Registration no: | | | | | | | | | | |

Total Number of Pages: 03

B.TECH
PEME5401

7th Semester Regular / Back Examination 2016-17
MECHANICAL VIBRATION
BRANCH: MECHANICAL
Time: 3 Hours
Max marks: 70
Q.CODE: Y216

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: **(2 x 10)**

a) Distinguish between longitudinal vibration and Transverse vibration along with diagrams and examples.

b) Determine the natural frequency of a spring-mass system by Rayleigh's method.

c) Explain D' Alemberts Principle and its significance for vibration through an example.

d) A harmonic motion has frequency value of 15cps and its maximum velocity is 5 m/sec. Find out its amplitude, time period of oscillation and maximum acceleration.

e) Distinguish between viscous damping and coulomb damping along with examples.

f) Give a diagrammatic comparison of motion under different types of damping conditions.

g) What is magnification factor? Draw the response curves between magnification factors against frequency ratio for different values of damping ratio.

h) Explain sharpness of resonance through diagram and quality factor.

i) Explain the transmissibility of motion and transmissibility of force and plot the response curves between transmissibility against frequency ratio of various values of damping factor

j) Explain the degrees of freedom and mode shapes of a system under vibration through diagram.

Q2 **a)** Find the natural frequency of vibration of a system as shown in fig.1. The rod is assumed to be rigid and weightless. **(5)**

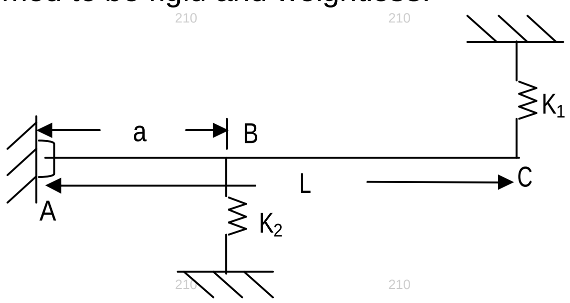

Fig. 1

b) A cylinder of mass ‘m’ and radius ‘r’ is connected by a spring of stiffness ‘k’ on an inclined plane as shown in fig.2. It is free to roll on the surface without slipping, find out the natural frequency. **(5)**

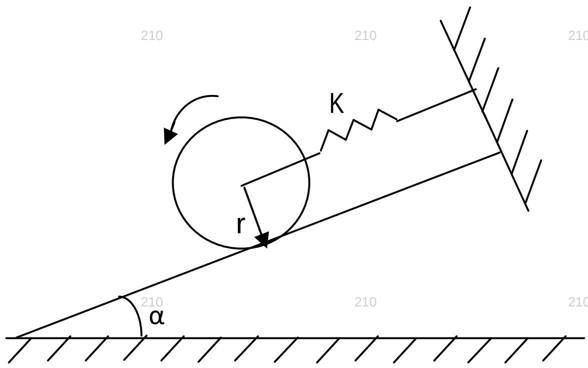

Fig-2

Q3 a) Find the frequency ratio for which the amplitude in forced vibration will be maximum. Also determine the peak amplitude and the corresponding phase angle. **(5)**

b) A spring mass damper system is defined by the following parameters **(5)**
m=3Kg, K=100N/m, C=3N-S/m.
Determine

i) The critical damping constant.
ii) Damping ratio.
iii) Frequency of damped oscillation
iv) Logarithmic decrement
v) No of cycles after which the initial amplitude is reduced to 20%.

Q4 a) A machine of 100Kg mass is supported on springs of total stiffness 700KN/m and has an unbalanced rotating element, which results in a disturbing force of 350N at a speed of 3000 rev/m. Assuming a damping factor of 0.25, determine (i) its amplitude due to the unbalance (ii) the transmissibility and (iii) the transmitted force. **(5)**

b) The spring of an automobile traler are compressed 0.1m under its own weight. Find the critical speed when the trailer is passing over a road with profile of sine wave whose amplitude is 80mm and the wavelength is 14m. find the amplitude of vibration at speed of 60 Km/hr (fig-3) **(5)**

