Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

I SEMESTER M.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2019

SUBJECT: VIBRATIONS AND ACOUSTICS [AAE -5174]

REVISED CREDIT SYSTEM

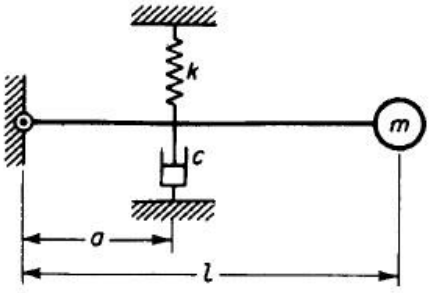
(19/11/2019)

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. **(05)**



1B. Derive the expression for logarithmic decrement. **(03)**

1C. Show that the spring potential modeled as lumped mass system is 0.5 kx^2. **(02)**

2A. A racing car is modeled as a SDOF system vibrating the vertical direction. The elevation of the road is assumed to be sinusoidal. Distance from peak to trough is 0.2m and the distance between the peaks is 70m. The natural frequency of the system is 2 Hz and the damping ratio is 0.15. Determine (a) the amplitude of the racing car at 120 km/hr and (b) the most unfavorable speed of the racing car if the speed varies. **(05)**

2B. Discuss the working principle of hand-held vibrograph. **(03)**

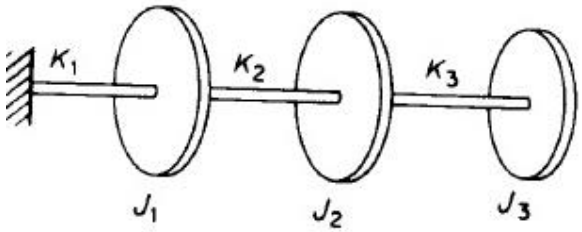
2C. What is a stationary random process? **(02)**

3A. A uniform string of length *l* and a large initial tension *S* is stretched between 2 supports is displaced initially through a distance of a_0 and released at t=0. Find the equation of motion of the string. **(07)**

3B. Express the governing differential equation of a non-linear spring-mass system. **(03)**

4A. With neat sketch discuss the principle of carbon granule microphone. **(04)**

4B. Determine the first 2 natural frequencies of the system using Holzer's method, Where, $J_1=J$, $J_2=J$ and $J_3=2J$.and $K_1=K$, $K_2=2K$ and $K_3=3K$ **(06)**



5A. A variable speed motor has a diametrical clearance of 2 mm between the stator and the rotor. The rotor is 37.5 kg and has an unbalance of 0.3 kg-cm. The rotor is mounted midway between 2 bearings which support the steel shaft. The operating speed varies between 400 to 6400 rpm. **(04)**

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

5C. During the installation of a 4 pole, 50 cycle induction motor of mass 250kg, the static deflection was found to be 0.12mm, Would you consider the foundation to be safe?. **(02)**