CBCS SCHEME

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15CV744

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021

Structural Dynamics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain the different methods to evaluate the damping in vibrating system. **(10 Marks)**

b. Form the equation of motion, express the frequency of motion for cantilever beam AB shown in Fig.Q1(b).

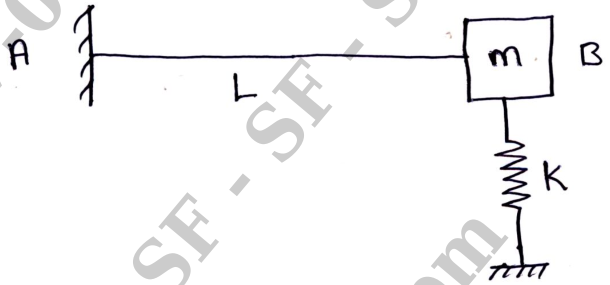

Fig.Q1(b) **(06 Marks)**

OR

2 a. Explain critical damping, under-damping and over-damping in a damped vibrating SDOF system. **(08 Marks)**

b. A SDOF system consists of mass with weight 6kN and spring with stiffness 5 N/mm. The system has the damping force of 300 N with a velocity of 250 mm/sec. find the damping ratio, damped frequency, logarithmic decrement and the ratio of two consecutive amplitudes. **(08 Marks)**

Module-2

3 a. Derive an expression for dynamic magnification factor for an under-damped SDOF system subjected to a harmonic loading, $F(t) = F_0 \sin\omega t$. **(08 Marks)**

b. A machine of weight 80 kN is mounted centrally on a simply supported beam, produces a harmonic force of magnitude F = 140 kN at frequency 60 rad/s. Neglect the weight of the beam and assume 15% of critical damping. Determine the amplitude of the motion of machine and the force transmitted to support. Given $E = 2 \times 10^5$ N/mm^2 and $I = 30 \times 10^6$ mm^4. Length of SSB = 3.5 m. **(08 Marks)**

OR

4 a. Explain beating phenomenon and resonance. **(08 Marks)**

b. A 1000 kg machine is mounted on four identical springs of total spring constant 'K' and having negligible damping. The machine is subjected to a harmonic external force of amplitude F_0 = 490 N and frequency 180 rpm. Determine the amplitude of motion of machine of maximum force transmitted to the foundation due to unbalanced force when (i) $K = 1.96 \times 10^6$ N/m (ii) $K = 9.8 \times 10^4$ N/m. **(08 Marks)**

Module-3

5 a. Explain the concept of shear building. **(06 Marks)**

b. Determine the natural frequencies and mode shapes of the vibration in the system shown in Fig.Q5(b).

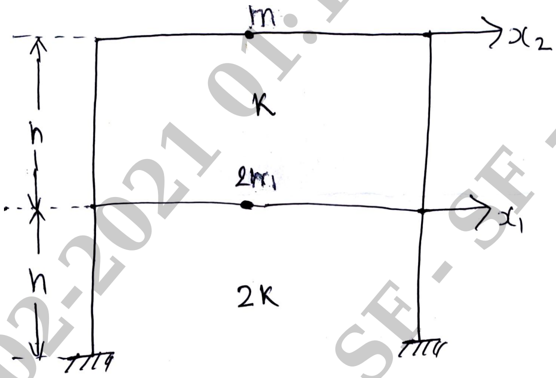

Fig.Q5(b) **(10 Marks)**

OR

6 For a three storeyed shear building shown in Fig.Q6. Compute the natural frequencies, natural periods and mode shapes. $K_1 = 40 \times 10^6$ N/m, $K_2 = K_3 = 100 \times 10^6$ N/m, $m_1 = 110 \times 10^3$ NS^2/m, $m_2 = 160 \times 10^3$ NS^2/m, $m_3 = 30 \times 10^3$ NS^2/m.

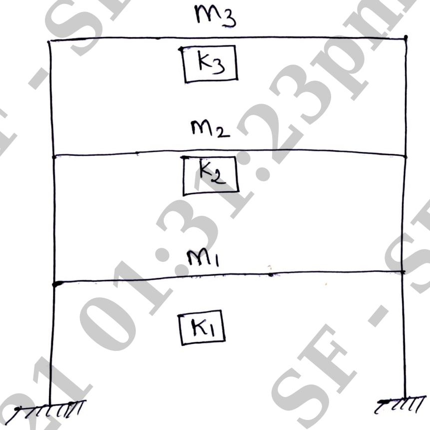

Fig.Q6 **(16 Marks)**

Module-4

7 Determine the response due to harmonic loading for the shear frame shown in Fig.Q7. Given $EI = 24 \times 10^6$ Nm^2, m = 500 kg, storey height = 3m, $P_1(t) = 0$, $P_2(t) = (10000 \sin 30t)$ kN.

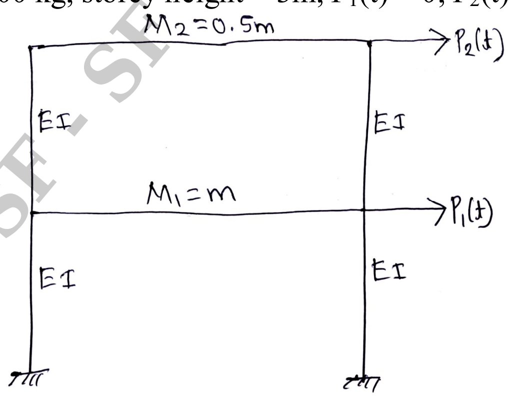

Fig.Q7 **(16 Marks)**

OR

8 Determine the response of the two storey shear building which viscously damped as shown in Fig.Q8.

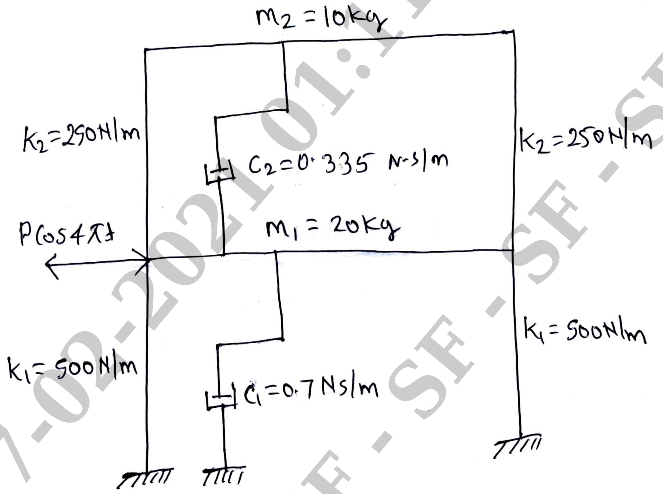

Fig.Q8 **(16 Marks)**

Module-5

9 Find the natural frequencies of the simply supported beam of length 'ℓ' using one finite element. **(16 Marks)**

OR

10 Find the natural frequencies of fixed uniform bar shown in Fig.Q10. Using consistent and lumped mass matrices. Use two bars elements for modeling.

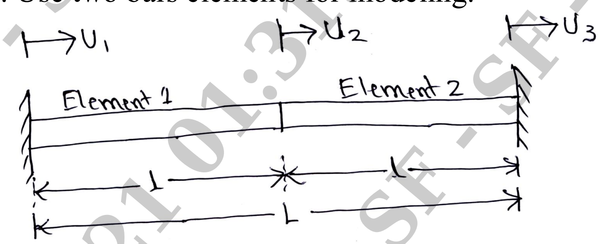

Fig.Q10 **(16 Marks)**

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