DEPARTMENT OF MECHANICAL ENGINEERING

UNIVERSITY INSTITUTE OF ENGINEERINGAND TECHNOLOGY, CSJM UNIVERSITY, KANPUR

DYNAMICS OF MACHINE AND VIBRATIONS (MEE-S301)

Semester: 2022-23 (Odd Semester) **Year: 3rd Year (2K19)**

End Semester Examination

Time: 3 h **Maximum marks: 50**

All questions are compulsory

Section A

10 marks (10 questions of 1 mark each)

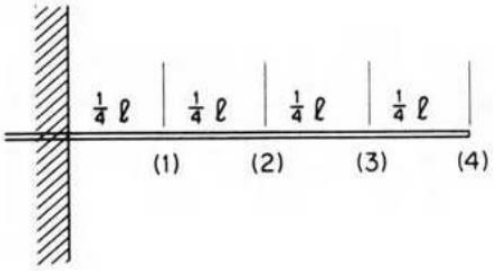
1. A simple spring-mass vibrating system has a natural frequency of N. If the spring stiffness is halved and the mass is doubled, then what will be the effect on natural frequency?
2. What do you understand by hunting?
3. Write the relationship between height of watt governor and speed of spindle.
4. What do you understand by controlling force in governor?
5. What do you understand by effort in a governor?
6. Write the expression of sensitiveness of a governor?
7. What do you understand by Flexibility influence coefficient matrix?
8. What do you understand by transmissibility ratio?
9. Write a shote notes on magnification factor.
10. Write the expression for steady state amplitude in forced vibration.

Section B

20 marks (5 questions of 4 marks each)

1. A refrigeration unit operating at 600 rpm and mass 25 kg is to be supported by 3 springs of kN/m. If only 10% of the shaking force of the unit is to be transmitted to this structure, what should be the value of k. Assume damping coefficient as 0.05.

2. Determine the flexibility matrix for the cantilever beam shown in below figure.

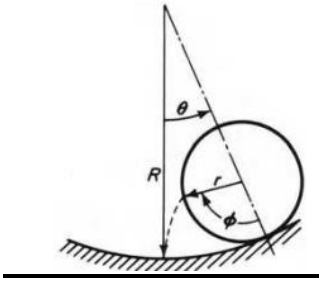


Find only a_{11} , a_{12} , a_{13} .

3. Derive the expression for Duckrely method for finding fundamental natural frequency for Multidegree of freedom system.

4. An undamped vibration pickup having a natural frequeney of 1 cm/s is used to measure a harmonie vibration of 4 cm/s. If the amplitude indieated by the piekup (relative amplitude between piekup mass and frame) is 0.052 cm, what is the eorreet amplitude?

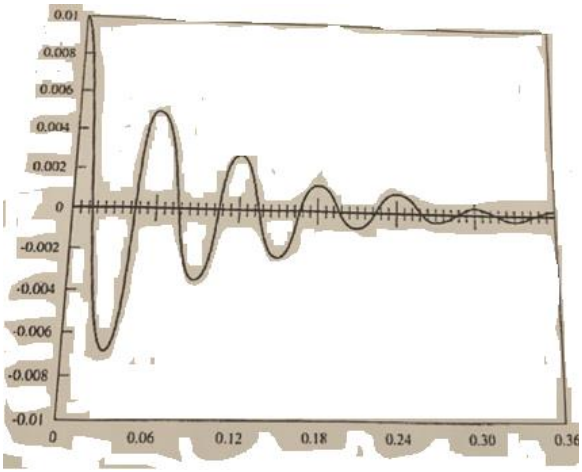
5. A cylinder of weight wand radius r rolls without slipping on a cylindrical surface of radius R, as shown in Fig. 2.3-2. Determine its differential equation of motion for small oscillations about the lowest point. For no slipping, we have r



Section C

20 marks (2 questions of 10 marks each,)

1. (a) A vibration test is run to determine the stiffness and damping properties of an elastic element. A 20 kg block is attached to the element. The block is displaced 1 cm and released. The resulting oscillations are monitored with the results shown in the figure. Determine k and c for this element. The displacement is recorded in seconds and the unit m.



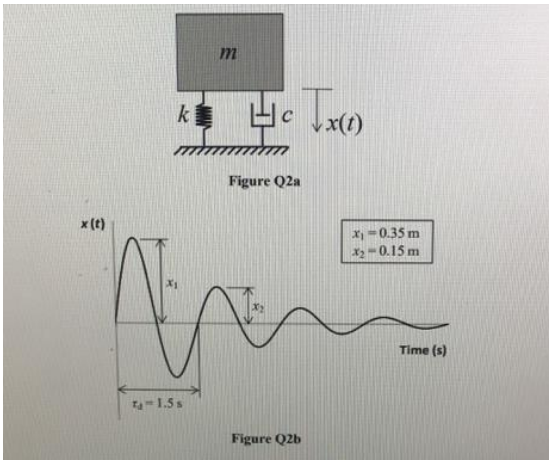
(b) A Mechanical vibration system, which can be represented by the system is subjected to an initial velocity of 3.0 m/s. The measured response of the system is shown figure. For this system, determine:

(a) The natural frequency of the system.

(b) An expression for the displacement of the system as a function of time only.

(c) The time taken to reach maximum displacement and the maximum displacement of the system.

(d) The acceleration of the system at maximum displacement.



2. Using Lagrange's method, determine the equations for the small oscillation of the bars. Mass of each bars is M.