U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

February / March 2023 Semester End Main Examinations

Programme: B.E. **Semester: V**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 20AE5DCVTA **Max Marks: 100**
Course: Vibrations Theory and Aeroelasticity **Date: 23.02.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Define :

i. Damping
ii. Resonance
iii. Natural frequency
iv. Linear Vibration
v. Non Linear vibration

5

b) Define and explain the phenomenon of 'Beats'. **5**

c) Add the following harmonic motions analytically & check solution graphically. **10**

$X_1 = 4\text{Cos}(\omega t + 10^0)$ & $X_2 = 6\text{Sin}(\omega t + 60^0)$

UNIT - II

2 a) Determine the natural frequency of simple pendulum considering the mass of rod. **10**

b) Determine the natural frequency of the system shown in figure 2b. **10**

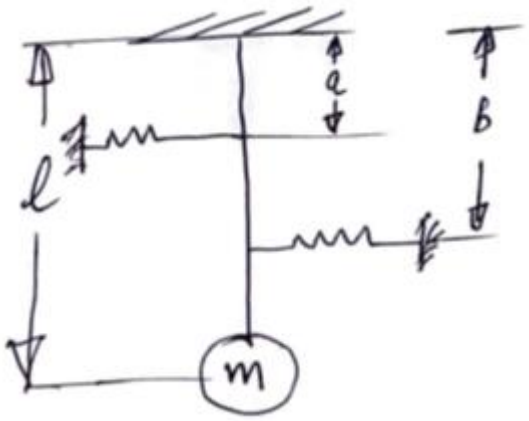

Figure 2b

UNIT - III

3 a) Define Logarithmic Decrement and derive the expression for same. **10**

b) A spring mass damper system is given an initial velocity of $A\omega_n$ where ω_n is the undamped natural frequency of the system. Find the equation of system for the cases i.e., i. $\xi = 2$ ii. $\xi = 0.2$. **10**

UNIT - IV

4 a) Define 'Magnification Factor' and derive the expression for 'Magnification Factor' due to harmonic excitation. **10**

b) A vibratory body of mass 150 kg supported on springs of total stiffness 1050 kN/m has a rotating unbalance force of 525N at a speed of 6000rpm. If the damping factor is 0.3, determine i. the amplitude caused by the unbalance and its phase angle ii. The transmissibility iii. The actual force transmitted and its phase angle . **10**

OR

5 a) Explain i. Vibrometer , ii. Accelerometer with necessary graphs and equations **10**

b) Determine the mass 'm' to be placed at the ends of the reeds of Frahm Tachometer in order that the reed be in resonance at a frequency of 1800 rpm. The steel reed is 50mm long, 6 mm wide and 0.75 mm thick. Youngs modulus of material of the reed is 19.6×10^{10} N/m^2. **10**

UNIT - V

6 a) Derive the governing equation for wing divergence. **10**

b) Explain the significance of wing flutter **6**

c) Explain collars triangle with respect to aeroelasticity **4**

OR

7 a) Determine the influence co-efficient of the problem shown in figure 7a and hence find the fundamental frequency by iteration method. Consider tension T in the string.

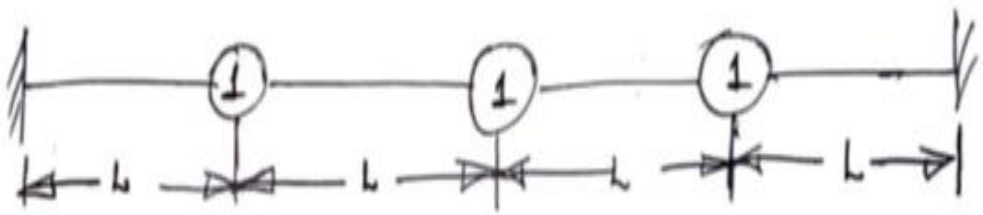

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Figure 7a

b) Determine the fundamental natural frequency of the system shown in figure 7b using Rayleigh's method. Take E = 196 GPa & I = 4 x 10^{-7} m^4 **10**

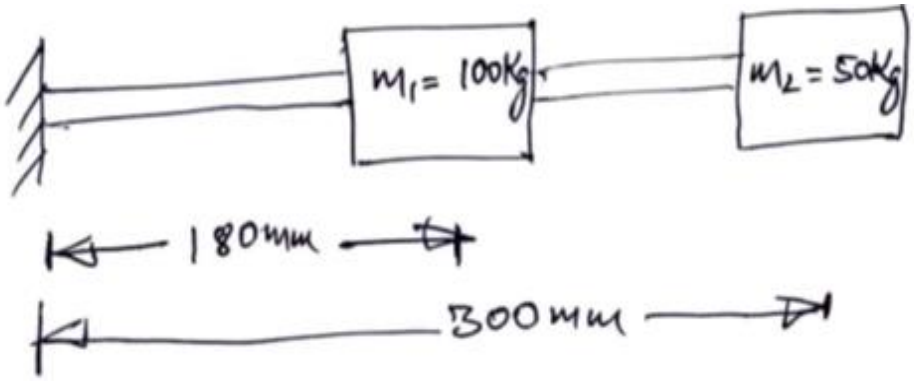

Figure 7b

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