Date:16/01/2021

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 Vibration
Instructor-in-charge **:** Arun Kumar Jalan
Tutorial Instructor **:** Arun Jalan, S S Yadav, G Watts

1. Course Description:

Small oscillations of linear dynamical systems, free and forced vibrations of single and multi degree-of-freedom systems, normal modes and orthogonality relations, generalized co-ordinates and Lagrange's equations, matrix formulation, eigen-value problem and numerical solutions, transient response of one-dimensional systems, approximate energy methods, continuous system, vibration of string, rods, bars and beams. Introduction to control systems.

2. Course Objectives:

No	Course Objectives
CO1	Provide an introduction to analytical dynamics and present Lagrange's equations of motion which is an efficient way of deriving equations of motion.
CO2	Present a matrix approach to the vibration of SDOF and MDOF systems, placing emphasis on modal analysis. To cover methods suited for automatic computation for obtaining the system response.
CO3	Response of a SDOF system under harmonic forces and transient forces.
CO4	Setting-up initial-boundary value problems for some important and fundamental structural members viz. Bars, strings, rods and beams. Analytical and approximate solutions to these problems for various loading and boundary conditions are discussed and analyzed.

3. Learning Outcomes

No	Learning Outcomes
LO1	An ability to apply mathematical knowledge to an engineering problem by developing the equations of motion for vibratory systems and solving them.
LO2	Understanding importance of how structural vibrations may affect safety and reliability of engineering systems.
LO3	Relation between Vibration and Control

4. Course Material

Text Book:

T1: *"Theory of Vibration with Application*", Thomson W. T., Dahleh M. D., Pearson Education, 5th Ed.

Reference Books:

R1: "*Mechanical Vibration", S S Rao*, Pearson Education, 4th Ed

R2: "Elements of Vibration analysis", Leonard Meirovitch, McGraw-Hill, Singapore, 1986.

5. Course Plan:-

Lect. No	Topics to be covered	Learning Objective	Reference Chap./Sec
1	Introduction to Oscillatory Motion	Study of Basic Terminology	T1-CH1
2-4	Free Vibrations of single degree of freedom system	Concept of natural frequency and system damping properties	T1-CH2
5-9	Harmonic Forced Vibration of SDO System	Responses due to harmonic forces and their practical application such as vibration isolation, vibration measuring instruments	T1-CH3

10-11	Transient Vibration of SDOF	Responses due to transient forces i.e. arbitrary excitations.	T1-CH4
12-14	Energy based Approaches	Study of Lagrangian Mechanics, Derive equation of motion for a discrete system	T1-CH6
15-16	System with Multi degree of freedom (2 DOF)	Modal analysis, Coupling co-ordinates, Vibration absorber	T1-CH5
17-20	Computational methods for MDOF system	Orthogonality principle, Modal analysis for MDOF system: Matrix iteration method (Iteration, & Deflation)	T1-CH 7
21-24	Approximation methods: Rayleigh's method, Dunkerley's equation, Holzer method	Approximate natural frequencies for discrete system	T1-CH 10
25-28	Vibration of continuous system: String, Rods, Beams	Study of lateral, axial and bending vibration of mechanical systems	T1- CH8
29-31	Continuous system: Approximate solution	Rayleigh's method, Rayleigh-Ritz method,	T1- CH10
32-37	Introduction to Control system	Basic Introduction of control system	Class notes

6. Evaluation Scheme:

Evaluation Components	Duration (min.)	Weightage (%)	Marks	Date and time	Remarks
Mid-sem	90	30	60	<TEST_1>	OB
Quiz	-	15	30		--
Tutorial	-	20	40		OB
Compre. Exam	180	35	70	**<TEST_C>**	OB
TOTAL			200		

7. a. Tutorial : There will be four evaluative tutorials, each of 10 marks. All are surprise in nature.
b. Quiz : Two Quiz will be there. Dates will be announced.

8. Chamber Consultation Hour: Through Google meet link : The link will be shared in CANVAS

9. Notices: Notice, will be given in CANVAS

Instructor-In-Charge
ME F343