Ex/CE/5/T/505A/2024(S)

BACHELOR OF ENGINEERING (CIVIL ENGINEERING) FIFTH YEAR

SECOND SEM. SUPPLEMENTARY EXAM. -2024

Subject: STRUCTURAL DYNAMICS **Time: 3 Hours** **Full Marks 100**

PART-I (marks-50)

Use a separate Answer-Script for each part

No. of questions	Answer all questions	Marks 15+15+10+10=50
1.	. Write short note: a. Logarithmic decrement b. Resonant response	7.5 x 2 =15
2.	Deduce the solution of equation of motion of a single degree of freedom system at free vibration condition for critically damped and underdamped system.	15
3.	A SDOF frame has a mass 5000 kg and having lateral stiffness k = 4.5 x10^6 N/m and damping ratio 4 percent. Determine its un damped and damped natural frequency.	10

4.	A Damped SDOF system has a mass of 400 N, stiffness of 20 kN/m and damping ratio 5%. It is subjected to a triangular force as shown in figure 1. The initial displacement and velocity are zero. Determine the displacement-time history up to 0.5 second taking time step as 0.1 second.	10

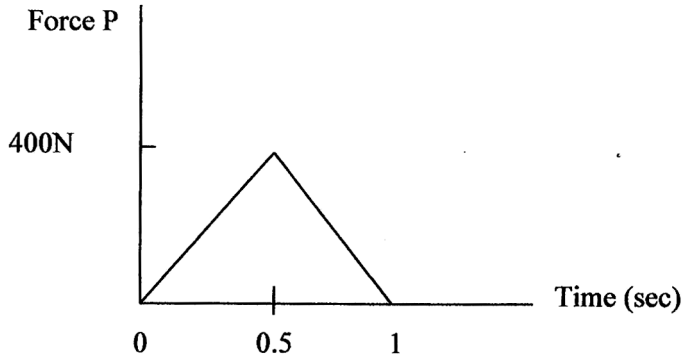


Fig. 1

Ref. No.: Ex/CE/5/T/505A/2024(S)

BACHELOR OF ENGINEERING (CIVIL ENGINEERING) FIFTH YEAR SECOND SEMESTER SUPPLEMENTARY EXAM 2024

Subject: STRUCTURAL DYNAMICS

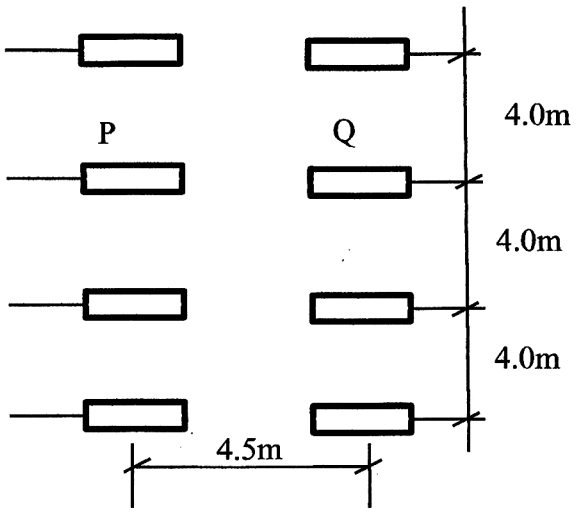
Full Marks:100 **Time: 3hours**

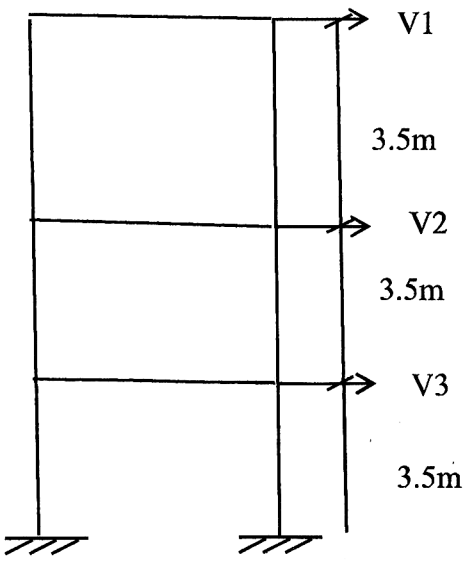
(Use Separate Answer scripts for each Part)

Part- II (Marks 50)

35

1. A three storeyed frame ***PQ*** and corresponding plan diagram are shown in Fig. 1. The total gravity load (*DL+LL*) intensity is 25.5 kN/m^2. Formulate the mass and stiffness matrix for this frame and evaluate the followings. Given, E=2 ×10^5 N/mm^2, c/s of column is 425mm ×425mm.
   a) Natural frequency and corresponding mode shape.
   b) Find displacement of the frame at t=8.6 sec, if frame is subjected to a displacement of $\begin{Bmatrix} V1 \\ V2 \\ V3 \end{Bmatrix} = \begin{Bmatrix} 41 \\ 24 \\ 14 \end{Bmatrix} mm$ at t=0.0 sec.





Frame PQ

2. The mass and stiffness matrix of a structure are given as **15**

$$m=\begin{bmatrix}6 & 0 & 0\\ 0 & 6 & 0\\ 0 & 0 & 2\end{bmatrix} \quad k=\begin{bmatrix}8 & -3 & 0\\ -3 & 6 & -1\\ 0 & -1 & 3\end{bmatrix}$$ and it is subjected to a force of, $F=\begin{bmatrix}0\\ 12\sin 9.8t\\ 0\end{bmatrix}$

If the displacement, velocity and acceleration at t=6.00sec are

$$v=\begin{bmatrix}0.62\\ 0.50\\ 0.32\end{bmatrix}m \quad \dot{v}=\begin{bmatrix}3.2\\ 2.1\\ 1.0\end{bmatrix}m/s \quad \ddot{v}=\begin{bmatrix}3.2\\ 1.2\\ 0.9\end{bmatrix}m/s^2$$

Find the responses of the structure at t=*6.25sec* and t=*6.50sec*.