III Year I Semester   **L   T   P   C**

17ME532   **3   1   0   3**

Professional Elective-I

MECHANICAL VIBRATIONS

Course Objectives:

The Students will acquire the knowledge

 1. To learn basic principles of mathematical modeling of vibrating systems
 2. To learn the basic concepts free and forced multi degree freedom systems
3. To learn concepts involved in the torsional vibrations
 4. To learn the principles involved in the critical speed of shafts
 5. To learn the basic concepts of transient vibrations

UNIT-I: INTRODUCTION Relevance of and need for vibrational analysis – Basics of SHM - Mathematical modelling of vibrating systems - Discrete and continuous systems -

UNIT-II: single-degree freedom systems - free and forced vibrations, damped and undamped systems.

UNIT-III: MULTI DEGREE FREEDOM SYSTEMS Free and forced vibrations of multi-degree freedom systems in longitudinal, torsional and lateral modes - Matrix methods of solution- normal modes - Orthogonality principle-Energy methods, Eigen values and Eigen vectors, modal analysis.

UNIT-IV: CONTINUOUS SYSTEMS Torsional vibrations - Longitudinal vibration of rods - transverse vibrations of beams – Governing equations of motion - Natural frequencies and normal modes - Energy methods, Introduction to non linear and random vibrations.

 UNIT-V:CRITICAL SPEEDS OF SHAFTS: Critical speed of a light shaft having a single disc without damping and with damping, critical speeds of shaft having multiple discs, secondary critical speed, critical speeds light cantilever shaft with a large heavy disc at its end.

UNIT-VI: TRANSIENT VIBRATIONS: Laplace transformations response to an impulsive input, response to a step input, response to pulse(rectangular and half sinusoidal pulse), phase plane method.

   Course Outcomes:
   At the end of the course the students shall be able to:
   1.   Understand the concepts of vibrational analysis
   2.   Understand the concepts of free and forced multi degree freedom systems
   3.   Summarize the concepts of torsional vibrations
   4.   Solve the problems on critical speed of shafts
   5.   Analyze the systems subjected to transient vibrations

Text books:
1. S.S.Rao, "Mechanical Vibrations ", 5th Edition, Prentice Hall, 2011.
2. L.Meirovitch, "Elements of vibration Analysis", 2nd Edition, McGraw-Hill, New York, 1985.

References:
1. W.T. Thomson, M.D. Dahleh and C Padmanabhan, "Theory of Vibration with Applications", 5th Edition,Pearson Education, 2008.
2. . M.L.Munjal, "Noise and Vibration Control", World Scientific, 2013.
3. 3. Beranek and Ver, "Noise and Vibration Control Engineering: Principles and Applications",JohnWiley and Sons, 2006.
4. Randall F. Barron, "Industrial Noise Control and Acoustics", Marcel Dekker, Inc., 2003.