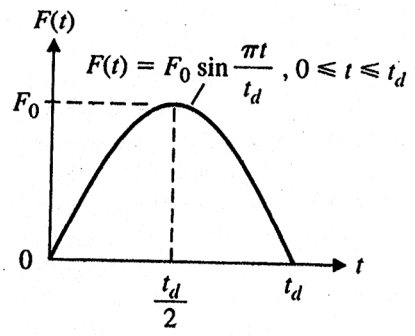
Ex/PG/CIV/PC/T/114B/2025

M.E. CIVIL ENGINEERING FIRST YEAR FIRST SEMESTER EXAM 2025

Dynamics of Structures

Time: Three Hours | Full Marks 100

No. of questions	Part -I (Answer Any THREE of the following questions.)	Marks (3X20=60)
1)	A single degree of freedom system mass 100kg stiffness 10kg/mm and damping=0.1 is excited by F(t)=5 cos 5t Determine any four of the followings i) Auto correlation function of excitation ii) Mean and mean square value of excitation iii) Fourier series expansion of excitation iv) Power spectral function of excitation iv) Mean square value of response	(4X5)
2) (a)	Derive Duhamel's integral for a single-degree-of-freedom (SDOF) system subjected to a general dynamic force. Explain its significance in solving dynamic response problems.	10
(b)	Use the Duhamel integral method to construct a response spectrum for a sine pulse of duration t_d as shown in Figure. Plot DMF versus t_d /T over the time interval $6 \geq t_d/T \geq 0$  	10
3 (a)	Derive the equation of motion in free vibration of a flexural uniform beam.	10
(b)	Determine the natural frequencies and mode shape for uniform beam with both end simply supported.	10
4) (a)	Define different Lagrangian coordinates.	8
b)	Derive equation of motion of of a simple pendulam having mass M and length L and find time period using Lagrangian method.	12

[Turn over

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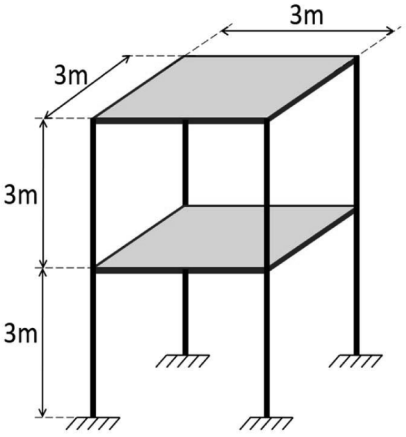
Name of the Examination: M.E. CIVIL ENGINEERING FIRST YEAR FIRST SEMESTER - 2025
Subject : DYNAMICS OF STRUCTURES

PART-II

Marks: 40

Instructions:	
I	All notations represent their standard relevant meaning.
II	If you feel that any data or condition is/are missing in any question, please assume relevant inputs and mention the same.

Sl No	**Question**	**Marks**
1	(a) Form equation of motion of a single degree of freedom undamped system under free vibration and derive the expression of velocity. (7 marks) (b) Consider a single degree of freedom system of mass = 55 kg, stiffness = 25 kN/m and damping ratio= 0.1. Find out damped circular frequency and Time period. (5 marks)	12
2	Derive the expression for Force Transmissibility? (7 Marks) An instrument of 90 kg is installed on a floor. The instrument is vibrating in a harmonic manner with force amplitude = 315 kN and exciting frequency 55 rad/sec. If the instrument rests on a fixed pad that provides stiffness of 65 kN/m between the instrument and the floor, considering damping ratio as 0.1, find out amplitude of force transmitted to the floor. (7 Marks)	14
4	A two storey PCC frame as shown in Figure: 1 made of M25 concrete (of density 2400kg/m^3) is having identical features in both storey. Thickness of the Slabs are 125mm and the columns are each of 350mm x 350mm cross section. Draw mode shapes of the system with respect any of its primary lateral directions. Consider the structure without any beam and ignore the mass of the columns.  Figure: 1 (Not to scale)	14