motion. **14**

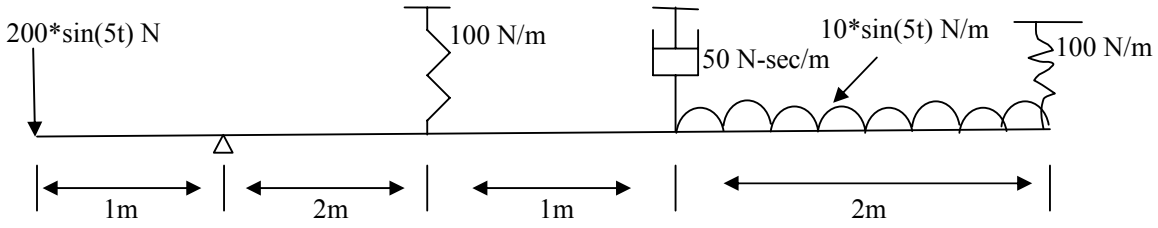

Figure.1

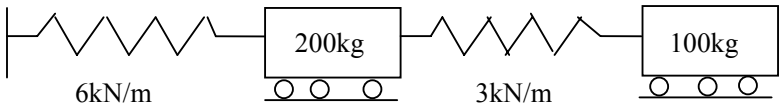

Figure.2

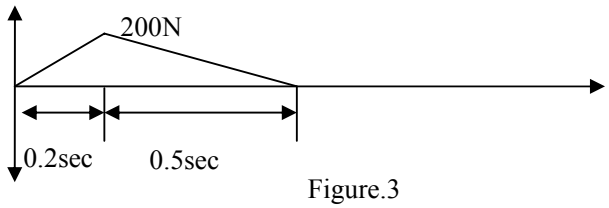

Figure.3

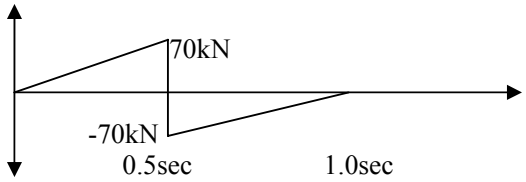

Figure.4

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