Printed Pages : 2 **Roll No.** | | | | | | | | | | | **EME024**

B.TECH.

THEORY EXAMINATION (SEM–VI) 2016-17

MECHANICAL VIBRATIONS

Time : 3 Hours ***Max. Marks : 100***

Note : *Be precise in your answer. In case of numerical problem assume data wherever not provided.*

SECTION – A

1. Explain the following: **10 x 2 = 20**

(a) What is Logarithmic decrement?

(b) What do you understand byself-excitation of vibrations.

(c) A car having a mass of 1000 kg deflects its springs 4 cm under its load. Determine the natural frequency of the car in vertical direction.

(d) Explain the term "Dynamic magnifier".

(e) What do you understand by critical speed?

(f) What are influence coefficients, Explain?

(g) An instrument has a natural frequency of 10 Hz. It can withstand a maximum acceleration of 10 m/sec^2. Find the maximum displacement amplitude.

(h) Explain the basic principle of vibration absorber.

(i) Define the stiffness coefficients.

(j) Explain the term Steady State vibrations.

SECTION – B

2. Attempt any five of the following questions: **5 x 10 = 50**

(a) A machine has a mass of 100kg and unbalance reciprocating parts of mass 2 kg which moves through a vertical stroke of 80mm with simple harmonic motion. The m/c is mounted on 4 springs, symmetrically arranged with respect to centre of mass. Neglecting damping, calculate the combined stiffness of the spring in order that the force transmitted to the foundation is 1/25th of the applied force, when the speed of rotation of crankshaft is 1000 r.p.m. When the m/c is actually supported on the springs, it is found that the damping reduces the amplitude of free vibrations by 25%. Find 1). The force transmitted to foundation at 1000 r.p.m 2) The force transmitted to the foundation at resonance. 3) The amplitude of forced vibration of the m/c at resonance

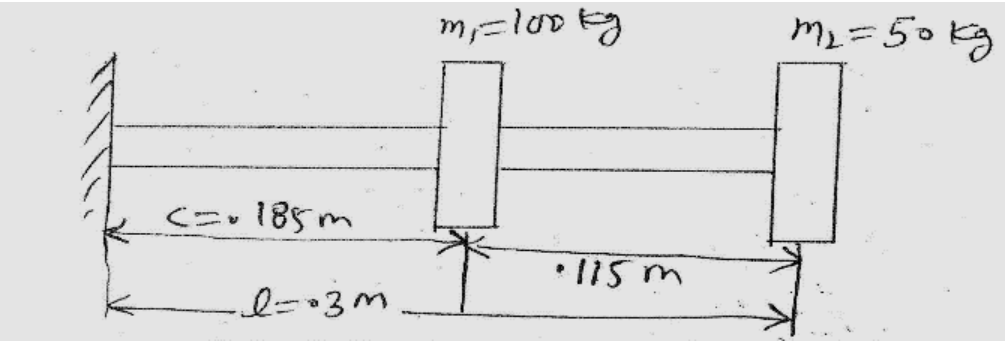
(b) A compressor runs at 5000 rpm with forcing frequency near to its natural frequency. Design a suitable vibration absorber for the system so that the nearest frequency should be at least 20% away from the forcing frequency. Assume mass of machine as 30kg

(c) Discuss some vibration measuring instruments in brief.

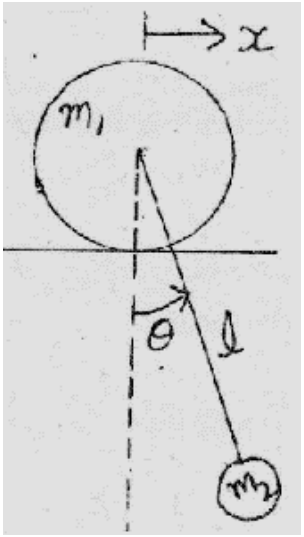
(d) Discuss Rayleigh's method for the analysis of MDF systems in detail.

(e) Derive the expression for finding out critical speed of a shaft having two discs.

(f) Find the fundamental natural frequency of transverse vibration of the shaft given below. E= 1.96 X10^{11} N/m^2 and I=4X10^{-7} m^4. Use Dunkerley's method.



(g) Derive the condition for frequency and amplitude of underdamped forced vibrations



(h) Find the natural frequency of the system shown in figure.

SECTION – C

Attempt any two of the following questions: **2 x 15 = 30**

3. Attempt all the parts.

(i) A spring mass system has spring stiffness k N/m and a mass of M kg. It has a natural frequency of vibration as 12 Hz. An extra 2 kg mass is coupled to M and the natural frequency reduces by 2 Hz. Find k and M.

(ii) A force $F_o \sin\omega t$ acts on a displacement $X_o \sin(\omega t-\pi/6)$where F_o=25N,X_o=0.05m $\omega=20\pi$rad/s.Find the work done during(a) first second (b) first 1/40 sec

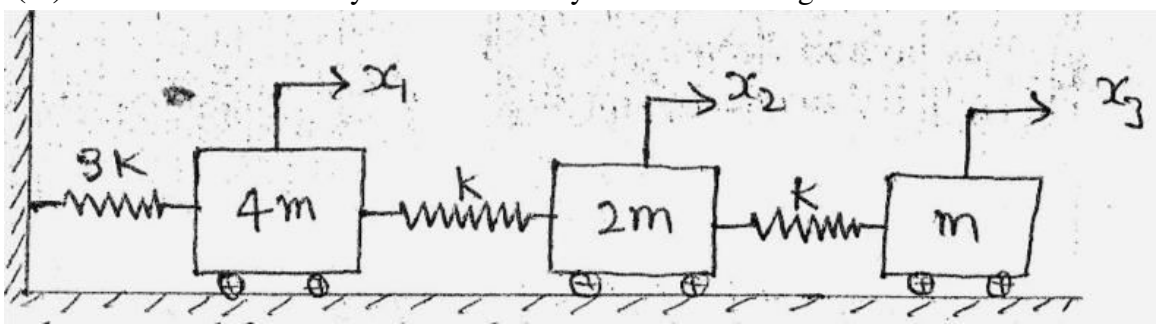
(iii) A body is subjected to two harmonic motions as given below.
$x_1 = 15 \cos(\omega t+\pi/6)$ and $x_2 = 25\cos(\omega t+\pi/3)$
What extra harmonic motion should be given to the body to bring it to the static equilibrium?

4. Attempt all the parts.

(i) Discuss in detail Dunkerley's Method of multi degree freedom.

(ii) State and explain Holzer method for finding the first natural frequency of a multi degree of freedom system.

(iii) Write the flexibility matrix for the system shown in figure.



5. Attempt all the parts.

(i) Determine the frequency equation in transverse vibration for a uniform beam of length "l" having one end fixed and the other end simply supported**.**

(ii) Discuss vibration measuring instruments in brief.

(iii) What do you understand by vibration isolation and transmissibility?