

**B.Tech. – VIEP – MECHANICAL ENGINEERING  
(BTMEVI)**

**Term-End Examination**

**December, 2014**

00485

**BIMEE-008 : MECHANICAL VIBRATION**

*Time : 3 hours*

*Maximum Marks : 70*

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*Note : Answer any **five** questions. All questions carry equal marks.*

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1. (a) What is Vibration ? Define the various terminologies used in it. 6

(b) A body is subjected to two harmonic motions as given below :

$$X_1 = 10 \sin (\omega t + \pi/4) \text{ and}$$

$$X_2 = 8 \cos (\omega t + \pi/3)$$

What harmonic motions should be given to the body to bring it to equilibrium ? 8

2. A vibrating system having mass 1.2 kg is suspended by a spring of stiffness 1000 N/m and it is put to harmonic excitation of 10 N. Assume viscous damping. Determine

- (a) Resonant frequency
- (b) Phase angle at resonance
- (c) Amplitude at resonance
- (d) Frequency corresponding to the peak amplitude
- (e) Damped frequency

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3. A force  $F(t)$  is suddenly applied to a mass 'm' which is supported by a spring with a constant stiffness 'K'. After a short period of time 'T', the force is suddenly removed. During the time the force is active, it is a constant 'F'. Determine the response of the system if  $t > T$ . The spring and mass are initially at rest before the force  $F(t)$  is applied.

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4. A machine of mass one tonne is acted upon by an external force of 3000 N at a frequency of 50 Hz. To reduce the effects of vibration, isolator of rubber having a static deflection of 2 mm under the machine load and an estimated damping  $\varepsilon = 0.2$  is used. Determine

- (a) Force transmitted to the foundation
- (b) Amplitude of vibration of machine
- (c) The phase lag

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5. A light cantilever of rectangular section (5 cm deep and 2.5 cm wide) has a mass fixed at its free end. Find the ratio of frequency of free lateral vibration in vertical plane to that in a horizontal plane. 14
- 6 (a) Determine the natural frequency of mass  $m = 1$  kg placed at one end of a cantilever beam of negligible mass. Length of cantilever = 500 mm,  $b = 20$  mm,  $d = 30$  mm,  $E = 210 \times 10^9$  N/m<sup>2</sup>. 8
- (b) What are the various methods of determining natural frequency of undamped free vibrations ? Explain Raleigh's method. 6
7. The rotor of a turbocharger having a mass of 10 kg is keyed to the centre of 25 mm diameter of steel shaft of 400 mm between bearing. Determine
- (i) Critical speed of shaft
- (ii) The amplitude of vibration of rotor at a speed of 3200 rpm  
if the eccentricity is 0.02 mm. 14
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