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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SECOND SEMESTER M.TECH DEGREE EXAMINATION (Regular), JULY 2022

STRUCTURAL ENGINEERING AND CONSTRUCTION MANAGEMENT

(2021 Scheme)

Course Code: **21SC202**

Course Name: **Structural Dynamics**

Max. Marks: **60** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Explain Degrees of freedom with suitable examples.
2. Explain the physical importance of logarithmic decrement and define equation for the same
3. Explain the salient features of frequency response curve of a damped SDOF system having harmonic excitation.
4. What is meant by orthogonality principle in multi degree of freedom system?
5. How to approximate the two lowest frequencies of the continuous system using Rayleigh – Ritz method?
6. What is meant by Mode superposition method?
7. List out various methods to solve nonlinear vibration problems.
8. What is the importance of using Runge Kutta method as a Numerical Techniques

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

9. a) What is meant by equations of motion? Explain two methods employed for the formulation of the equations of motion. (6)

OR

10. a) Determine the natural frequency of a simply supported beam of span L meters carrying a concentrated weight W newton at its center. Neglect the mass of the beam (3)
    b) Develop the mathematical model of a single degree of freedom system (3)

MODULE II

11. a) A vibrating system consisting of a weight of 100 N and spring stiffness of 4000 N/m is viscously damped so that two consecutive amplitudes measured are 150 mm and 8021 mm respectively. Determine the logarithmic decrement and the coefficient of damping. (6)

OR

12. a) Write short note on any two vibration measuring instruments (6)

MODULE III

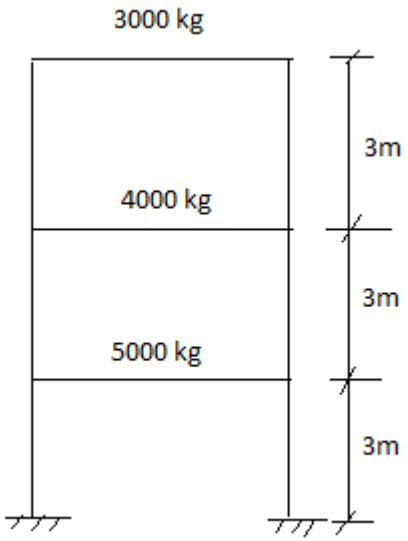
13. a) A steel rigid frame of height 4 m supports a rotating machine which exerts a horizontal force at the girder level of 50000 sin11t N. Assume 4% critical damping and mass of the girder as 5000 kg. What is the steady state amplitude of vibration? (Take I = $1500x10^{-7}$ m^4 and E = $2x10^{10}$ N/m^2). (6)

OR

14. a) Derive the equation for response of an undamped SDOF system excited by a force F(t) = F sin wt. (6)

MODULE IV

15. a) Calculate the natural frequency and mode shapes of vibration for the MDOF system shown in figure. EI = 4.5 $x10^6$ $N\text{-}m^2$ for all columns (6)

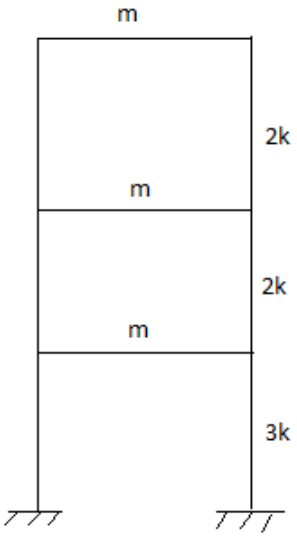


OR

16. a) Determine the natural frequencies and mode shapes of a uniform thin slender rod having one end fixed and other end free. Plot the first three principle mode shapes. (6)

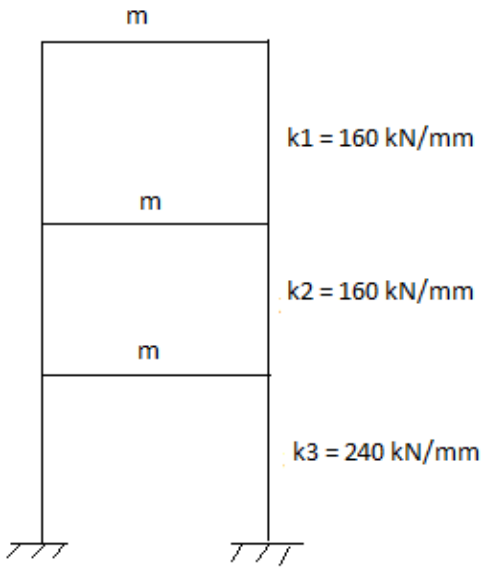
MODULE V

17. a) For the multistory building shown in fig, obtain frequencies and modes of vibration using Stodolla's method (6)



OR

18. a) A three-storey frame is subjected to an excitation force of P cos (wt) at the top level due to steady state vibration. Determine the response at the top level by the mode acceleration method, on the basis of consideration of first two modes for w=0 and w=0.5p_1. Given m= 20000 kg.



(6)

MODULE VI

19. a) Substantiate the relevance of the numerical technique the Wilson Theta method of used for non-linear dynamic analysis (6)

OR

20. a) Substantiate the relevance of the numerical technique Newmark Beta method used for non-linear dynamic analysis (6)

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