Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

I SEMESTER M.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2018

SUBJECT: VIBRATIONS AND ACOUSTICS [AAE -5102]

REVISED CREDIT SYSTEM

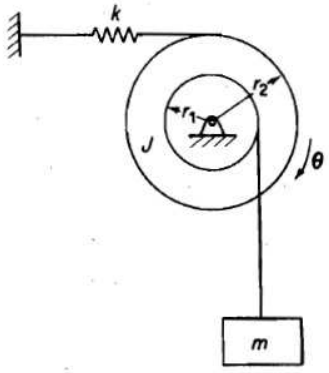
(22/11/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. Derive the natural frequency of the following system for small oscillations. **(04)**



1B. A spring-mass system k_1 and m has a natural frequency of f_1. If a second spring k_2 is added in series with the first spring, the natural frequency is lowered to $0.5f_1$. Determine k_2 in terms of k_1. **(04)**

1C. How to find the damping ratio from frequency response curves. **(02)**

2A. A disk of 5kg is mounted midway between the bearings with a span of 0.5m. The shaft diameter is 10mm and the cg of the disk is 2mm away the geometric center. The equivalent viscous damping may be taken as 60 Ns/m. Determine the power required to run the shaft at 1440 rpm and the steady state amplitude at that speed. **(05)**

2B. Briefly explain the principle of electrodynamic /moving coil microphone. **(03)**

2C. Explain the significance of phase-plane method. **(02)**

3A. A point mass is attached to the midpoint of a stretched string with an initial tension of T. Derive the equations of motion of the system by considering non-linearity. **(05)**

3B. Differentiate between contact and non-contact type transducers. **(02)**

3C. What is stability of equilibrium and how many equilibrium positions are there for a simple pendulum? **(03)**

4A. With neat sketch briefly explain the principle of Electret capacitor microphone **(03)**

4B. What are random vibrations? **(02)**

4C. Determine the time period of non-linear pendulum given by the equation $\ddot{\theta}+\omega_0^2\left(\theta-\frac{\theta^3}{6}\right)=0$, with the initial conditions of zero angular velocity and angular displacement of θ_0 at t=0. **(05)**

5A. A motor of 45 kg is mounted on a simple beam with stiffness 35000 N/m at that point. The rotator mass is 8 kg and has eccentricity of 0.085mm. What will be the amplitude of vibration at a speed of 1440 rpm? **(03)**

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

5C. A machine part is 1.95 kg and vibrates in a viscous medium. Compute the damping coefficient when a harmonic force of 24.46 N results in a resonant amplitude of 1.27 cm with a period of 0.2 seconds. **(03)**