Reg.No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VII SEMESTER B.TECH. (AERONAUTICAL/AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, DEC 2018

SUBJECT: THEORY OF VIBRATIONS [AAE -4101]

REVISED CREDIT SYSTEM

(22/12/2018)

Time: 3 Hours MAX. MARKS: 50

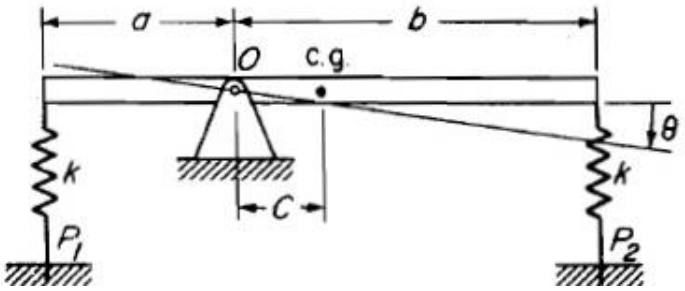
Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. Define the following **(03)**

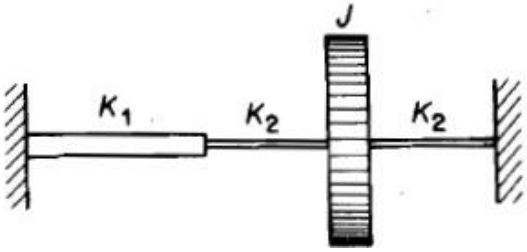
- Beats
- Damping
- Periodic motion

1B. Compute the natural frequency of the following system for small angular displacements. **(03)**



1C. The following data are given for a vibrating system with viscous damping-m=4.5 kg, k=5250 N/m and C=21Ns/m. Determine the logarithmic decay and ratio any 2 successive amplitudes. **(04)**

2A. Determine the effective stiffness and the natural frequency of the following system. **(03)**



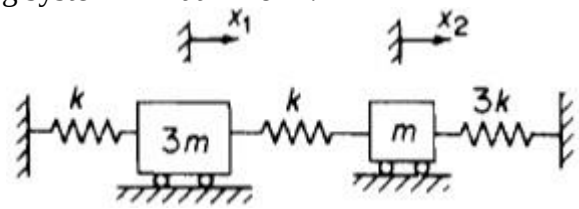
2B. A spring-mass system is excited by a harmonic force. At resonance the amplitude is measured to be 0.58 cm. At 80% of resonant frequency, the amplitude was measured to be 0.46 cm. Determine the damping ratio. **(03)**

2C. An electric motor of mass 68 kg is mounted on an isolator mass of 1200 kg and the natural frequency of the assembly is 160 cpm with a damping ratio of 0.1. The unbalance in the motor results in a force of F=100 sin (31.4t). Compute the amplitude of vibration of the block and force transmitted to the floor. **(04)**

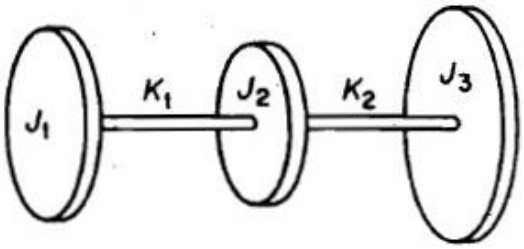
3A. A body of mass 1500 kg is suspended on a leaf spring. The system was set into vibrations and the measured frequency was 0.982 Hz. The successive amplitudes were measured to be 4.8 cm, 4.1 cm, 3.4 cm and 2.7 cm. Determine the spring stiffness and Coulomb damping. **(04)**

3B. Derive the expression for the amplitude of forced vibration when the system has Coulomb damping. **(04)**

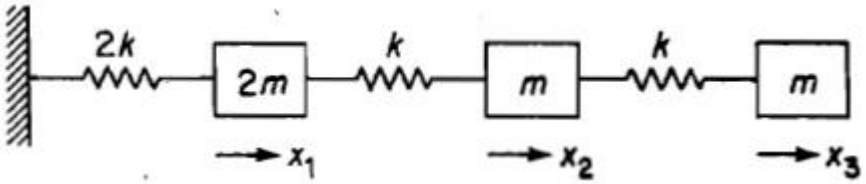
3C. Express the following system in matrix form. **(02)**



4A. The following figure shows a degenerate 3 degrees of freedom system. Its characteristic equation yields one zero root and 2 elastic vibration frequencies. Discuss the physical significance that 3 coordinates are required but only 2 natural frequencies are obtained. **(02)**



4B. Express the following system equation in terms of flexibility coefficient. **(03)**



4C. Compute the first natural frequency of the system shown in question 4B by matrix iteration method **(05)**

5A. Derive the governing equation of lateral vibrations of a beam by continuous system approach. **(05)**

5B. Derive the expression for lateral vibration of a shaft with a disc at the midway between the bearing span. Assume undamped condition. **(03)**

5C. Briefly explain the Rayleigh's method of computing the first natural frequency of a multi degree of freedom system **(02)**