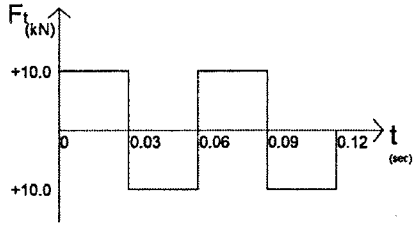
	Sanjay Ghodawat University, Kolhapur Established as State Private University under Govt. of Maharashtra. Act No XL, 2017	2019-20 EXM/P/09/01
Year and Program:2019-20	**School of Technology**	**Department of Civil Engineering** **M. Tech. Structural Engineering**
Course Code: CES503R1	**Course Title: Structural Dynamics**	**Semester – I**
Day and Date- Friday 20/12/19	**End Semester Examination (ESE)**	**Time:** 9hr 10.30am to 2.30pm **Max. Marks: 100**

Instructions:
1) All questions are compulsory.
2) assume suitable data wherever necessary.
3) Figures to the right indicate full marks.

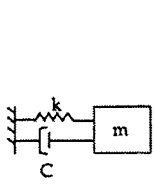
			Marks	Bloom's Level	CO
Q.1	a)	Derive the equation of motion and its solution for free damped vibration system.	08	L_4	CO1
	b)	A SDOF vibrating system is having following parameters. $m = 400\ kg$, $k = 320\ N/m$, $c = 80\ N-\text{sec}/m$ Determine (i) the damping factor (ii) the natural frequency of damped vibration (iii) logarithmic decrement (iv) the ratio of two successive amplitudes & (v) the number of cycles after which the original amplitude is reduced to 50%.	10	L_5	CO2
		OR			
	b)	A simply supported beam of negligible mass spanning $3.5\,m$ supports a machine of $80\ kN$ at center with an unbalanced rotor applying a vertical force of $200\sin 50t\ kN$. The damping is 15% & Flexural rigidity of beam is 6 x 10^{12} N-mm^2. Determine (i) maximum amplitude of vibration (ii) amplitude of transmissibility.	10	L_5	CO2
Q.2		Evaluate the displacement component using Fourier form of expression for the forcing functions shown in Figure below.	16	L_4	CO4

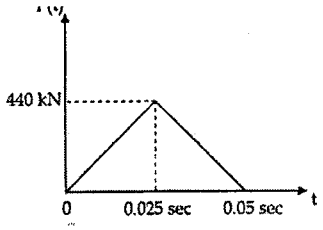


OR

Evaluate the response for the SDOF system in figure shown below for $t = 0$ to $0.06\,\text{sec}$, $k = 41\times10^3\ kN/m$, $m = 44000\ kg$, $\xi = 0.05$.	16	L_4	CO4

ESE





Q.3	Determine fundamental frequency and corresponding modes of vibration of the following two storey frame as shown in Figure 1. $E = 2.1\times10^5 N/mm^2$, $I = 6000cm^4$	16	L_4	CO3
Q.4	Evaluate the steady state response of the top level of a three story frame is subjected to a harmonic load of $100\sin(0.5\omega_{n1})t\ kN$ at top level. Considering the contribution from first two mode only. Take $m_1 = m_2 = m_3 = 20000\,kg$, $k_1 = k_2 = 160$ kN/m and $k_3 = 240$ kN/m. Stories are numbered from top to bottom. $[\omega] = \begin{bmatrix}43.872\\120.155\\167.000\end{bmatrix} rad/sec$ and $[\emptyset] = \begin{bmatrix}1.000 & 1.000 & 1.000\\0.7594 & -0.8047 & -2.427\\0.3361 & -1.1572 & 2.512\end{bmatrix}$	18	L_4	CO3
Q.5	Compute the response due to harmonic loading for shear frame shown in Figure 2. $EI = 25\times10^6 Nm^2$ and $P_t = 12000\sin45t\ kN$ (damped structure)	16	L_5	CO3
Q.6	Determine the amplitude of the response at quarter point from left support of a simply supported beam due to the first three modes, neglecting damping, for the beam particulars given below. $EI = 5\times10^{16} N-m^2, m = 500\times10^3 N-s^2/m, L = 320cm$ $P_t = 1000\sin500t\ N$ applied at mid-span.	16	L_5	CO4

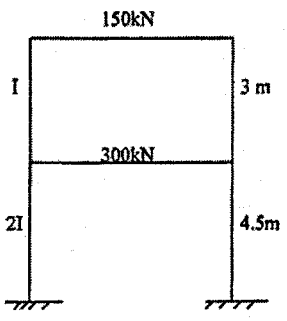


Figure 1

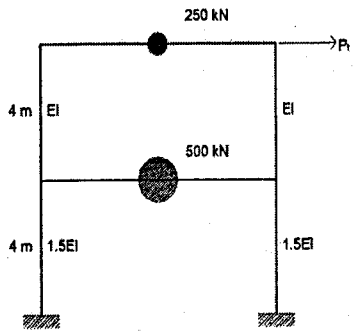


Figure 2

ESE