

15AS401	VIBRATIONS AND ELEMENTS OF AEROELASTICITY			L	T	P	C
				3	0	0	3
<i>Co-requisite:</i>	Nil						
<i>Prerequisite:</i>	15AS102						
<i>Data Book / Codes/Standards</i>	Nil						
<i>Course Category</i>	P	PROFESSIONAL CORE	STRUCTURES				
<i>Course designed by</i>	Department of Aerospace Engineering						
<i>Approval</i>	Academic Council Meeting – 23 rd July, 2016						

PURPOSE	To make the students to understand the methods to study the dynamic behavior of different aircraft components and the interaction of aerodynamic, elastic and inertia forces.						
INSTRUCTIONAL OBJECTIVES				STUDENT OUTCOMES			
At the end of the course, student should be able							
1.	To familiarize concept of basic motions of a structure.			a	e		
2.	To familiarize concept of the single degree of freedom systems.			a	e		
3.	To familiarize the concept of multi degree of freedom systems.			a	e		
4.	To familiarize the concept of approximate methods to find the natural frequencies of a system.			a	e		
5.	To familiarize with the interaction of aerodynamic, elastic and inertia forces.			a	e		

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: BASIC MOTIONS	9			
1.	Simple harmonic motion-Terminologies.	2	C	1	1,4,6
2.	Newton's law-D'Alembert's principle.	2	C	1	1,4,6
3.	Energy Methods	5	C	1	1,4,6

	UNIT II: SINGLE DEGREE OF FREEDOM SYSTEMS	9			
4.	Free vibrations-Damped vibrations	3	C	2	1,4,6
5.	Forced vibrations-with and without damping.	2	C	2	1,4,6
6.	Support excitation.	2	C	2	1,4,6
7.	Vibration measuring instruments.	2	C	2	1,4,6
	UNIT III: MULTI DEGREE OF FREEDOM SYSTEMS	9			
8.	Two degree of freedom systems-Static and Dynamic couplings, vibration absorber	3	C	3	1,4,6
9.	Principal coordinates, Principal modes, Orthogonal condition, Eigen value problem.	2	C	3	1,4,6
10.	Hamilton's principle, Lagrangean equation and application, vibration of elastic bodies.	2	C	3	1,4,6
11.	Vibration of strings, Longitudinal, lateral and torsional vibrations.	2	C	3	1,4,6
	UNIT IV: APPROXIMATE METHODS	9			
12.	Rayleigh's method to find natural frequencies.	5	C	4	1,4,6
13.	Holzer's method to find natural frequencies.	4	C	4	1,4,6
	UNIT V: ELEMENTS OF AEROELASTICITY	9			
14.	Aeroelastic problems-Collar's triangle of forces	3	C	5	2,3,5
15.	Wing divergence problem	3	C	5	2,3,5
16.	Aileron control reversal, Flutter problems	3	C	5	2,3,5
	Total contact hours*			45	

*Excluding Assessment hours

LEARNING RESOURCES	
Sl.No.	TEXT BOOKS
1.	Timoshenko S., “ <i>Vibration Problems in Engineering</i> ”– John Wiley and Sons,New York, 1993.
2.	Fung Y.C., “ <i>An Introduction to the Theory of Aero elasticity</i> ” – John Wiley & Sons, New York, 1995.
REFERENCE BOOKS/OTHER READING MATERIAL	
3.	Bisplinghoff R.L., Ashley H and Hoffman R.L., “ <i>Aero elasticity</i> ” – Addison Wesley Publication, New York, 1983.
4.	Tse. F.S., Morse, I.F., Hinkle, R.T., “ <i>Mechanical Vibrations</i> ”, – Prentice Hall,New York, 1984.
5.	Scanlan R.H. & Rosenbaum R., “ <i>Introduction to the study of Aircraft Vibration & Flutter</i> ”, John Wiley and Sons. New York, 1982.
6.	Tongue. B. H., “ <i>Principles of Vibration</i> ”, Oxford University Press, 2000.

Course nature					Theory		
Assessment Method (Weightage 100%)							
In-semester	Assessment tool	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	Total
	Weightage	10%	15%	15%	5%	5%	50%
End semester examination Weightage :							50%