MME4041: Mechanical Vibration

Programme: B.Tech. (MME)   Year:4th   Semester: VII
Course : Program Elective   Credits: 3   Hours:

Course Context and Overview (100 words):

The structure design to support the automotive parts, locomotive, aircraft, etc are subjected to vibration. Due to faulty design, and unbalance, unwanted vibration may induced on machine component which causes loosening of the parts from the machine, and sometimes the structure may become unstable. Thus keeping in view of all these devastating effects the study of vibration is essential. This will help the students for designing the structure considering the vibration in to account.

Prerequisites Courses:

(Course name and course code)

Course outcomes (COs):

On completion of this course, the students will have the ability to:	
CO1 To understand the basic of Vibration	Unit 1
C02 To understand the analysing the machine components considering free vibration	Unit 2
C03 To understand the analysing the machine components considering free damped vibration	Unit 3, 4
C04 To understand the multi degree of freedom under free and forced vibration	Unit 5, 6

Course Topics:

Topics	Lecture Hours		Student development
UNIT - I **Fundamental of Vibration**			Employability
Introduction, History of vibration, Basic concepts of vibration, Importance of vibration, Definitions, Method of vibration analysis, Energy Method, Rayleigh's Method, Equilibrium Method, Type of vibration, Free Vibration, Forced Vibration, Damped and Undammed Vibration, Beats phenomenon, problems for practice	4	4	
UNIT - II **Undamped Free Vibration single degree of freedom** Introduction, Derivation of differential equation, Natural frequency of free longitudinal vibration, Natural frequency of free transverse vibration, Newton Method, Energy Method, Rayleigh Method, Natural frequency for transverse vibration subjected to multiple masses, Torsional Vibration, Equivalent stiffness of spring in combinations, transverse vibration of beams, beam with several masses, critical or whirling speed of shaft, problems for practice	8	8	Employability
UNIT - III **Damped Free Vibration single degree of freedom** Introduction, Different type of Damping, Free vibration with viscous damping, over-damped system, critically damped, under damped system, damping factor, Logarithmic decrement, problems for practice	6	6	Employability
UNIT-IV **Forced Vibration of single degree of freedom** Introduction, Forced vibration with constant harmonic excitation, magnification or dynamic magnifier, forced vibration with rotating and reciprocating unbalance, forced vibration due to excitation of the support , Forced vibration due to coulomb damping, forced vibration with structural damping, vibration isolation, transmissibility factor, problems for practice	7	7	Employability
UNIT-V **Two Degree of Freedom** Introduction, Principle mode of vibration, torsional vibration, vibration of undamped two degree of freedom, vibration of damped two degree of freedom, coordinate coupling, vibration absorber, torsionally equivalent shaft, eigen value, eigen vector, problems for practice	7	7	Employability
UNIT-VI **Multi Degree of Freedom** Introduction, free vibration - equation of motion, free damped vibration equation of motion, Lagrange's equation, Rayleigh's method, Dunkerley's method, Holzer's method, Stadola method, Torsional vibration with multi degree of freedom, problems for practice	8	8	Employability

Textbook references (IEEE format):
Text Book:

1.   C.K. Grover, "Mechanical Vibrations", Nem Chand & Bros

2. *Rao, J.S., & Gupta, K*., "Ind. Course on Theory and Practice Mechanical Vibration", New Age International (P) Ltd.

Reference books:

1.   *Thomson W.T., "*Theory of Vibration with Applications, CBS Publishers and Distributors", New Delhi, 1990

2.   *Shriniwasan P.,* "Mechanical Vibration Analysis", Tata McGraw Hill,

Additional Resources (NPTEL, MIT Video Lectures, Web resources etc.):

Evaluation Methods:

Item	Weightage
Midterm	30
Assignment, Mini Project and Quiz	20
Final Examination	50

Prepared By: Dr. Ashok Kr Dargar
Last Update: 17/03/2016