Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER-1 (OLD) EXAMINATION – WINTER 2016

Subject Code: 712002N Date:18/11/2016

Subject Name: STRUCTURAL DYNAMICS

Time:10:30 Am to 1:00 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)** Name various methods to compute the damping ratio for the structure. Explain any one of them in detail. **07**

(b) Explain the use of consistent mass matrix for calculating the natural frequencies. Derive the same for the beam element. **07**

Q.2 **(a)** Derive the equation of displacement of the forced damped system with usual notations. **07**

(b) Explain why the relative acceleration is considered in earthquake analysis in compare to absolute acceleration. Derive the differential equation of the system excited by the ground acceleration. **07**

(b) Discuss the raileygh's method for converting a continuous system in to a single degree freedom system. Applying the same rule calculate the natural frequency of a cantilever beam having mass as M, span as L, flexural rigidity as EI. Assume the displacement function as $\varphi(x) = (1-\cos(\pi x/2L))$. **07**

Q.3 **(a)** A simple support beam having span of 6m and EI of 20000kN/m^2 is supporting a machine at the centre span. The machine has weight of 100kN and it is operating at the frequency of 2Hz with 40kg mass rotating eccentrically with the lever arm of 0.05m. Calculate the maximum deflection of the beam when the machine is operated. **07**

(b) A water tank, modeled as single degree of freedom with equivalent mass of 1000tons and stiffness of 20000kN/m has the capacity of 500000L. Calculate the natural frequency of the water tank. It is excited by a force of 500sin3t N. Calculate the steady state displacement when the tank is empty and full. **07**

OR

Q.3 **(a)** Derive the response of the force free damped system from basic differential equation under initial displacements for a system having Mass = 100kg, Damping ratio = 15%, Spring stiffness = 400N/m, Initial displacement = 0.02m and initial velocity = 0.1m/S. **07**

(b) A rigid bar ABCDE of mass 50kg is supported by a hinge at A and supported on springs at C and E. it is supporting mass of 100kg and 200kg at B and D respectively. The spring constant for both the springs is 1000N/m. If this bar is displaced by 2mm at E and released to vibrate, obtain the equation of the motion. Lengths AB=BC=CD=DE=1.5m. **07**

Q.4 A two storeyed shear building is modeled as two springs and two masses system. The values of the weights form support are 2000 kN and 1500 kN respectively. The values of the stiffness from the support are 20000kN/m and 18000kN/m respectively. During the experiment the first floor is displaced by 10mm and released. Calculate the displacement functions of both the slabs. **14**

OR

Q.4 A two storeyed shear building is modeled as two springs and two masses system. The values of the weights form support are 200 kN and 100 kN respectively. The values of the stiffness from the support are 2000kN/m and 1500kN/m respectively. During the experiment the first floor is excited by a force of 100sin(3t). Calculate the displacement functions of both the masses.

Q.5 A single spring mass system has K = 1000N/m and mass = 500kg. It is loaded by a constant of 100kN for the 1 second, after which the mass vibrates freely. Calculate the response of the mass after 1 second. **14**

OR

Q.5 A damped single spring mass system has K = 2000N/m, C = 100N-sec/m and mass = 500kg. It is loaded by a periodic load for which one period is shown in the figure.1. Calculate the steady state response of the mass. **14**

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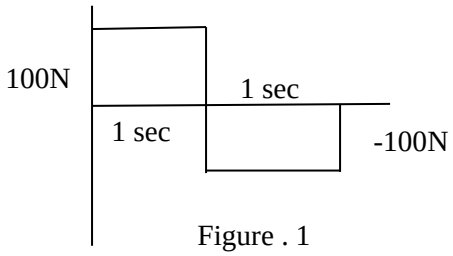

Figure . 1