# ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
**(AUTONOMOUS)**

M.Tech II-Semester Regular Examinations, May 2016

**MECHANICAL VIBRATIONS**

**(MACHINE DESIGN)**

**Date:** **Time: 3 hours** **Max Marks: 60**

**Answer ONE Question from each unit**
**All questions carry equal marks**
**All parts of the question must be answered at one place only**

## UNIT-I

**1.** A block of mass 0.065 kg is suspended from a spring having a stiffness of 50 N/m. The block is displaced downwards from its equilibrium position through a distance of 2 cm and released with an upward velocity of 3 cm/s. Determine **(12 M)**

(i) Natural frequency
(ii) Period of oscillation
(iii) Maximum velocity
(iv) Maximum acceleration and
(v) Phase angle.
(vi) Also derive the equation of motion of the given system.

**(OR)**

**2**. a) A U-tube manometer used in a fluid mechanics laboratory has a uniform bore of cross-section area A. If a column of liquid of length L and density is set into motion, find the frequency of the resulting motion? What will be frequency if one of the tube makes an angle of θ with the vertical. **(6 M)**

b) A cylinder of mass M and radius r rolls without slipping on a cylindrical surface of radius R. Find the natural frequency for small oscillations about the lowest point **(6 M)**

## UNIT-II

**3** An undamped two degree of freedom spring mass system shown in Fig 1. **(12 M)**

Determine:
a. The governing equations of motion for the system
b. The frequency equation for the system
c. The natural frequencies of the system
d. The normal modes of the system

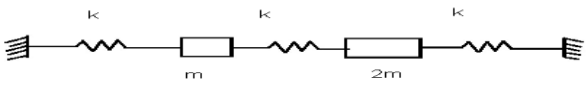


**Fig -1**

**(OR)**

**4** Find the natural frequencies and mode shapes of a spring-mass system, shown in Fig. 2, which is constrained to move in the vertical direction only. Take n=1 **(12M)**

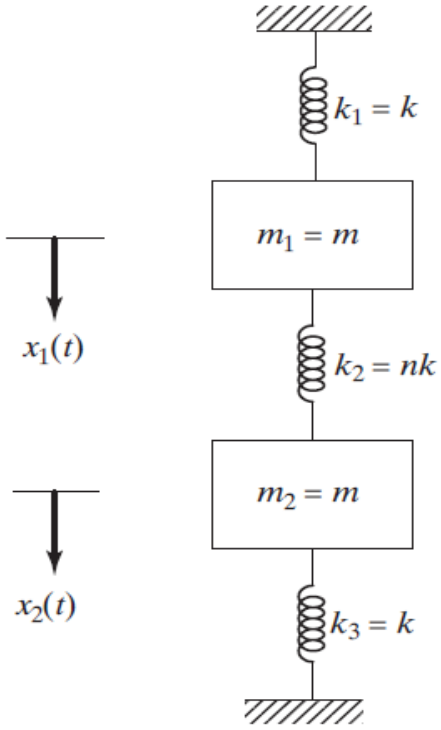


**Fig. 2**

## UNIT-III

**5** a) Find the Laplace transform of a pulse of height A and duration τ. Also deduce the Laplace transform of unit impulse **(6M)**

b) Draw the phase plane plot and the displacement time plot for a spring mass system subjected to a rectangular pulse of duration τ **(6M)**

**OR**

**6** a) For a vibratory system subjected to an impulse, plot the maximum peak displacement against the damping ratio **(6M)**

b) Determine the shock spectrum of a rectangular plate **(6M)**

**UNIT-IV**

**7** Find the stiffness influence coefficients of the system shown in Fig. 3 **(12M)**

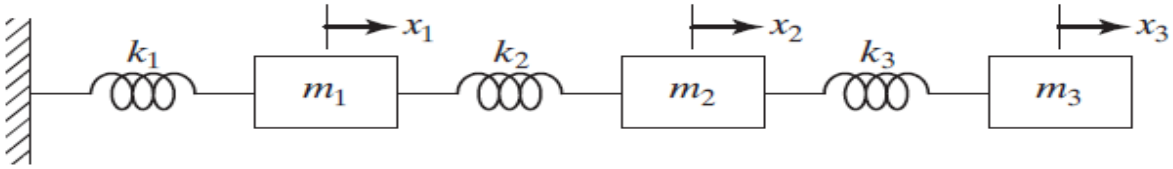


**Fig. 3**

**(OR)**

**8** Determine the stiffness matrix of the frame shown in Fig. 4 Neglect the effect of axial stiffness of the members *AB* and *BC*. **(12M)**

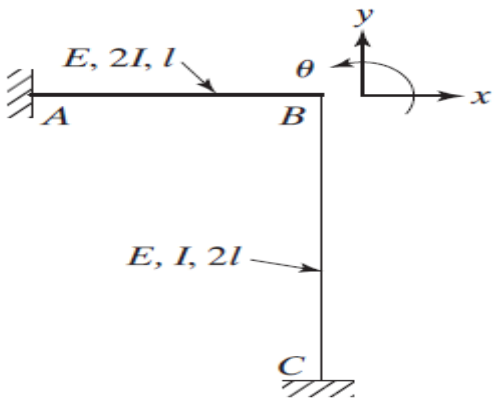


**Fig. 4**

## UNIT-V

**9** Derive an expression for Longitudinal Vibration of a Bar or Rod **(12M)**

**(OR)**

**10** Find the natural frequencies of a bar with one end fixed and a mass attached at the other end, as in Fig. 5 **(12M)**

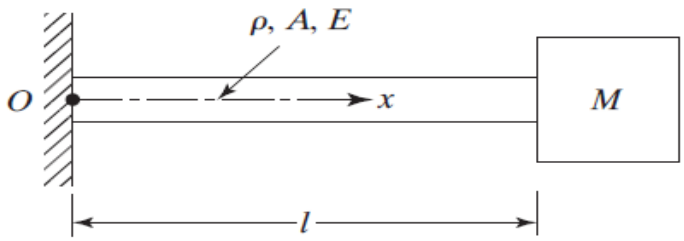


**Fig. 5**

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