MANIPAL INSTITUTE OF TECHNOLOGY

Manipal University, Manipal – 576 104

I SEM. M.Tech. DEGREE (COMPUTER AIDED MECHANICAL DESIGN AND ANALYSIS)
END SEMESTER EXAMINATIONS NOV./DEC.-2015
ADVANCED MECHANICAL VIBRATIONS (MME 501)

(01/12/2015)

Time: 3 Hours   **Max. Marks:** 50

Note: Answer **FIVE** full questions.

Q.1.A. A shaft of 100 mm diameter and 1m long is fixed at one end and carries a flywheel of weight 50 kN at the other end. The flywheel has a radius of gyration of 50 mm. Find the natural frequency of the system for longitudinal, transverse and torsional vibration. Take Young's modulus of 200 GPa and shear modulus of 80 GPa for the shaft material. Neglect the mass of shaft.   **03**

B. Derive an expression for the peak amplitude and phase angle corresponding to the peak amplitude for a damped forced vibration system.   **04**

C. What is the difference between a hard spring and a soft spring   **03**

Q.2.A. A machine weighing 68 N is mounted on springs of total stiffness 110 kN/m with a damping factor of 0.2. The piston within the machine weighing 2N has reciprocating motion with stroke of 75 mm and speed of 3000 rpm. Assuming the motion of piston is SHM, determine,
1) The steady state amplitude of machine vibration.
2) Check whether the vibration isolation is possible or not.
3) Transmissibility ratio and force transmitted to the base.   **04**

B. 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

C. What is meant by static and dynamic coupling?   **02**

Q.3.A. A refrigerator unit weighing 295 N is to be supported by three springs of stiffness 'k' N/m each. If the unit operates at 580 rpm, what should be the value of the spring constant 'k' if only 10% of the shaking force of the unit is to be transmitted to the supporting structure?   **03**

B. Describe the Poincare's method for the solution of pendulum equation with nonlinear terms.   **04**

C. Explain the difference between a stationary process and nonstationary process   **03**

Q.4.A. Discuss the subspace iteration scheme   **03**

B.	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?	**05**
C.	What is a limit cycle? Explain with sketches	**02**
Q.5.A.	With neat sketches explain the stability of equilibrium of states. What is a 'Phase Plane' and how it can be used to ascertain system stability.	**04**
B.	Explain the jump phenomenon in nonlinear systems.	**02**
C.	Find the response of a single degree freedom system using the frequency response approach	**04**
Q.6 A.	Describe the three types of maintenance schemes used for machinery.	**03**
B.	With a neat sketch explain the working of an electrodynamic shaker	**04**
C.	Write a note on vibration measuring transducers.	**03**