No. of Printed Pages : 5 **BIMEE-008**

B.Tech. MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination

June, 2014 00737

BIMEE-008 : MECHANICAL VIBRATION

Time : 3 hours *Maximum Marks : 70*

Note : *(i) Attempt any five questions.*
(ii) Standard symbols have usual meaning.
(iii) Assume missing data if any.

1. (a) Represent the following periodic motion by harmonic series Fig-1(a). 7

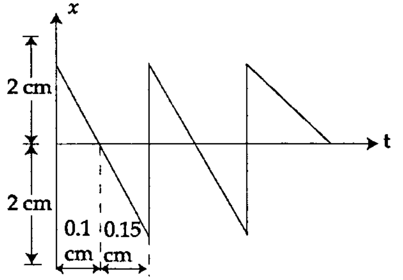


Fig - 1(a)

(b) Find the frequency of oscillation for the system shown below Fig-1(b). Assuming bell crank lever to be weightless and stiff. 7

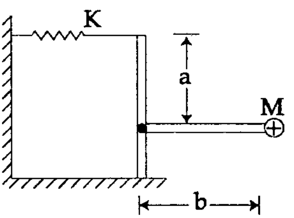


Fig - 1(b)

2. (a) Derive the expression for displacement of mass. If $C = C_c$ and $\xi = 1$, Fig-2(a). 7

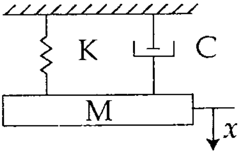


Fig - 2(a)

(b) For the system shown in Fig-2(b). $M = 1.5$ kg, $K = 4900$ N/m, $a = 6$ cm and $L = 14$ cm assuming rod to be massless and stiff determine the value of 'C' for the system to be critically damped. 7

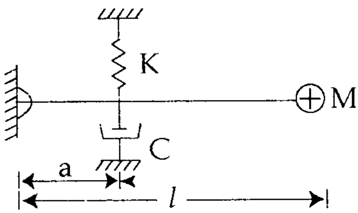


Fig - 2(b)

3. (a) The mass of a "spring-mass dashpot" system is given intial velocity from its equilibrium of $A\omega_n$, where ω_n is undamped natural frequency of the system. Find the equation of motion for the system when, 7

   (i) $\xi = 2.0$

   (ii) $\xi = 1.0$

   (iii) $\xi = 0.2$

(b) Find the expression for the logrithmic decreament in case of an underdamped case of spring mass system. 7

4. (a) A 75 kg machine is mounted on spring of stiffness $K = 11.76 \times 10^5$ N/m with an assumed damping factor $\xi = 0.2$ A. 2 kg piston within the machine has a reciprocating motion with stroke 0.08 m and 3000 rpm. Assuming the motion of piston to be harmonic, determine the amplitude of vibration of machine and vibratory force transmitted to foundation. 7

(b) The support of a spring-mass system is vibrating with an amplitude of 5 mm and a frequency of 1150 cycles/min. if the mass is 0.9 kg. and spring has a stiffness of 1960 N/m determine the amplitude of vibration of mass. What amplitude will result if damping of 0.2 is included in system. 7

5. (a) Derive the expression for natural frequency of torsional system shown in Fig-5(a). Draw the normal mode curve. Show that the nodal distance from J_2 is $l_2 (1 + Kt_2/Kt_1) / (1 + J_2/J_1)$. 7

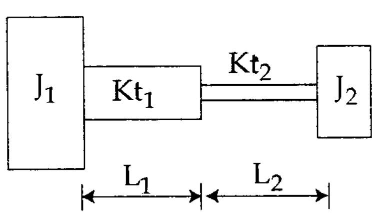


Fig - 5(a)

(b) Assuming the connecting rod AB to be light and rigid. Determine the natural frequency of oscilation of system Fig-5(b). 7

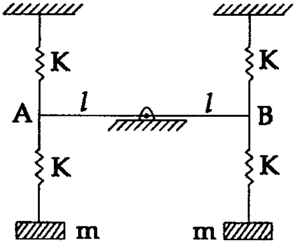


Fig - 5(b)

6. (a) Find the principle co-ordinate for the system given in Fig-6(a) 7

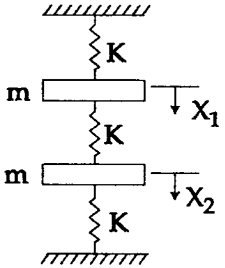


Fig - 6(a)

(b) Obtain the three natural frequencies and corrosponding mode shape for the three degree of freedom system shown in Fig-6(b) below. 7

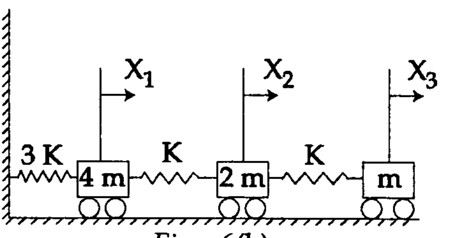


Fig - 6(b)

7. (a) Find by Holzer's method the natural frequency of the torsional system when its right end is fixed as shown in Fig-7(a) below. 7

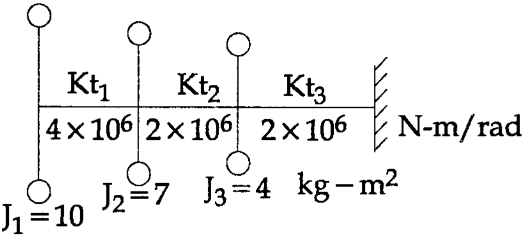
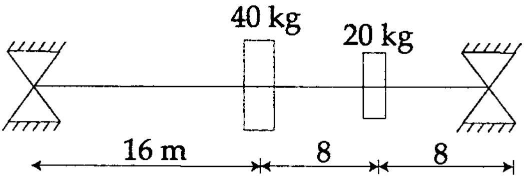


Fig - 7(a)

(b) Find the lowest natural frequency of transverse vibration of system shown in Fig-7(b) below by Raylaigh's method. 7



$E = 1.96 \times 10^{11}$ N/m^2, $I = 1 \times 10^{-6}$ m^4

Fig - 7(b)

8. Explain in brief **(any four)** : 14

(a) Vibration measuring instruments

(b) Vibration monitoring and diagnosis

(c) Vibration of beams

(d) Frequency response curves

(e) Vibration isolation

(f) Eigen values and Eigen vectors