

COURSE CODE	COURSE TITLE	L	T	P	C
1152AE138	Theory of Vibrations	3	0	0	3

Course Category:

Programme Elective

a. Preamble :

This course makes an attempt to introduce fundamental concepts of aircraft structural dynamics and aeroelasticity. The numerical techniques on structural dynamics will enhance the approximation techniques on vibrations.

b. Prerequisites:

- Strength of Materials

c. Links to other courses:

- Finite Element Method
- Aeroelasticity

d. Course educational objectives :

Students undergoing this course are expected:

- To explain fundamental concepts of structural dynamics and approximation techniques.
- To evolve the students view on aircraft structures to synthesis dynamics of structures.

e. Course outcomes :

On the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Estimate force response for damped and undamped system	K3
CO2	Differentiate Dynamic, static and impulse loading and estimate damping ratio.	K3
CO3	Analyze dynamics of Multi Degree of freedom and rotating system.	K4
CO4	Synthesis the dynamics of aircraft structures	K5
CO5	Explain principles of Aeroelasticity	K2

f. Correlation of cos with pos :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		H	H		H	H	H		H		
CO2	H		H	H		H	H	H		H		
CO3	H		H	H		H	H	H		H		
CO4	H		H	H		H	H	H		H		
CO5	H		H	H		H	H	H		H		

H- High; M-Medium; L-Low

g. COURSE CONTENTS :

UNIT I FUNDAMENTAL CONCEPTS L – 9

Introduction, discrete systems, matrix formulation, generalized equations of motion, generalized forces, response of undamped systems, special kinds of damping. Single Degree of Freedom System - Force Response for Damped and Undamped Condition

UNIT II PROPERTIES OF VIBRATION SYSTEMS L-9

Effect on the Support of a Vibrating Structure. Determination of Damping Ratio. Response to General Dynamic Loading-Impulsive Loading and Duhamel's Integral, Laplace Transformation. Modal Response Analysis, Lagrangian Equations

UNIT III MULTI- DEGREE OF SYSTEM AND ROTATIONAL DYNAMICS L-9

Vibration of multiple degree-of-freedom systems; Forced harmonic Oscillation of Multi-Degree of Freedom System. Modal Response Analysis - rotational kinematics and dynamics of rigid bodies.

UNIT IV APPROXIMATE METHODS IN STRUCTURAL DYNAMICS L-9

Longitudinal Vibration of Rods-Torsional Vibration of Rods, Euler Equation of Beam-Approximate Methods Related to Structural Dynamic - Rayleigh-Ritz Method, Galerkin's Method. Numerical Methods Related to General Dynamic Loading.

UNIT V INTRODUCTION TO AEROELASTICITY L-9

Fundamentals; In-depth examination of aerodynamic and dynamic structural phenomena associated with flexible airplanes and missiles; equations of disturbed motion of elastic and inelastic aircraft;

Total: 45 Hrs

h. TEXT BOOKS :

1. W. T. Thomson, "Theory of Vibration with Applications", CBS Publishers & Distributors.
2. Leonard Meirovitch, "Elements of Vibration Analysis", Tata McGraw-Hill Publishing Company Limited.
3. Roy R. Craig, Jr., "Structural Dynamics-An introduction to Computer Methods", John Wiley & Sons.
4. Y.C.Fung, "An introduction to the Theory of Aeroelasticity", Dover Publications.

i. REFERENCES:

1. Mario Paz, "Structural Dynamics-Theory and Computation", CBS Publishers & Distributors.
2. Journal of Aeroelasticity and Structural Dynamics, ISSN 1974-5117