

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE - SEMESTER-VI • EXAMINATION – WINTER 2013**

**Subject Code: 160103****Date: 02-12-2013****Subject Name: Vibration and Noise Control****Time: 02:30 pm to 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) Expression for the natural frequency of vibration using Energy method and Rayleigh's method. **07**  
(b) Define the following terms. **04**  
(I) Period of time (II) Periodic motion (III) Simple harmonic motion  
(IV) Amplitude  
(c) What are the causes of vibrations? Write application where vibration is essential. **03**
- Q.2** (a) Derive expression for frequency of compound pendulum. **07**  
(b) Establish the effect of mass of the spring on the natural frequency of the spring mass system. **07**
- OR**
- (b) Describe with help of sketches of longitudinal vibration, torsional vibration and transverse vibration. **07**
- Q.3** (a) Starting from fundamentals prove that under damped system is having a periodic motion. **07**  
(b) A vibrating system is defined by the following parameters: Mass = 4 kg, K = 100 N/m, C = 3Ns/m. Determine : (a) Damping factor, (b) the natural frequency of vibration, (c) Logarithmic decrement, (d) the ratio of two consecutive amplitude, and (e) the number of cycles after which the original amplitude is reduced to 20 percent. **07**
- OR**
- Q.3** (a) Derive the equation for logarithmic decrement for under damped system. **07**  
(b) The disc of a torsional pendulum has a moment of inertia of 600 kg-cm<sup>2</sup> and is immersed in viscous fluid. The brass shaft attached to it is of 10 cm diameter and 40 cm long. When the pendulum is vibrating, the observed amplitude on the same side of the rest position for successive cycle is 9°, 6°, 4°. Determine (a) logarithmic decrement, (b) damping torque at unit velocity, and (c) the periodic time of vibration. Assume for brass shaft,  $G = 4.4 \times 10^{10}$  N/m<sup>2</sup>. **07**
- Q.4** (a) Explain about different types of damping. **07**  
(b) Define torsional vibration and derive the equation of motion for torsional vibrations of circular member. **07**
- OR**
- Q.4** (a) Derive the equation of frequency for combined rectilinear and angular modes. **07**  
(b) A periodic torque having a maximum value of 0.588 N-m at a frequency corresponding to 4 radians per second is impressed upon a flywheel suspended from a wire. The wheel has a moment of inertia of 0.12 kg-m<sup>2</sup> and the wire has stiffness of 1.176 N-m/rad. A viscous dashpot applies damping couple of 0.392 N-m at an angular velocity of 1 rad /sec. calculates: (a) the maximum angular displacement from rest position, (b) the maximum couple applied to dashpot and (c) the angle by which the angular displacement lags the torque. **07**

- Q.5** (a) Explain the tachometer and accelerometer. **07**  
(b) Explain the rotating unbalance in a machine in detail and derive the relation. **07**
- OR**
- Q.5** (a) What is influence co-efficient? Also explain and state the Maxwell's theorem. **07**  
(b) A horizontal spring mass system with coulomb damping has a mass of 0.5 kg **07**  
attached to a spring of stiffness 980 N/m. if the coefficient of friction is 0.025,  
calculate: (a) the frequency of free oscillations, (b) the number of cycles  
corresponding to 50% reduction in amplitude if the initial amplitude is 5.0 cm and  
(c) the time taken to achieve this 50 % reduction.

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