No. of Printed Pages : 5

**BIMEE-008**

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

## Term-End Examination

## June, 2016

00726

## BIMEE-008 : MECHANICAL VIBRATION

*Time : 3 hours* *Maximum Marks : 70*

***Note :*** *Answer any **five** questions. All questions carry equal marks. Use of scientific calculator is permitted.*

**1.** Define the following terms (any ***four***) : $4 \times 3\frac{1}{2} = 14$

(a) Amplitude

(b) Frequency

(c) Resonance

(d) Transmissibility

(e) Phase Angle

2. The beam AB of the crane shown in Figure 1 is a uniform steel bar of length 10 m and area of cross-section 2500 $mm^2$. A weight W is suspended while the crane is stationary. The cable CDEBF is made of steel and has a cross-sectional area of 100 $mm^2$. Neglecting the effect of the cable CDEB, find the equivalent spring constant of the system in the vertical direction. *14*

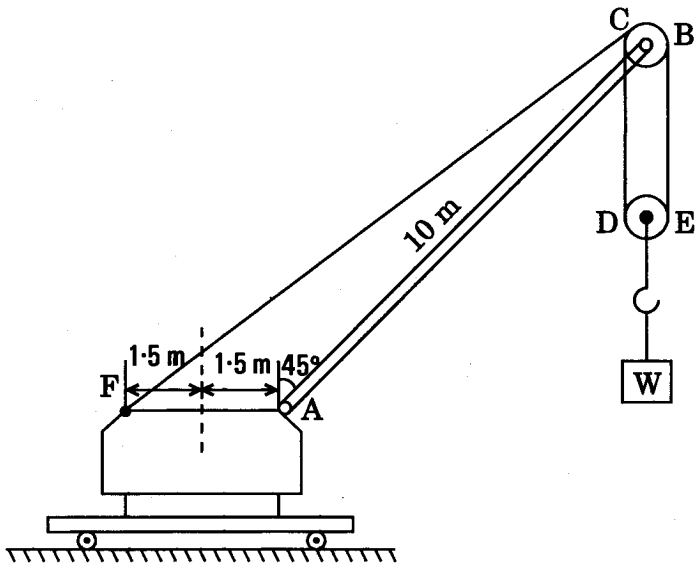


*Figure 1*

3. An underdamped shock absorber is to be designed for a motorcycle of mass 200 kg [Figure 2 (a)]. When the shock absorber is subjected to an initial vertical velocity due to a road bump, the resulting displacement time curve is to be as indicated in Figure 2 (b). Find the necessary stiffness and damping constants of the shock absorber, if the damped period of vibration is to be 2 s and the amplitude $x_1$ is to be reduced to one-fourth in one half cycle (i.e., $x_{1\cdot5} = x_1 / 4$). Also find the minimum initial velocity that leads to a maximum displacement of 250 mm. *14*

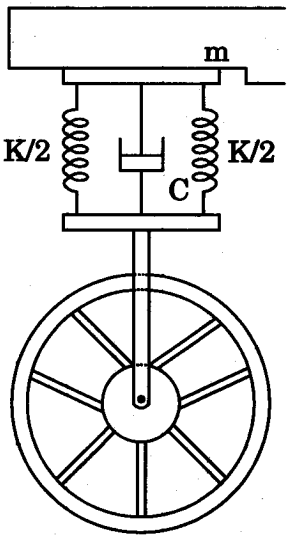


*Figure 2 (a)*

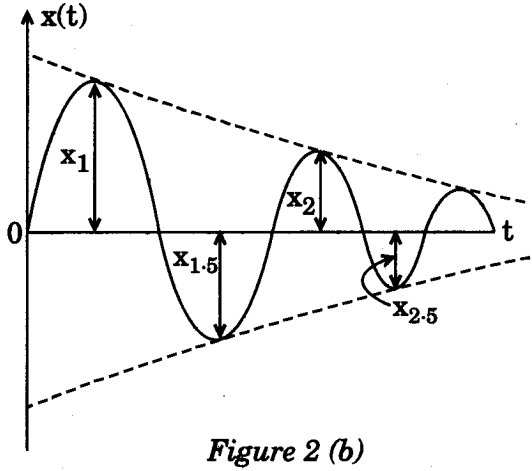


*Figure 2 (b)*

**4.** Find the natural frequencies and mode shapes of a spring mass system, shown in Figure 3 which is constrained to move in the vertical direction only. Take n = 1. *14*

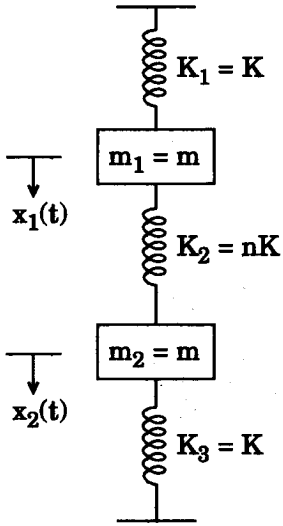


*Figure 3*

5. Derive the free vibration equation for a longitudinal bar. *14*

6. (a) Derive the Rayleigh's quotient used for finding the natural frequency of continuous systems. *8*

   (b) State Maxwell's reciprocity theorem. Also define flexibility influence coefficients and stiffness influence coefficients. *6*

7. Find the flexibility influence coefficiencts of the system shown in Figure 4. *14*

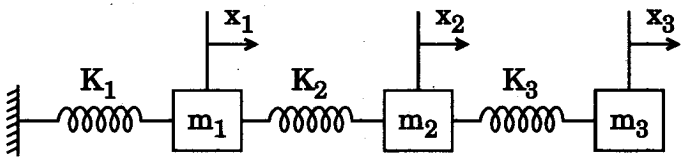


*Figure 4*

8. Write short notes on the following : $4 \times 3\frac{1}{2} = 14$

   (a) Critical Speed of Shafts

   (b) Stiffness

   (c) Vibration Absorber

   (d) Underdamped System