

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – I • EXAMINATION – SUMMER • 2013****Subject code: 712002N****Date: 04-06-2013****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) Discuss the various methods to evaluate the damping ratio for the various structures. **07**
- (b) A single spring mass system has spring constant of 10kN/m, damping constant of 120N-sec/m and mass of 200kg. If the damping ratio is 10%, derive the equation of the motion of the mass from basic differential equation. Assume the initial displacement as 10mm and initial velocity as 0.1m/sec. **07**
- Q.2** (a) Discuss the damped forced vibrations. Derive the steady state equation of the motion of the mass. Also discuss the resonance effect in the system. **07**
- (b) Derive the consistent mass matrix. Discuss the usage of it. **07**
- OR**
- (b) Discuss the use of mode shapes in the analysis of multi degree freedom system. Also discuss how the multi-storey storey building is converted in the multi spring-mass system. **07**
- Q.3** A multi spring mass unit has two springs as 4kN/m, 1kN/m and two masses as 200kg, 150kg from the support respectively. A force of $10\sin(3t)$ N is applied to both the masses. Derive the steady state equation of the motion of both the masses. **14**
- OR**
- Q.3** A multi spring mass unit has two springs as 6kN/m, 2kN/m and two masses as 300kg, 200kg from the support respectively. Derive the equation of the motion of both the masses if the 300kg mass is displaced by 10mm from the stable condition and left to vibrate. **07**
- Q.4** A periodic load for which one period is as shown in the figure.1 is acting on a spring mass system has spring constant of 2kN/m and mass of 200kg. If the damping ratio of the system is 5%, derive the steady state equation of the motion. **14**
- OR**
- Q.4** (a) When a sudden force F is applied on the spring mass system having spring constant K and mass M , derive the equation of the motion. **05**
- (b) A simple support beam having span of 8m and flexural rigidity of 20000kN-m² is in state of rest. The equivalent mass of the beam is 10000kg. If a mass of 500kg falls on the beam from 0.02m at the centre of the beam and gets stuck to the beam, calculate the maximum and minimum displacement of the beam at the centre during the vibrations. **09**
- Q.5** (a) Discuss the various methods of constructing the damping matrix in the multi degree freedom system. **04**
- (b) A propped cantilever beam has mass of 6000kg/m, span of 10m, flexural rigidity of 15000kN-m² and deflection function as $Q(x) = 0.12x^2 - 0.02x^3 + 0.0008x^4$. Calculate the natural time period of the beam. **10**

OR

- Q.5** (a) Explain how Eigen value problems are useful in the analysis of multi degree freedom system. Also give names of various methods by which it can be applied in the dynamics. **04**
- (b) A simple support beam has span of 6m, flexural rigidity of 20000kN-m^2 and mass 5000kg/m . Using the fourth order differential equation calculate the natural time period of the beam. **10**

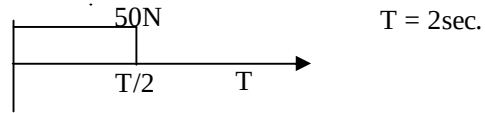


Figure.1
