Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

I SEMESTER M.TECH. (COMPUTER AIDED ANALYSIS AND DESIGN)

END SEMESTER MAKEUP EXAMINATIONS DEC 2016/JAN 2017

SUBJECT: ADVANCED MECHANICAL VIBRATIONS [MME 5102]

REVISED CREDIT SYSTEM
(29/12/2016)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. Explain with examples the following:

1. Natural Frequency 2. Damping ratio 3. Critical damping 4. Motion Transmissibility 5. Force Transmissibility. 6. Normal Mode. **03**

1B. Show that vibration isolation is possible in the region $\omega/\omega_n > \sqrt{2}$ **03**

1C. A mass of 1 Kg is to be supported on a spring having a stiffness of 9800 N/m. The damping coefficient of the system is 5.9 N-Sec/m. Determine the natural frequency of the system. Find also the logarithmic decrement and the amplitude after 3 cycles if the initial displacement is 0.3 cm. **04**

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2A. With the usual notations derive an expression for the lateral vibration of strings. Take the string as a continuous system. **03**

2B. With an example explain the Rayleigh damping model. **03**

2C. Define critical speed. Show that for an unbalanced shaft rotating in bearings without considering damping

$$\frac{r}{e} = \frac{\left(\frac{\omega}{\omega_n}\right)^2}{1-\left(\frac{\omega}{\omega_n}\right)^2}$$ **04**

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

3B. Describe the Poincare's method for solution of equations describing Nonlinear vibrations. **04**

3C. With an example explain the graphical method applied to nonlinear systems **03**

4A. A commercial type vibration pickup has a natural frequency of 5.75 Hz and a damping factor of 0.65. What is the lowest frequency beyond which the amplitude can be measured within one percent error. **04**

4B. Describe the three types maintenance strategies used in practice. **03**

4C. With neat sketches explain the Jump phenomenon in Nonlinear systems **03**

5A. A 3 rotor system has the following physical constants :

$J_1 = 4.9$ kg-m^2, $J_2 = 9.8$ kg-m^2, $J_3 = 6.86$ kg-m^2,

$K_{t1} = 2.16 \times 10^5$ N-m/rad, $K_{t2} = 0.78 \times 10^5$ N-m/rad

Find the first natural frequency of the system and the corresponding mode shape **03**

5B. With a neat sketch explain the working of a Electrodynamic Shaker **03**

5C. Write a note on the following:

1. Phase distortion
2. Frequency measurement
3. Dynamic Testing of machines and structures
4. Digital signal processing **04**