Register No.: .... Name: ....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH DEGREE EXAMINATION (R), DECEMBER 2023
CIVIL ENGINEERING
(2020 SCHEME)

Course Code : **20CET391**

Course Name: **Structural Dynamics**

Max. Marks : **100** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. A weight of 20 N is suspended at the midpoint of a simply supported beam using a coil of stiffness 40 N/mm. The mass of the beam is negligible in comparison to the suspended mass. Determine the angular frequency and natural period of vibration. E = 2.1×10^5 MPa, I = 281.25×10^5 mm^4.
2. Explain the importance of the logarithmic decrement method. How is it estimated?
3. Elucidate Transmissibility.
4. Describe the applications of vibration isolation systems.
5. Explain shear building frames.
6. State and explain the orthogonality condition.
7. Explain the concept of frequency response function (FRF).
8. Explain mode superposition method of analysis.
9. Describe seismic waves.
10. Define seismology. List out the causes of earthquake.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11.	a)	Differentiate among critically damped, over-damped, and under-damped systems.	(4)
	b)	In a system, the amplitude of motion reduces from 0.5 m to 0.1 m in 4 cycles in 8 seconds, Find (i) the damped natural period (ii) logarithmic decrement (iii) the damping ratio (iv) the damping coefficient if k=12.5 N/mm and m=2 kg.	(10)

OR

12	A generator of 1-ton weight is placed on a concrete plank of width 500 mm, length 2 m and thickness 120 mm. The generator is running at 2000 rpm. The plank is made up of M20-grade concrete. Find (i) static	(14)

deflection (ii) dynamic deflection of generator assuming the system is undamped (iii) dynamic deflection assuming 5% damping.

MODULE II

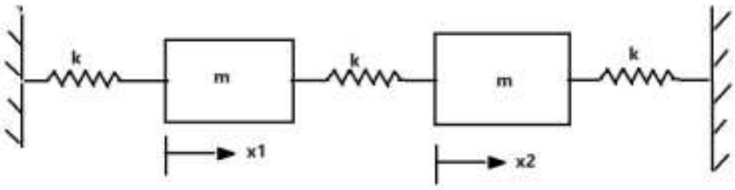
13. A 1000 kg machine is mounted on four identical springs of total spring constant k and having negligible damping. The machine is subjected to a harmonic external force of amplitude 500 N and frequency of 180 rpm. Determine the amplitude of motion of the machine and the maximum force transmitted to the foundation because of unbalanced force (i) when k=1.96 x 10^5 N/m (ii) when k= 9.8 x10^4 N/m. (14)

OR

14. a) Elucidate the concept of Duhamel Integral. (4)
    b) Derive the expression for steady-state response and DLF for a rectangular impulse. (10)

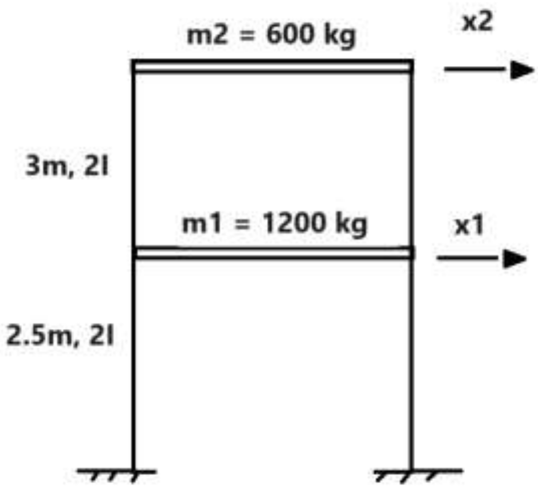
MODULE III

15. Determine the natural frequencies and mode shape of the system given below. (14)



OR

16. Calculate the natural frequency and mode shapes of vibration for the MDOF system shown in the figure. I= 5 x10^5 mm^4, E = 2.5 x10^4 N/mm^2 for all columns. (14)

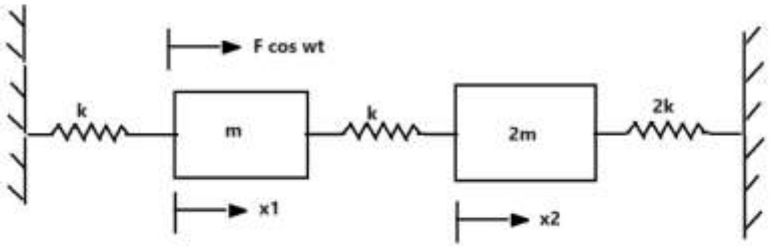


MODULE IV

17 Derive the characteristic equation of forced vibration of the undamped MDOF system. (14)

OR

18. Determine the modes of vibration and the steady-state response of the system given below. (14)



MODULE V

19. a) Explain earthquake analysis using the response spectrum method. (4)

b) What is design response spectra? How is it developed? Explain the response spectra as specified in IS 1893:2002 (10)

OR

20. Determine the natural frequencies and mode shapes of a uniform thin slender rod having one end fixed and the other end free. Plot the first three principle mode shapes. (14)

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