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

Autonomous Institute Affiliated to VTU

February / March 2023 Semester End Main Examinations

Programme: B.E. **Semester: VII**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 21CV7PESDY **Max Marks: 100**
Course: Structural Dynamics **Date: 28.02.2023**

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) State and Explain D'Alembert's principle. **05**

b) Determine natural frequency, cyclic frequency and natural time period for the systems Shown in fig Q1 (b). Take $E=2x10^5$ N/mm^2. The C/S is same for both the systems. **08**

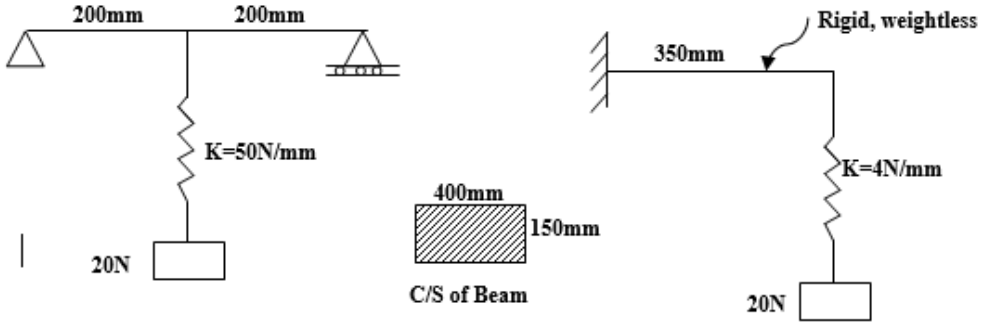

Fig Q1 (b)

c) A 2 kg block sits on a frictionless table and is connected to a coil of stiffness 4.935N/m. The mass is displaced 1 m and released with a velocity of 2.721 m/sec. Determine the natural frequency of the system and the amplitude and phase lag of the response. **07**

UNIT - II

2 a) Derive an expression for logarithmic decrement $\boldsymbol{\delta}$. **08**

b) A free vibration test is carried out on an empty elevated water tank. A cable attached to the tank applies a lateral force 144 kN and pulls the tank by 0.050m. Suddenly the cable is cut and the resulting vibration is recorded. At the end of five complete cycles, the time is 2 seconds and the amplitude is 0.035 m. Compute (a) stiffness, (b) damping factor (c) undamped natural frequency (d) weight of the tank (e) damping coefficient and (f) number of cycles when the amplitude becomes 0.005m. **12**

UNIT - III

3 a) Derive an expression for steady state response for the underdamped case of a spring mass-dashpot system, subjected to harmonic excitation $F_o \sin\omega t$. **10**

b) The foundation of a one-story building undergoes harmonic ground motion of magnitude 0.05 m and frequency 25 rad/sec. If the roof of the structure weighs one ton, the bending stiffness of each of the four identical 3.6 m columns is 1650 kN-m^2 and the structural damping factor at this frequency is estimated to be 0.1, determine the steady state amplitude. Also determine the magnitude of the shear force within each column. **10**

OR

4 a) Explain the behaviour of SDOF system subjected to a harmonic excitation with reference to Dynamic magnification factor Vs frequency ratio and phase angle Vs frequency ratio under different damping ratios. **10**

b) A building frame is modeled as an undamped single degree of freedom system shown in fig Q4 (b). Find the response of the frame if it is subjected to a blast loading represented by the triangular pulse shown in fig Q4 (b). **10**

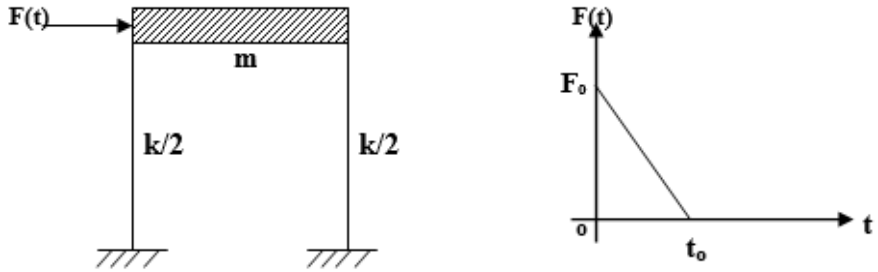

Fig Q4 (b)

UNIT - IV

5 Determine the natural frequencies and mode shapes of a 3 storied framed structure with mass at 1st, 2nd and 3rd floor is 110x10^3 kg, 160x10^3 kg and 30x10^3 kg respectively. Assume the stiffness of GF =20x10^6 N/m and the other two floors is 50x10^6 N/m and check the orthgonality of mode shapes. **20**

OR

6 Compute the steady state response of two storied shear building as shown in fig Q6. Take: Mass m_1=5000 kg, m_2=4000 kg. Given $(EI)_1$=8x10^6 N-m^2 and $(EI)_2$=10x10^6 N-m^2. **20**

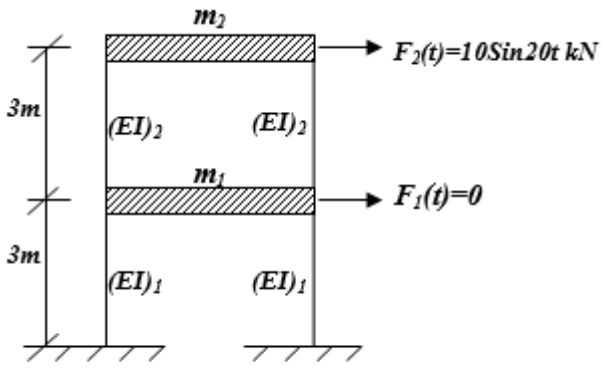

Fig Q6

UNIT - V

7	a)	Derive the governing differential equation for free flexural vibration of beam.	**10**
	b)	Explain the principle of vibration measuring instruments: 1) seismometer 2) accelerometer.	**10**

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