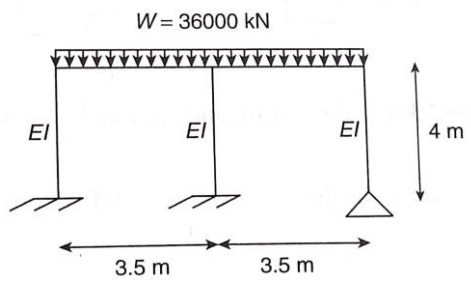
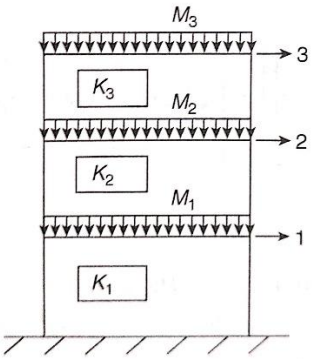
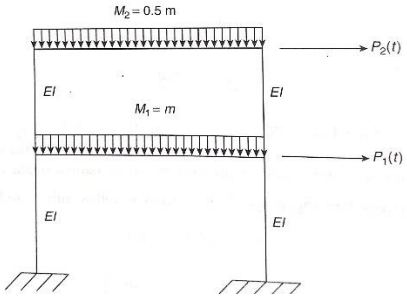
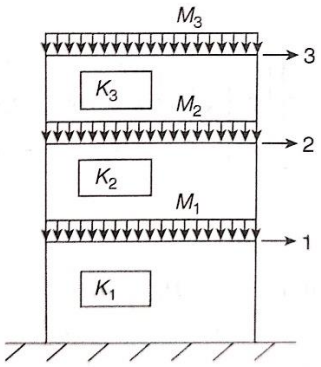
GLOBAL ACADEMY OF TECHNOLOGY **PG**
(Autonomous Institution, Affiliated to VTU)
SEE MODEL QUESTION PAPER
First Semester M.Tech. STRUCTURAL ENGINEERING
20MST14: Structural Dynamics

Time: 3 hr. **Max Marks: 100**

Q.No.	Module 1	Marks
1a	State and explain D'Alemberts principle? Derive the equation of motion and expression for x(t) for the free undamped vibration of SDOF system.	15
1b	An SDOF system of mass *m* & stiffness K is found to vibrate with a period of 0.12sec. When the mass is increased by 3kg, the period recorded is 0.135sec. Determine mass and stiffness for the original system.	05
	OR	
2a	Derive the equation of motion and expression for x(t) for the free damped vibration of SDOF system.	10
2b	Compute the natural frequency in the side sway for the frame shown in Fig.1 if the initial displacement is 30mm and the initial velocity is 30mm/sec, compute the displacement at t=2sec. Given EI=$30x10^{12}$ Nmm^2.  Fig. 1	10
3a	Derive an expression for Duhamel's Integral in respect of SDOF system to general dynamic loading?	10
3b	Compute the magnification factor of forced vibration produced by a machine operating at a speed of 600 rpm, installed at the middle of the beam. The static deflection at the middle of the beam due to weight of the machine W= 5000N is δ_{st} = 0.25mm. Neglect the weight of the beam and consider the viscous damping force of 500N at a velocity of 25mm/sec	10
4	Obtain the expression for the response of a damped SDOF system subjected to harmonic base motion in terms of relative displacement and phase angle. Obtain the expression for transmissibility ratio and show a typical sketch of transmissibility versus frequency ratio for different values of damping.	20
5	For a three storeyed shear building as shown in Fig.2, compute the natural frequencies, natural periods, and mode shapes. Plot the mode shapes. Neglect axial deformations in all structural elements. Given:	20

	Stiffness of floor: K_1= 3x10^{6}N/m, K_2=K_3 = 4x10^{6}N/m Mass of floor: M_1=2x10^3 kg, M_2= 1.5x10^3 kg, M_3=1.0x10^3 kg  Fig.2	
6	Compute the response due to harmonic loading for the shear frame shown in Fig.3. Given K1=2.5x10^{6}N/m, K2=5.0x10^{6}N/m, M1=25X10^{3}kg and M2=15X10^{3}kg, $P_1(t)$=50000sin(20t)N, $P_2(t)$=0, storey height=3m  Fig.3.	20
7a	Explain the term shear building along with assumptions made in the analysis of shear building. Write short note on orthogonality of modes.	10
7b	Explain normal mode method and response of MDOF system with different methods of evaluation of damping?	10
8	For a three storeyed shear building as shown in Fig.4, compute the natural frequencies, natural periods and mode shapes. Plot the mode shapes. Neglect axial deformations in all structural elements. Given the stiffness and mass of each floor as Stiffness of floor: K_1= 40x10^{6}N/m, K_2=K_3 = 100X10^{6}N/m Mass of floor: M_1=110X10^3 kg, M_2= 160x10^3 kg, M_3=30x10^3 kg	20

	 Fig.4	
9a	Derive the governing differential equation for a free flexural vibration of beam.	10
9b	Explain the lumped mass and consistent mass formulation for vibration of beam.	10
	OR	
10	Derive the natural frequency expression and draw mode shapes for a longitudinal vibration of a bar.	20