

Course code.	Course Name	L-T-P-Credits	Year of Introduction
ME374	THEORY OF VIBRATIONS	3-0-0-3	2016
Prerequisite: ME304 Dynamics of machinery			
Course Objectives <ul style="list-style-type: none"> • To understand the principles of vibration theory. • To introduce techniques for solving vibration problems. • To enable development of mathematical model for engineering problems in vibrations. 			
Syllabus Introduction to mechanical vibrations; Analysis of free, forced single degree of freedom systems; Damping; Vibration measuring instruments; Multi degree of freedom systems; Eigen value problems; Lagrange's equation; Vibration of continuous systems; Transient vibrations; Introduction to non linear and random vibrations.			
Expected outcome The students will be able to <ol style="list-style-type: none"> i. formulate differential equations of motion of mechanical systems ii. determine the natural frequencies of multi degree of freedom systems iii. understand non linear and random vibrations. 			
Text Books: <ol style="list-style-type: none"> 1. Graham Kelly S, Schaum's outline of Mechanical Vibrations, Schaum's Outlines, 1996 2. Singiresu S Rao, Mechanical Vibrations, Pearson, 2016 3. Thomson, W T , Theory of Vibration with Applications., Prentice Hall India, 1981 			
References Books: <ol style="list-style-type: none"> 1. Den Hartog, J P, Mechanical Vibrations, McGrawHill, 1956. 2. Leonard Meirovitch, Elements of Vibration Analysis, McGraw Hill, 1975. 			

Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Introduction to mechanical vibrations- Simple harmonic motion- Natural frequency -Equation of motion-- Energy method-Rayleigh method	2	20%
	Free vibration of single degree of freedom (DOF) systems with damping- Viscous damping- Logarithmic decrement. Coulomb damping-Energy dissipated by damping- Structural damping -Equivalent viscous damping.	4	
II	Forced harmonic vibration- Magnification factor-Transmissibility- Vibration isolation-Base excitation-Rotating unbalance- whirling of shafts- Resonance Vibration measuring instruments. Seismometer-Accelerometer	5	15%
FIRST INTERNAL EXAM			
III	Two degree of freedom systems-Normal mode vibration-Principal coordinates-Coordinate coupling.	3	15%
	Beat phenomenon-Undamped vibration absorbers- Vibration dampers.	2	
IV	Multi degree of freedom systems- Matrix formulation- Influence coefficients-Flexibility matrix-Stiffness matrix	5	20%
	Eigen Value problem:Eigen value and Eigen vectors-Frequency mode shape -Modal analysis.	4	
SECOND INTERNAL EXAM			
V	Lagrange's equation- Solution to problems using Lagrange's equation.	4	15%
	Vibration of continuous systems-Vibrating strings- Longitudinal vibration of rods—Torsional vibration of rods	6	
VI	Transient vibrations- Impulse excitation- Convolution integral.	4	15%
	Introduction to non linear vibrations and random vibrations	3	
END SEMESTER EXAM			

2014

Question Paper Pattern

Maximum marks: 100

Time: 3 hrs

The question paper should consist of three parts

Part A

There should be 2 questions each from module I and II

Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part B

There should be 2 questions each from module III and IV

Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part C

There should be 3 questions each from module V and VI

Each question carries 10 marks

Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: Each question can have a maximum of four sub questions, if needed.

