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

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE- VI$^{th}$ SEMESTER–EXAMINATION – MAY- 2012**

**Subject code: 160103** **Date: 15/05/2012**

**Subject Name: Vibration and Noise Control**

**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.**

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| Q-1 | | | |
| | (a) | What are the causes of vibrations? Write applications where vibration is essential. | 03 |
| | (b) | Define Simple Harmonic Motion. Add the following harmonic motions analytically , $x_1 = 4\cos(\omega t + 10^0)$ and $x_2 = 6\sin(\omega t + 60^0)$ | 06 |
| | (c) | Explain beat phenomenon | 05 |
| Q-2 | (a) | A shock absorber is to be designed so that its overshoot is 10% of the initial displacement when released. Determine the damping ratio $\xi_1$. If $\xi$ be made equal to 0.5 $\xi_1$. | 07 |
| | (b) | Derive expression for frequency of compound pendulum. | 07 |
| | | OR | |
| | (b) | Prove: for a spring mass system, ratio of natural frequency (without effect of spring mass) to the natural frequency (with effect of spring mass) is $\sqrt{1+\frac{m_s}{3m}}$. Where m is the mass attached to the system and $m_s$ =mass of spring. | 07 |
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| Q-3 | (a) | Using Energy method derive differential equation of motion for undamped free vibrations of single degree of freedom system | 07 |
| | (b) | Starting from fundamentals prove that under-damped system is having a periodic motion. | 07 |
| | | OR | |
| Q-3 | (a) | A vibrating system is defined by the following parameters:<br>M=3 kg, k=100 N/m, C = 3 Ns/m. Determine: (a) The 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 |
| | (b) | Starting from fundamentals prove that critically damped system is having non-periodic motion. | 07 |
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| Q-4 | (a) | Explain about different types of damping. | 07 |
| | (b) | A Torsional pendulum consists of a rotor of mass 2 kg and diameter 0.2 m, at its lower end, supported by a rod of diameter 5 mm and length 1 m. The modulus of rigidity of the rod material may be assumed to be 0.83 x $10^{11}$ N/m$^2$ . Calculate the natural frequency of Torsional vibration. | 07 |
| | | OR | |
| Q-4 | (a) | A shaft 40 mm diameter and 2.5 m long has a mass of 1.5 kg per meter length. It is simply supported at the ends and carries three masses 90 kg, 140 kg and 60 kg at 0.8 m, 1.5 m and 2 m respectively from the left support. Taking E = 200 GN/m$^2$, find the frequency of the | 07 |

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| | | transverse vibrations | |
| | (b) | Derive the equation of motion for Torsional vibrations of circular members. | 07 |
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| Q-5 | (a) | Explain about Vibration absorbers. | 07 |
| | (b) | For undamped two degree of freedom free vibration system derive expressions for the principal modes of vibration. | 07 |
| | | OR | |
| Q-5 | (a) | Explain about frequency measuring instruments (Tachometer) and accelerometers. | 07 |
| | (b) | Explain vibration isolation and force transmissibility? Derive expression for force transmissibility for a damped spring mass system. | 07 |

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