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

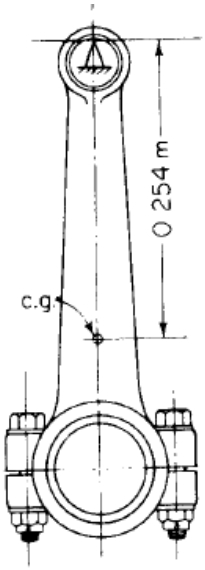
(24/12/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. A connecting rod weighing 21.35 N oscillates 53 times in one minute when suspended as shown below. Determine the moment of inertia about its CG. **(04)**



1B. A weight attached to a spring of stiffness 500 N/m has a viscous damping device. When the weight is displaced and released, the period of vibrations is found to be 1.82 sec and the ratio of successive amplitudes is 4.1 to 1. Determine the amplitude and phase when a force $F = 2\cos 3t$ acts on it. **(04)**

1C. How to determine the damping ratio and natural frequency of a cantilever beam using free vibration experiment? **(02)**

2A. The rotor of a turbine 13.6 kg is supported at the midspan between 2 bearing with a span of 0.4064 m. The rotor has an unbalance of 0.2879 kg-cm. Determine the force exerted on the bearings at a speed of 6000 rpm if the diameter of the steel shaft is2.54 cm. **(05)**

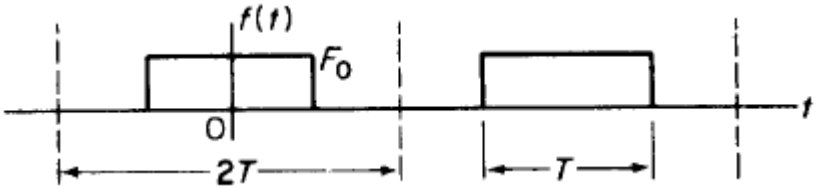
2B. Differentiate between absolute and relative measuring instruments. **(02)**

2C. Explain the working principle of seismic velocity transducer. **(03)**

3A. Explain how to find the vibration characteristics of a material using electrodynamic vibration shaker **(03)**

3B. A simple pendulum is vibrating in the vertical direction harmonically. The equation is represented by $\ddot{x}+(\partial+\varepsilon\cos t)x=0$, where ε is a small parameter. Find a periodic solution using Lundstedt's perturbation method. **(07)**

4A. Determine the Fourier coefficients C_n and the power spectral density of the periodic function shown below. **(03)**



4B. What is a non-linear system? Explain spring-softening and hardening with respect amplitude with an example. **(03)**

4C. Explain the working principle of condenser microphone. **(04)**

5A. Briefly explain about acoustic excitation technique and its applications. **(03)**

5B. Determine the first natural frequency of the following system using Eigen value method and compare it with Dunkerley's approximation method. **(07)**