Reg.No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VII SEMESTER B. TECH (AERONAUTICAL/AUTOMOBILE ENGINEERING)

END SEMESTEREXAMINATIONS DEC/JAN 2017-18

SUBJECT: THEORY OF VIBRATIONS [AAE 4101]

REVISED CREDIT SYSTEM
(20/12/2017)

Time: 3 Hours MAX.MARKS: 50

Instructions to Candidates:

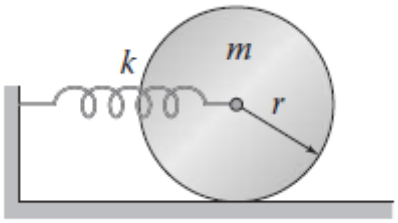
- Answer **ALL** the questions.
- Missing data, if any, may be suitably assumed.

1A. Derive an equation to find the natural frequency of a spring-mass system by considering the mass of the spring. **(05)**

1B. Show that the sum of 2 harmonic functions of the same frequency but with different phase angles is also harmonic function of the same frequency. **(03)**

1C. What is coordinate coupling? Explain. **(02)**

2A. Determine the natural frequency of following system for small oscillations **(05)**



2B. What is Logarithmic decrement? Derive an equation for the same. **(03)**

2C. Explain Eddy current and dry friction damping **(02)**

3A. A 1000kg machine is acted upon by an external force of 2450 N at a frequency of 1500 rpm. To reduce the effects of vibration, isolator of rubber having a static deflection of 2mm under the machine load and an estimated damping ratio of 0.2 are used. Determine force transmitted to the foundation, amplitude of vibration and phase lag. **(05)**

3B. A machine weighs 18kg and is supported on springs and dampers. The total stiffness of the spring is 12N/mm and damping is 0.2N/mm/s. The system is initially at rest and a velocity of 120mm/s is imparted to the mass. Determine: **(03)**

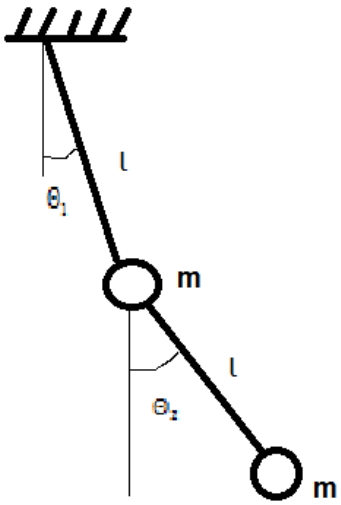
i. The displacement and velocity of mass as a function of time.

ii. The displacement and velocity after 0.4s.

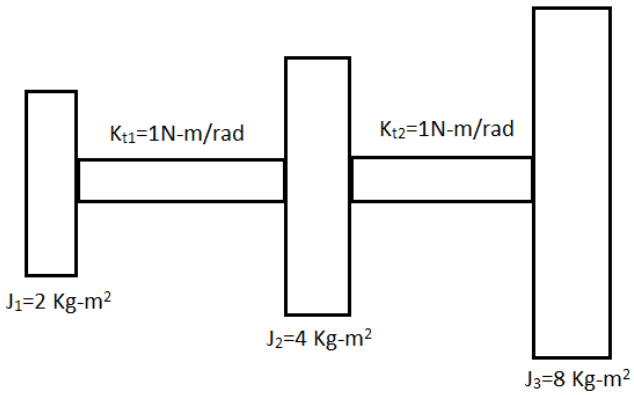
3C. Explain the working principle of Vibrometer. **(02)**

4A. A vertical shaft 12.5 mm in diameter rotates in long bearings and a disc of mass 15 kg is attached to the shaft at mid span. Distance between the bearings is 0.5m. Mass centre of the disc is 0.5mm from the geometric centre Neglecting mass of shaft determine the critical speed of rotation. Also determine the speed at which stress in the shaft due to bending will exceed 125MPa **(04)**

4B. Derive the differential equation of motion, amplitude ratio and mode shape for the double pendulum shown in fig. **(06)**



5A. Determine the natural frequencies Eigen values and mode shape of the three rotor system shown in fig., using matrix method. **(06)**



5B. Derive the governing equation for longitudinal vibrations of a bar using continuous system approach. **(04)**