BACHELOR OF TECHNOLOGY (C.B.C.S.) (2014 COURSE)
B.Tech.Sem - VII MECHANICAL : : SUMMER - 2022
SUBJECT : MECHANICAL VIBRATION

Day : Monday
Date : 30-05-2022

S-13457-2022

Time : 02:30 PM-05:30 PM
Max. Marks : 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable **CALCULATOR** is allowed.
4) Assume suitable data if necessary.

Q.1 Define the following terms: **[10]**

i) Simple harmonic motion
ii) Natural frequency
iii) Resonance
iv) Periodic vibration
v) Non-linear vibration
vi) Degree of freedom

OR

Explain the steps involved in vibration analysis with suitable example. **[10]**

Q.2 Explain Newton's method for finding natural frequency of vibration system. **[10]**
Spring mass system having spring constant of K N/m and mass M kg. It has natural frequency of vibration as 15 cycles per second and extra 3kg mass is coupled to M and natural frequency is reduces by 2 cycles per second find K and M.

OR

Explain longitudinal and transverse vibration with example. **[10]**
An unknown mass M is attached to the one end of the spring of stiffness K having natural frequency of 10Hz. When additional mass of 2kg is attached with W, the natural frequency of the system is lowered by 25%. Find the value of unknown mass W and stiffness K.

Q.3 Define Coulomb damping. **[10]**
In single degree damped vibratory system, a suspended mass of 8kg makes 30 oscillations in 18 sec. The amplitude decrease to 0.25 of the initial value after 6 oscillations. Find:

i) Stiffness of spring
ii) Logarithmic decrement
iii) Damping factor
iv) Damping coefficient

OR

What is logarithmic decrement derive its expression. **[10]**
A shock absorber is to be designed so that its overshoot is 10% of initial displacement when release. Determine the damping factor, If the damping factor is reduced to 1/2 above calculated value, what will the overshoot?

Q.4 A single cylinder vertical petrol engine of total mass 400kg is mounted upon a steel chassis frame and causes a vertical static deflection of 4mm. The reciprocating parts of the engine have a mass of 20kg and move through a vertical stroke of 150mm with approximately SHM. If the dashpot is provided with damping resistance of 1600N-sec/m determine : **[10]**

i) The speed of the driving shaft at which the resonance will occur.
ii) The amplitude of steady state vibrations when the driving shaft of the engine rotates at 800rpm.

OR

P.T.O.

A rotor of 10kg mass is mounted midway on a 2cm diameter, horizontal shaft supported at the ends by two bearings. The bearing span is 80cm because of certain manufacturing defect the centre of gravity of the rotor is 0.01mm away from its geometric centre. If the system rotates at 3000rpm, determine the amplitude of the steady state vibration and dynamic force transmitted to the bearing. Take $E = 2 \times 9.81 \times 10^{10}$ N/m^2. **[10]**

Q.5 A shaft of 50mm diameter and 3m length has a mass of 10kg per meter length. It is simply supported at the ends and carries three masses of 70kg, 90kg and 50kg at 1m, 2m and 2.5m respectively from the left support, find the natural frequency of transverse vibration by Dunkerlay's method. **[10]**
Assume $E = 200 \times 10^9$N/m^2.

OR

Explain the concept of torsionally equivalent shaft. **[10]**
Determine the natural frequencies and the position of node of torsional vibration system having 2 rotors A and B attached to the ends of a shaft 1500mm long. The mass moment of inertia of rotor A is 650kg-m^2 and that of rotor B is 215kg-m^2. The shaft is 95mm diameter for the first 600mm, 60mm diameter for the next 500mm length and 50mm diameter for remaining length. Modulus of rigidity of shaft material is 0.8×10^5MPa.

Q.6 Write short notes on:

a) FFF Spectrum Analyzer **[05]**

b) Time Domain and Frequency Domain Signal Analysis **[05]**

OR

How the vibration measuring instruments are classified? Explain vibrometer in details with the help of figure. **[10]**

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