Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institute of Manipal University, Manipal

I SEMESTER M.TECH (CAAD) END SEMESTER EXAMINATIONS

NOVEMBER 2017

SUBJECT: ADVANCED MECHANICAL VIBRATIONS [MME 5102]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **FIVE FULL** questions.
- Missing data may be suitably assumed.

1A. Distinguish between **04**
i) Free and forced vibrations
ii) Damped and undamped vibrations
iii) Static and dynamic coupling
iv) Linear and nonlinear systems.

1B. A mass of 2 kg is supported on an isolator having a spring scale of 2940 N/m and viscous damping. If the amplitude of free vibration of the mass falls to one half its original value in 1.5 secs, determine the damping coefficient of the isolator. **03**

1C. Starting from the magnification factor equation, derive an expression for peak amplitude, when a system having viscous damping is subjected to constant sinusoidal excitation force. **03**

2A. A horizontal shaft is supported between bearings (simply supported). At the centre of the shaft, a disc of mass “m” is mounted. The lateral stiffness of the shaft is “k”. Due to manufacturing inequalities, the centre of gravity is shifted by a distance “e” from the geometric centre. The lubrication at the bearings provides a damping of “c”. Derive the expression for the lateral deflection of the shaft in terms of eccentricity “e” and angular velocity ‘ω’. **04**

2B. A compressor unit of mass 200 kg is mounted rigidly on a concrete bed having a mass of 500 kg. The disturbing force whose frequency is the same as the compressor speed and which is sinusoidal has maximum value of 294 N. If the compressor speed is 100 RPM, determine the stiffness of the rubber pads to be used beneath the concrete bed such that the force transmitted is 0.5 % of the disturbing force. Neglect damping. **03**

2C. Describe the iterative method for solution of equations describing nonlinear vibrations. **03**

3A. With the relevant equations of motion, explain the working of a dynamic vibration absorber. What is the effect of mass ratio on the natural frequency? **04**

3B. For a simply supported beam of length ‘l’ and of uniform cross section, find the first natural frequency of transverse vibrations by the Rayleigh’s method **03**

3C. Explain the Simultaneous iteration scheme. **03**

4A.	Derive the free vibration equation for longitudinal vibrations of bars and obtain its solution.	**04**
4B.	For a seismic instrument obtain an expression for the magnification factor and phase angle and show its variation with the frequency ratio.	**03**
4C.	Find the response of a single degree freedom system using the frequency response approach	**03**
5A.	With a neat sketch explain the working of a electrodynamic shaker	**04**
5B.	What is a 'bath tub curve'? What is its significance in machine condition monitoring?	**03**
5C.	With an example, explain the graphical method for a nonlinear system.	**03**