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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SECOND SEMESTER M.TECH DEGREE EXAMINATION (Regular), MAY 2023

GEOMECHANICS AND STRUCTURES

(2021 Scheme)

Course Code: **21GS203**

Course Name: **Dynamics of Soil and Design of Machine Foundations**

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

Use of IS: 2974(Part I) - 1982 and IS: 2974 (Part II) - 1980 are permitted

PART A

(Answer all questions. Each question carries 3 marks)

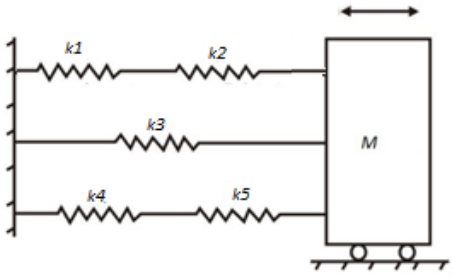
1. A vibration system consists of mass of 6 kg, a spring stiffness of 0.7 N/m and a dashpot with a damping coefficient of 2 N-s/m. Determine the critical damping and damping ratio.
2. Describe different types of damping.
3. Enlist the different modes of vibration of a foundation block?
4. Explain the design criteria of reciprocating type machine.
5. Discuss the design criteria of impact type machine.
6. Explain hammer foundation with a neat sketch.
7. Differentiate between force isolation and motion isolation.
8. Describe the properties of vibration isolators.

PART B

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

MODULE I

9. For the system shown in following fig; calculate the natural frequency and time period. Given;
   k_1 = 100 N/mm, k_2 = 200 N/mm, k_3 = 150 N/mm, k_4 = 100 N/mm, k_5 = 150 N/mm and M = 100 kg. (6)



OR

10. Derive the expression for magnification factor in case of forced vibration with viscous damping. (6)

MODULE II

11. Explain cyclic plate load test with neat sketch, for the determination of coefficient of elastic uniform compression. (6)

OR

12. A foundation is subjected to a constant force-type vertical vibration. Given: Weight of the machine and foundation block, W = 400 kN; γ = 18.0 kN/m^3; G = 38000 kN/m^2; μ = 0.25 and Q_0 = 10 kN and operating frequency 2000 cpm. Size of the foundation, L= 3.5 m and B = 2.5 m. Determine; (a) the resonant frequency (b) the amplitude of vibration at operating frequency using elastic half space method. (6)

MODULE III

13. Explain in detail the general considerations in the design of machine foundations. (6)

OR

14. A reciprocating machine is symmetrically mounted on a block of size 5.0 m x 4.0 m x 3.0 m high. The soil at the site is sandy in nature having γ_{sat} = 18 kN/m^3. The machine vibrating at a speed of 250 rpm generates; (6)
Maximum vertical unbalanced force = 4 kN.
Torque about z-axis = 4.0 kN-m.
Maximum horizontal unbalanced force = 2.5 kN at a height of 0.2 m above the top of the block.
The machine weight is small in comparison to the weight of foundation. The data obtained from the test is as follows:
C_u = 3.62 x 10^4 kN/m^3 and E = 8.89 x 10^4 kN/m^2 and μ = 0.35
Determine the natural frequencies and amplitudes by linear weightless spring method.

MODULE IV

15. Explain the single crank mechanism of a reciprocating type machine with a neat sketch. Also give expression for unbalanced forces in a single cylinder and two-cylinder engine. (6)

OR

16. The following data refer to a single cylinder reciprocating machine; (6)
crank radius = 100mm, length of connecting rod = 300 mm, operating speed = 1500 rpm, weight of reciprocating parts = 45 N, weight of rotating parts = 9 N. Calculate the maximum unbalanced force generated by the machine.

MODULE V

17. Explain IS code procedure for design of impact type machine foundations. (6)

OR

18. Consider the case of a drop hammer foundation. For this system the frame is attached to the anvil. Given are the following: (6)
Weight of the anvil and frame = 580 kN;
Weight of foundation = 900 kN;
Spring constant for the elastic pad between the anvil and foundation = 2. 2 x 10^6 kN/m;
Spring constant for the soil supporting the foundation = 320 x 10^6 N/m;
Weight of tup = 35 kN;
Velocity of tup before impact = 3 m/s;
Coefficient of restitution, e = 0.4.
Determine the amplitude of vibration of the anvil and the foundation.

MODULE VI

19. Explain active and passive isolation with clearly specifying the requirements in the construction of open trenches. (6)

OR

20. A 75 kg machine is mounted on springs of stiffness 11.76 x 10^5 N/m. A 2 kg piston within the machine has a reciprocating motion with a stroke of 0.08 m and a speed of 3000 cpm. Assuming a damping factor of 0.2, determine amplitude of vibration of the machine and the vibratory force transmitted to the foundation. (6)

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