CBCS SCHEM

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15C\744

Seventh Semester B.E. Degree Examination, 9/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

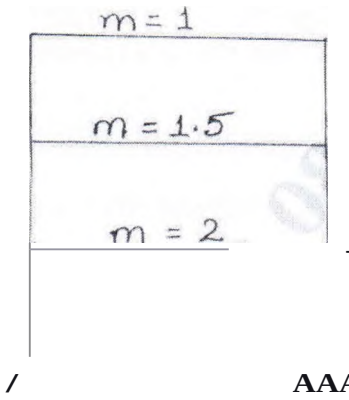
5 a. Explain the concept of shear building. **(06 Marks)**

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

Fig. Q5 (b)

OR

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



K_1=600 kN/m
K2 = 1200 kN/m
= 1800 kN/m

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:

$[M]=\begin{bmatrix} 9 & -1 \\ -1 & 1 \end{bmatrix}$; $[C]=\begin{bmatrix} 3 & -1 \\ -1 & 1 \end{bmatrix}$ $[K=49\ \ -2\ \ 2]$ (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 9 in torsional vibration by using a lumped mass model and 4 elements. (Element length = 4). **(08 Marks)**