Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NMED527	Structural Dynamics and Aeroelasticity	3	0	0	3

Course Objective
• To learn the concept of modal analysis, various methods of structural dynamics analysis of simple beam structures and simplified analysis of such aeroelastic phenomena as divergence, control-surface reversal, and flutter. • To learn the importance of incorporating aeroelastic phenomena in aircraft design and some elementary methods for doing so.
Learning Outcomes
Upon successful completion of this course, students will be: • Familiar with modal representation and to be able to solve elementary structural dynamics problems for beams; • Able to formulate and solve static aeroelasticity problems such as typical section and wing divergence problems; • Able to use simplified unsteady aerodynamic theories to formulate and solve typical section flutter problems with one and two degrees of freedom • Developed a qualitative understanding of the role of aeroelastic phenomena, such as divergence, control-surface reversal, and flutter, in aircraft design and performance.

Unit No.	Topics	Lecture Hours	Learning Outcome
1	Introduction : Structural Dynamics, Uniform Beam Bending , Beam Torsion	8	Understanding the modal representation and solve elementary structural dynamics problems for beams
2	Torsional divergence and static airload distributions, Complete vehicle equilibrium and sweep effects, Control effectiveness and reversal of complete vehicle	9	Understanding the formulation and solution of static aeroelasticity problems
3	Lifting surface flutter, flutter analysis using modal representation, the p, k and p-k methods of solutions, effects of Mach number, altitude and mass ratio	9	Understanding the simplification of unsteady aerodynamic theories to formulate and solve typical section flutter problems

4	panel flutter, linear theory for flat panels and design considerations	8	Understanding the supersonic flutter theories
5	Assumed mode solutions for flat and cylindrical panels, Non-linear theory for flat panels and development of fatigue criteria.	8	Understanding the supersonic flutter theories
Total		42	

Text:

1. D.H. Hodges and G.A. Pierce, "Introduction to Structural Dynamics and Aeroelasticity" Cambridge Aerospace Series, 2012.

Reference:

1. E.H. Dowell et.al., "A Modern Course in Aero elasticity", Sijthoff&Noordhoff, 1980..
2. R.L. Bisplinghoff and H. Ashley, "Principles of Aeroelasticity", Dover, 1962.
3. Y.C. Fung, "An Introduction to the Theory of Aeroelasticity", John Wiley & sons, 1955.