CBCS SCHEME

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15CV744

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020

Structural Dynamics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define the following terms:
(i) Amplitude (ii) Damping (iii) Resonance (iv) Free vibration **(04 Marks)**

b. Derive equation of motion for a freely vibrating undamped SDOF system and obtain its solutions. **(12 Marks)**

OR

2 a. Define logarithmic decrement and derive an expression for logarithmic decrements. **(09 Marks)**

b. An SDOF system having mass of 2.5 kg is subjected to free vibration with viscous damping. The frequency of oscillation is found to be 20 Hz and measurement of the amplitude of vibration shows two successive amplitudes to be 6 mm and 5.5 mm. Determine the damping coefficient. **(07 Marks)**

Module-2

3 a. Derive the expression for Duhamel's integral for the response of SDOF system subjected to arbitrary excitation. **(08 Marks)**

b. An SDOF system consists of a mass of 20 kg, a spring of stiffness 2200 N/m and a dashpot with a damping coefficient of 60 N.S/m is subjected to a harmonic excitation of F = 200sin5t. Write the complete solution of the equation of motion. **(08 Marks)**

OR

4 Derive an equation of motion for a damped harmonic excitation of a SDOF vibrating system and obtain its complete solution. **(16 Marks)**

Module-3

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

b. Determine the natural frequencies of the system shown in Fig.Q5 (b). **(10 Marks)**

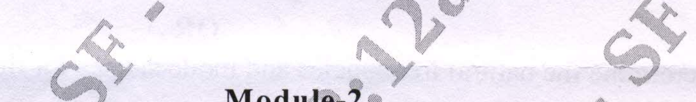

Fig. Q5 (b)

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.

OR

6 Determine the natural frequencies and mode shapes for the structure as shown in Fig. Q6.

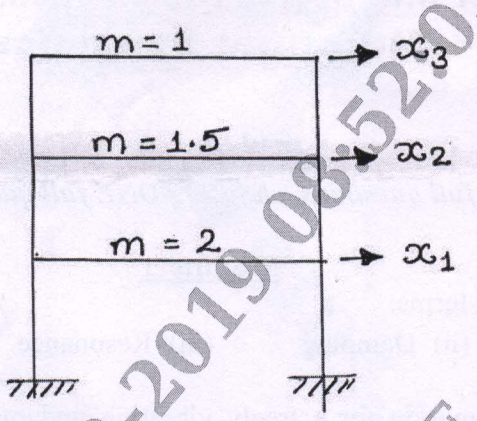

Fig. Q6

(16 Marks)

Module-4

7 a. What do you mean by decoupling of equations? Explain the concept of modal superposition method. **(08 Marks)**

b. Explain orthogonality principle. **(08 Marks)**

OR

8 Determine the natural frequencies and mode shapes for the given system. **(16 Marks)**

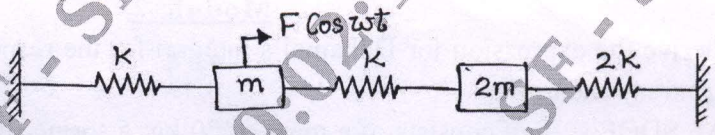

Fig. Q8

Module-5

9 a. Explain proportional damping in detail. **(08 Marks)**

b. Calculate the natural frequencies, mode shapes and damping ratio's for a proportionally damped system given by:

$$[M]=\begin{bmatrix}9 & -1\\ -1 & 1\end{bmatrix};\ [C]=\begin{bmatrix}3 & -1\\ -1 & 1\end{bmatrix} \text{ and } [K]=\begin{bmatrix}49 & -2\\ -2 & 2\end{bmatrix}.$$ **(08 Marks)**

OR

10 a. Explain consistent and Lumped mass matrices. **(08 Marks)**

b. Estimate the first 3 natural frequencies of a clamped free bar of length ℓ in torsional vibration by using a lumped mass model and 4 elements. (Element length = $\frac{\ell}{4}$). **(08 Marks)**

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