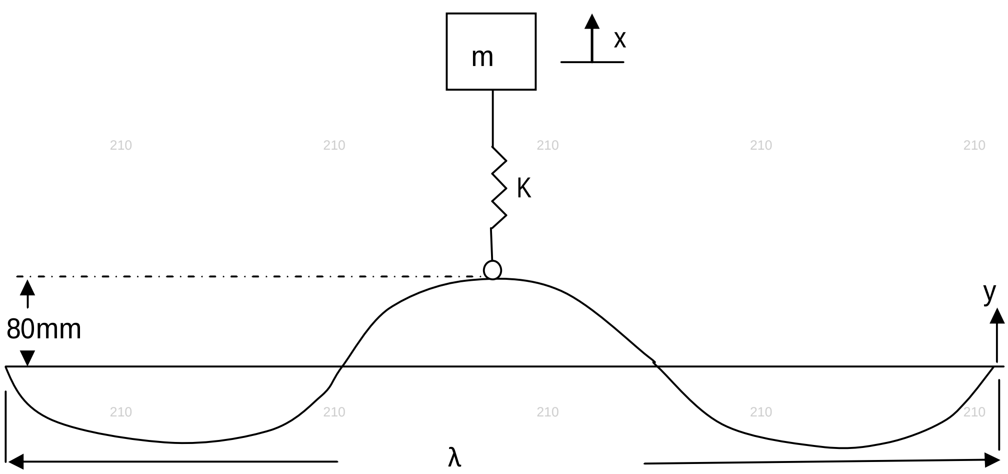

Fig-3

Q5 Find the natural frequencies, amplitude ratios and mode shapes of the system as shown in fig.4. When K=1000N/m and M=20Kg. **(10)**

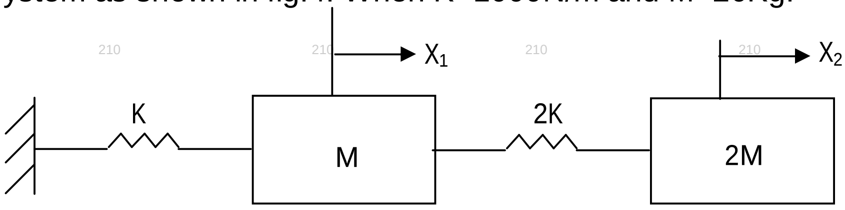

Fig-4

Q6 a) A beam of negligible weight and length 1.2m is simply supported at the ends and carries three transverse loads of 200N, 800N, and 400N at a distance of 0.3m, 0.6m and 0.9m from the left support. Find the frequency of transverse vibration by Dunkerley's method **(5)**

b) Consider a spring-mass damper system with K=4000N/m, M=10Kg and C=40 N-S/m. Find the steady state and total response of the system under harmonic force of F=200Sin 10t (N), and initial conditions x = 0.1m and $\dot{x}$= 0 at t = 0. **(5)**

Q7 a) A machine has a mass of 200Kg. It is placed on an isolator and the corresponding free vibration records one shown in fig-5. Determine the type of damping and its characteristics and also determine the undamped natural frequency. **(5)**

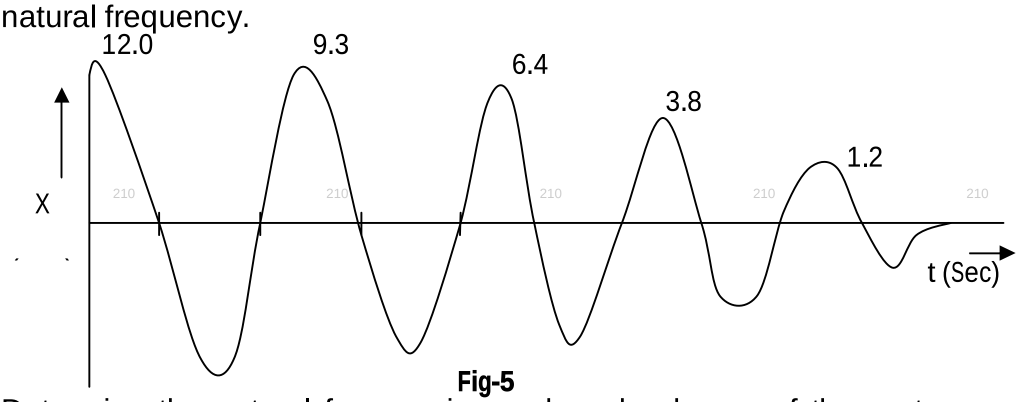

Fig-5

b) Determine the natural frequencies and mode shapes of the system as shown in fig-6 by using Holzer's method. **(5)**

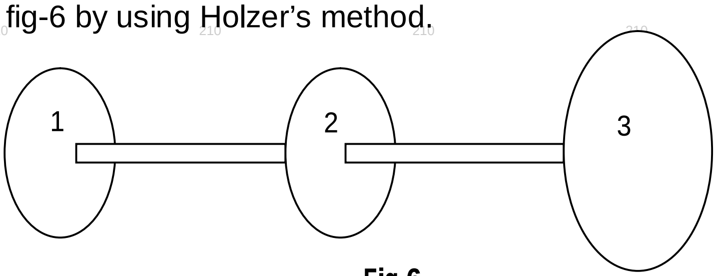

Fig-6

K_1 = 0.10 × 10^6 N-m/ rad
K_2 = 0.20 × 10^6 N-m/rad
J_1= 5.5 Kg-m^2
J_2 = 11.0 Kg-m^2
J_3 = 22.0 Kg-m^2

Q8 a) Determine the frequency equation for transverse vibration of a uniform beam fixed at both ends. **(5)**

b) Find out the natural frequencies for the transverse vibration of a beam simply supported at both the ends and draw the mode shapes. **(5)**