Ex/CE/5/T/505B/2018(OLD)

B.E. CIVIL ENGINEERING (PART TIME) FIFTH YEAR

SECOND SEM. EXAM. -2018 (OLD)

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

PART-I (50 marks for each part)

Use a separate Answer-Script for each part

No. of questions	Answer question no.1 and any 3 from the rest	Marks (5+15x3)=50
1.	What do you know about free vibration, forced vibration and natural frequency	5
2.	Write short :	5x3=15
a)	D'Alemberts Principle	
b)	Viscous damping.	
c)	Dynamic magnification factor.	
3.		10+5 =15
a)	Deduce the solution of equation of motion of a single degree of freedom system at un damped condition and critically damped condition at free vibration.	
b)	What do you know about resonant response?	
4. a)	A harmonic oscillation test gives the natural frequency of an overhead water tank to be 0.50 Hz. Given that the weight of the tank is 950 kN. What deflection will result if 85 kN horizontal load is applied statically? The mass of the tank staging can be neglected.	10+5 =15

b)	A SDOF frame has a mass 4500 kg and having lateral stiffness $k = 4 \times 10^6$ N/m and damping ratio 4.1 percent. Determine its un damped and damped natural frequency.	
5.	Deduce the solution of equation of motion of a single degree of freedom system at forced vibration condition.	15

Form A : Paper-setting Blank

Ref. No. ...*EX/CE/5/T/505B/2018(Old)*

.....*B. E. Civil Engineering (Part Time) 5th Year*... EXAMINATION, *2018(Old)*
(~~1st~~ / 2nd Semester / ~~Repeat /~~ Supplementary ~~/ Annual / Bi-Annual~~)

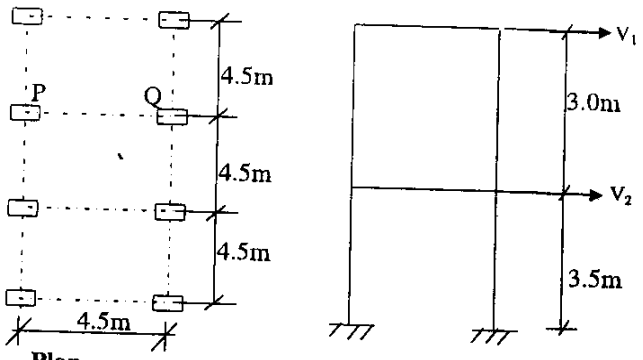
SUBJECT .....*Structural Dynamics*
(Name in full)

PAPER .....*XX*.....

Time: ~~Two hours~~/Three hours/~~Four hours/Six hours~~

Full Marks 100
(50 marks for part II)

Use a separate Answer-Script for each part

No. of Questions	PART II	Marks
	Assume reasonable data if not given	
	Answer Q.1 and any one from the rest	
1.	A two storeyed frame PQ and the corresponding plan diagram are shown in Fig.1. The total gravity load *(DL+LL)* intensity is 12.0 kN/m^2. Formulate the mass matrix and stiffness matrix for this frame and evaluate the followings. Given, E=2×10^{5}N/mm^2, c/s of column 300mm×300mm. a) Natural frequencies and mode shapes for this shear building. b) Find the displacement of the frame at t=*5.2sec* if the frame is subjected to a displacement of $\begin{Bmatrix} v_1 \\ v_2 \end{Bmatrix} = \begin{Bmatrix} 24 \\ 09 \end{Bmatrix} mm$ at $t = 0.0$ sec  **Fig.1**	35
2.	a) Starting from the dynamic equilibrium equation, find the uncoupled equation of motion for undamped system.	7
	b) Prove that for **Newmark's average integration method,** $\gamma = \frac{1}{2}$ *and* $\beta = \frac{1}{4}$.	8

3.	If the responses of the frame (**Fig.1**) due to the force ($F=8.5\sin 4.67$) at tip of the frame at $t=4.00sec$ are $v=\begin{Bmatrix}0.0045\\0.0022\end{Bmatrix}m,\quad \dot{v}=\begin{Bmatrix}-0.0080\\-0.0032\end{Bmatrix}m/\sec,\quad and\quad \ddot{v}=\begin{Bmatrix}-1.278\\-0.626\end{Bmatrix}m/\sec^2$ Find responses at $t= 4.50sec$ *and* $t = 5.00sec$. Use **Newmark's average integration method**. Mass and stiffness matrices are same as question no 1.	15