SEMESTER 8

AERO ACOUSTICS

Course Code	**PEAOT864**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	Engineering Mechanics, Mechanics of Aircraft Materials	**Course Type**	Theory

Course Objectives:

1. Understand fundamental principles of Aero Acoustics.
2. Understand the generation and propagation of sound in atmosphere, and the physical mechanisms behind noise production.

SYLLABUS

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Module No.	Syllabus Description	Contact Hours
1	Basic acoustic terminology and definitions - Plane waves and harmonic solution - velocity of sound in fluids - relationship between wavelengths, particle velocities, acceleration. Acoustic energy density and intensity - acoustic impedance associated with fluid flows. Logarithmic decibel scales – acoustic reference standards and noise regulations.	**9**
2	Conservation laws and governing equations of fluid mechanics - Light hill's analogy and derivation of Light hill's equation. Noise generated from flow turbulence – sound generation in subsonic and supersonic fluid flow over solid and flexible boundaries. Sound radiation from simple sources like monopole, dipole and quadruple. Brief introduction to computational aero acoustics.	**9**
3	Duct acoustics, sound fields in ducts and wave guides – property of duct modes. Cavity noise- turbo-machinery noise and buzz-saw noise - noise suppression devices like mufflers and plenum chambers. Noise insulation and absorption – Acoustic materials. Various sources of noise in an aircraft - noise produced by engine, propellers, fans, combustion chambers, - helicopter rotor noise – noise generated by subsonic and supersonic jets and rocket exhausts.	**9**

4	Noise produced by boundary layers on external surfaces- like fins and stabilizers or from sonic boom. Impact of noise levels on humans and environment. Phone and Sone scales. Perceived noise levels and noise number index - hearing loss index. Aircraft noise regulations near airports – important noise measurements and common instruments. Noise control by source modification, transmission path alterations and receiver protection.	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Micro project	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

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End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand acoustics definitions and plane wave solutions in time and frequency domain.	**K2**
CO2	Explain importance of Light hill's analogy and light hill's equation in turbulence acoustic field.	**K2**
CO3	Understand the acoustic concepts in duct, cavity and mufflers to reduce noise.	**K2**
CO4	Describe the types of noise generation and sound measuring instruments in aircraft.	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	1	1	-	-	-	-	1
CO2	2	-	-	-	-	1	1	-	-	-	-	1
CO3	2	-	-	-	-	1	1	-	-	-	-	1
CO4	2	-	-	-	-	1	1	-	-	-	-	1

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1.	Aero Acoustics	M.E. Goldstein	Mc Graw Hill Publications	1976
2.	Acoustics and Noise Control	R.J. Peters, B.J. Smith and Margret Hollins	Routledge Publications,London	2011

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Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1.	Aerodynamic Noise – An introduction for physicists and engineers	Tarit. K. Bose	Springer Publications, 2013 ISBN:9781461450191	2013
2.	Fundamentals of physical acoustics.	Blackstock, David T	John Wiley & Sons	2000
3.	Mechanics of Solids	S.Jose, Sudhi Mary Kurian	Pentagon	2009
4.	Engineering Principles of Acoustics	Reynolds D. D.	Allyn and Bacon Inc., Boston	1975

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1.	https://archive.nptel.ac.in/courses/112/106/112106225/
2.	https://archive.nptel.ac.in/courses/112/106/112106225/
3.	https://archive.nptel.ac.in/courses/112/106/112106225/
4.	https://archive.nptel.ac.in/courses/112/106/112106225/

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