USN | | | | | | | | | | |

10CV767

Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019
Structural Dynamics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

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.

PART – A

1 a. Define damping in structures and explain types of damping. **(06 Marks)**

b. A free vibration test conducted on a model of empty elevated water tank. A cable is attached to a tank applying a lateral force of 30N and pulls the tank horizontally by 3mm. The cable is suddenly cut and the resulting free vibration is recorded. At the end of four complete cycles the time is 2sec and the amplitude is 1mm. From these data compute the following :

i) Damping ration
ii) Natural period of undamped vibration
iii) Stiffness
iv) Effective weight
v) Damping co-efficient
vi) Number cycles required for the displacement amplitude to decrease by 0.5mm. **(14 Marks)**

2 a. Derive the expression for transmissibility of SDOF system subjected to harmonic excitation considering absolute displacement of mass and relative displacement. **(10 Marks)**

b. A structural system shown in figure is subjected to a harmonic excitation force. The excitation is caused by an rotating unbalance of 150N at an eccentricity of 200mm. Speed of the machine is 300 RPM. Calculate the steady state amplitude and maximum bending stress. E = 210GPa, I for each column = $205 \times 10^6 mm^4$, Z for each column = $1025 cm^3$, Damping ratio = 0.1. **(10 Marks)**

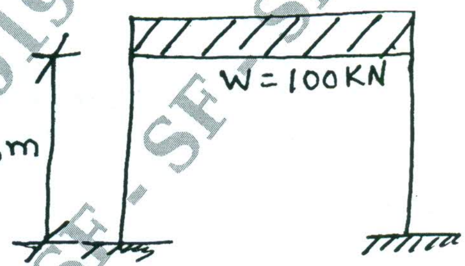

Fig Q2(b)

3 a. Derive Duhamel's integral for determining the undamped vibration response due to general dynamic loading. **(06 Marks)**

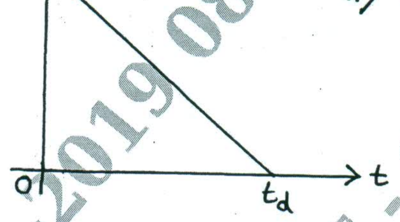

Fig Q3(b)

4 a. Explain behaviour of a SDOF system subjected to a harmonic excitation with reference to dynamic magnification factor and frequency ratio under different damping ratio's with the help of graph. **(06 Marks)**

b. What are the assumptions in multi degree of freedom systems? **(04 Marks)**

c. Develop the differential equation of motion in matrix form for the system shown in fig Q4(c).

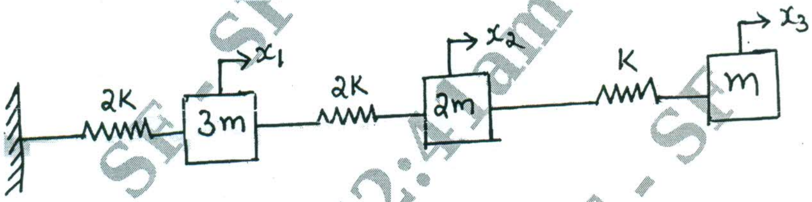

Fig Q4(c) **(10 Marks)**

PART – B

5 Compute the natural frequencies and mode shapes for the shear building as shown in Fig Q5 **(20 Marks)**

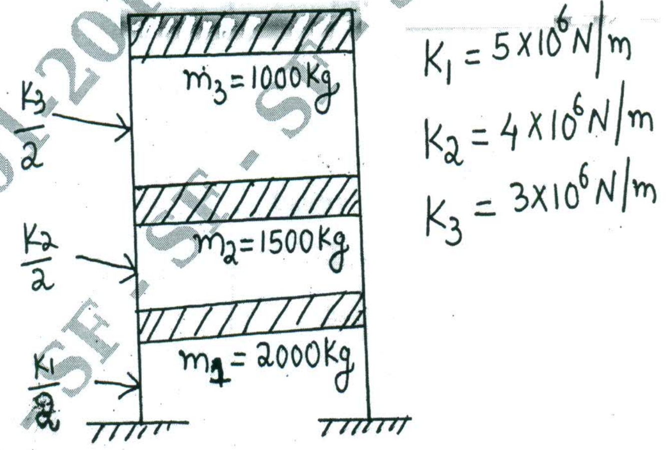

Fig Q5

6 For the shear building modeled as shown in Fig Q6, determine the natural frequency, normal modes and check orthogonality relation b/w normal modes. Also obtain steady state response. **(20 Marks)**

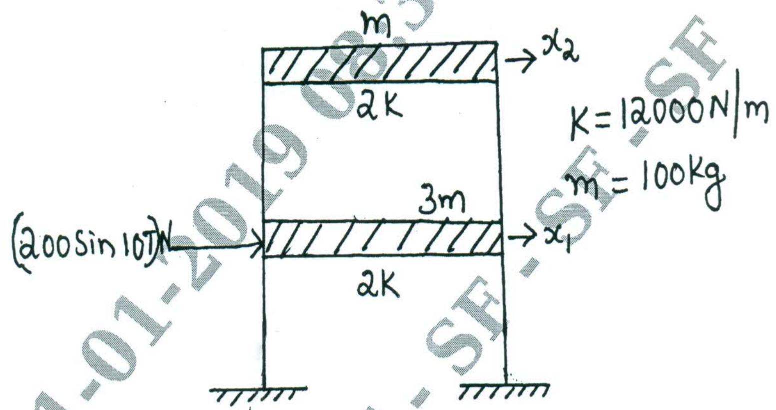

Fig Q6

7 For the two storied frame with viscous damping compute the displacement of top storey. Refer Fig Q7. **(20 Marks)**

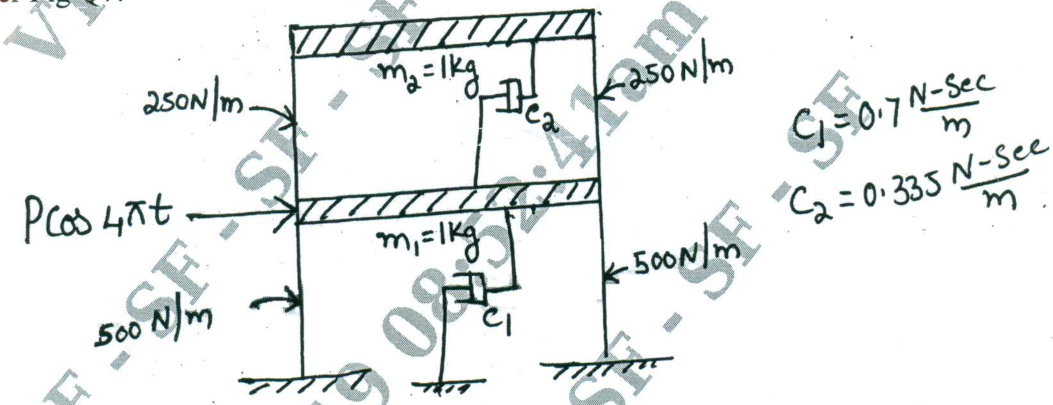

Fig Q7

Given :

$$w_{n_1} = 17.11 \text{rad/sec}$$

$$w_{n_2} = 41.32 \text{rad/sec}$$

$$[\phi] = \begin{bmatrix} 1 & 1 \\ 2.414 & -0.414 \end{bmatrix}$$

8 Write short notes on :

a. Logarithmic decrement
b. Springs in series and parallel
c. Orthogonality of mode shapes
d. Lumped mass and consistent mass formulation. **(20 Marks)**

* * * * *