



SECOND SEMESTER 2019-2020

Course Handout Part II

Date: 06-01-2020

In addition to Part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : **ME F343**
Course Title : **Mechanical Vibrations**
Instructor-in-Charge : **Dr. Brajesh Kumar Panigrahi**

Scope and Objective of the Course: This course is designed to acquaint the students with topics in vibrations. The emphasis is on application to common engineering situations. The main aim of the course is to prepare students to tackle complex and frontier technological problems in vibrations. The analysis of increasingly complex system has been instrumental in the usage of concepts like Lagrange equations and generalized coordinates. Introductory topics in control systems are included in the last part of the course.

Textbooks:

1. T1. "Theory of Vibrations with Applications", William T. Thomson, Marie Dillon Dahleh and Chandramouli Padmanabhan, Pearson, Sixth Ed.
2. T2. "Modern Control Engineering", Katsuhiko Ogata, Pearson, 5th Edition

Reference books

1. R1. "Mechanical Vibrations", Singiresu S Rao, Pearson, 4th Ed.
2. R2. "Mechanical Vibrations - Theory and Application", Francis S. Tse, Ivan E. Morse and Rolland T. Hinkle, Allyn and Bacon Inc. London, 1983.
3. R3. "Elements of vibration analysis", Meirovitch, L, Mc graw Hill, U.S.A, 1986.

Course Plan:

Lecture Nos.	Learning Objectives	Topics to be covered	Chapter in the Text Book
1-3	Brief review of fundamental concepts of vibration	Introduction to Vibration: Basic concepts of Vibration, Oscillatory Motion, Harmonic motion, Periodic Motion, Elementary parts of Vibrating systems, Degree of freedom, Discrete and continuous systems	T-1-CH-1, R1-CH-1
4-6	Understand the causes and reasons for vibration and why vibrations die out. Analysis of simple vibrating systems	Vibration analysis, spring mass and damping elements in a vibrating system, Types of damping, Complex number notation, Harmonic analysis	T-1-CH-1, R-1,CH-1



Lecture Nos.	Learning Objectives	Topics to be covered	Chapter in the Text Book
7-10	Modeling of vibrating systems natural and undamped. Effect of damping on systems in vibration, Other types of damping and energy loss	Single dof free undamped vibration systems ,Single dof free damped vibration systems , Coulomb damping	T-1-CH-2, R-1 CH-2
11-17	Forced system analysis. Need for Vibration isolation and critical speed and resonance Construction and functioning of measuring instruments	Single dof forced vibration systems, Vibration isolation, support motion, rotary unbalance, whirling of shafts, sharpness of resonance Structural damping, energy dissipated by damping, equivalent viscous damping Vibration measuring instruments	T-1-CH-3, R-1-CH-3
18-20	Transient versus steady systems and analysis	Transient vibration of single dof systems, Laplace and finite difference methods	T-1CH-4, R-1-CH-4
21-26	Two and more dof systems modeling and analysis, Matrix methods and forced multi dof systems	Multi dof free vibration systems, Normal modes, initial conditions, coordinate coupling, decoupling Matrix formulation, Eigen values and vectors, Multi dof forced harmonic vibration, Orthogonality relations Vibration absorber	T-1CH-5, R-1-CH-5,6
27-32	Energy methods and Generalized coordinates and use of Lagrange's mechanics	Energy method, Rayleigh Method, Virtual work methods, Lagrange Mechanics, Generalized Coordinates	T-1CH-6 R-1CH-7
33-36	Classical Methods	Rayleigh method, Rayleigh-Ritz method, Dunkerley's equation	T-1CH-10 R-1CH-8
37-41	Vibration of continuous systems, FEM Control theory concepts,	Vibration of string, rods, bars and beams Stiffness Matrix and flexibility influence coefficients Introduction to control systems	T-1CH-8,11 R-1CH-6,8 T-2-CH1&2

Evaluation Scheme:



<u>Evaluation Component</u>	Duration	Weightage (%)	Date & Time	Nature of Component
Mid Semester	90 min	20	2/3 11.00 -12.30 PM	Closed Book
Class Assessments	-	10	To be announced by IC	Continuous Assessment (Open Book)
*Tutorial Tests	-	10	To be announced by IC	Closed Book
Home Assignments	-	20	To be announced by IC	Open Book
Comprehensive Exam	180 min	40	01/05 AN	Closed Book

Chamber Consultation Hour: To be announced in the class room.

*Surprise tutorial tests of 10 minutes' duration each will be conducted during the tutorials or regular classes and these will be evaluated for ten marks each.

Notices: All notices concerning this course will be displayed on CMS_only, students are advised to visit regularly CMS for latest updates.

Make-up Policy: Make-up shall be given only to the genuine cases with prior intimation. No make-up will be given for the surprise tests.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Dr. Brajesh Kumar Panigrahi
ME F343

