

Course code	Course Name	L-T-P-Credits	Year of Introduction
AO304	VIBRATION AND AEROELASTICITY	3-0-0-3	2016
Prerequisite :Nil			
Course Objectives			
<ul style="list-style-type: none"> To study the dynamic behavior of different aircraft components and the interaction among the aerodynamic, elastic and inertia forces 			
Syllabus			
Simple harmonic motion -Free and forced vibrations- Vibration measuring instruments - Static and Dynamic couplings - Eigen value problems -Hamilton's principle- Lagrangean equation and application – Vibration of elastic bodies- Vibration of strings- Longitudinal, Lateral and Torsional vibrations – Rayleigh's and Holzer methods - Transverse vibrations of strings - Aero elastic instabilities			
Expected Outcome			
The students will			
<ol style="list-style-type: none"> Gain knowledge on vibration Be able to define and predict the motion of vibrating body. Get an idea of Aeroelasticity. 			
Text Books:			
<ol style="list-style-type: none"> Fung Y.C., "An Introduction to the Theory of Aeroelasticity" – John Wiley & Sons, New York, 1995. Timoshenko S., "Vibration Problems in Engineering"– John Wiley and Sons, New York, 1993. V P Singh, Mechanical Vibrations, Dhanpat Rai & Co (P) Ltd 			
Reference:			
<ol style="list-style-type: none"> Bisplinghoff R.L., Ashley H and Hoffman R.L., "Aeroelasticity" – Addison Wesley Publication, New York, 1983. Scanlan R.H. & Rosenbaum R., "Introduction to the study of Aircraft Vibration & Flutter", John Wiley and Sons, New York, 1982. Tongue. B. H., "Principles of Vibration", Oxford University Press, 2000. Tse. F.S., Morse, I.F., Hinkle, R.T., "Mechanical Vibrations", – Prentice Hall, New York, 1984. 			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Simple harmonic motion – Terminologies.	1	15%
	Newton's Law. D' Alembert's principle.	1	
	Energy Methods	3	
II	Free vibrations, numerical problems	3	15%
	Damped vibrations, numerical problems	3	

	Forced Vibrations, with and without damping – support excitation	2	
FIRST INTERNAL EXAM			
III	Two degrees of freedom systems – Static and Dynamic couplings vibration absorber.	2	15%
	Principal co- ordinates, Principal modes and orthogonal condition – Eigen value problems.	3	
	Hamilton’s principle– Vibration of elastic bodies.	3	
	Vibration of strings- Longitudinal, Lateral and Torsional vibrations.	2	
IV	Rayleigh’s Methods to find natural frequencies.	3	15%
	Holzer Methods to find natural frequencies.	3	
SECOND INTERNAL EXAM			
V	Transverse vibrations of strings.	1	20%
	Longitudinal, Lateral and Torsional vibrations.	1	
	Approximate methods for calculating natural frequencies.	3	
VI	Concepts – Coupling.	2	20%
	Aero elastic instabilities and their prevention.	2	
	Basic ideas on wing divergence, loss and reversal of aileron control.	2	
	Flutter and its prevention.	2	
END SEMESTER EXAM			

Question Paper Pattern

Maximum marks: 100

Exam duration: 3 hours

The question paper shall consist of three parts

Part A

4 questions uniformly covering modules I and II. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part B

4 questions uniformly covering modules III and IV. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part C

6 questions uniformly covering modules V and VI. Each question carries 10 marks
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed.