SEMESTER 4

INDUSTRIAL AERODYNAMICS

Course Code	**PEAOT413**	**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)	PCAOT205 PCAOT402	**Course Type**	Theory

Course Objectives:

1. To familiarize non-aeronautical uses of aerodynamics in road vehicles, buildings and problems of flow induced vibrations.

SYLLABUS

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Module No.	Syllabus Description	Contact Hours
1	**Atmosphere** Introduction and Role of Atmosphere in the Aerodynamics, Types of wind, causes of variation of wind- Effect of terrain on gradient height- Atmospheric boundary layer, -Atmospheric disasters- clones, tornado. Classification of Wind Tunnels -Dimensional Analysis (Concept of Flow Similarity, Geometric Similarity, Kinematic Similarity, Dynamic Similarity),	**9**
2	**Introduction to Wind Engineering** Wind energy collectors -Pressure and velocity variations of wind turbines - Vertical and horizontal axis machines - Power coefficient, Betz coefficient by momentum theory Aerodynamic design of blades	**9**

3	**Vehicle and Building Aerodynamics** Power requirements and drag coefficients of automobiles, Effects of cut back angle, aerodynamics of trains and Hovercraft. Pressure distribution on low rise buildings, wind forces on buildings, Environmental winds in city blocks, special problems of tall buildings and bridges	**9**
4	**Atmospheric Turbulence ,Flow Induced Vibrations & Sports Aerodynamics & Hydrodynamics** Atmospheric turbulence and the causes - Structure of turbulence flow- Boundary layers and separation. Vortex shedding - Effects of Reynolds number on wake formation of bluff bodies across wind galloping - wake galloping-along wind galloping of circular cables - stall flutter- Wind loads on launch vehicles speed sports(Ski jumping and cycling), ball sports(Football) ,projectile sports and, Sports garments (Outfits)	**9**

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

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Continuous Internal Evaluation Marks (CIE):

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

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:

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	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Familiarize with atmosphere and its effects, and wind tunnels	**K2**
CO2	To analyze the aerodynamics of automobiles, trains, hovercraft, buildings and bridges.	**K4**
CO3	Explain the concept of vortex induced vibrations.	**K2**
CO4	To determine the effect of wind on different structures and sports aerodynamics.	**K3**

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										3
CO2	2					2						2
CO3	3											3
CO4	3											3

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	wind turbines theory and practice book	Colin Anderson.		2020
2	"Aerodynamics and drag mechanisms of bluff bodies and road vehicles"	M.Sovran (Ed	Plenum press, New York,	1978
3	"The aerodynamics of heavy vehicle- Trucks, buses and trains"	Rose Mccallen, Fred Browand, James Rose	Springer	2004
4	Building Aerodynamics	T. Lawson,	Imperial College Press	(2001)
5	Wind power principles	N.G Calvent,	Charles Griffin, & Co..	1979

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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	" Wind forces in engineering",	P. Sachs	Pergamon Press,	
2	" Flow induced vibrations",	R.D Belvins,	Van Nostrand,	
3	A review on aerodynamics and hydrodynamics in sports	Firoz Alam,Harun Chowdhury	2nd International Conference on Energy and Power, ICEP2018, 13–15 December 2018	

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://youtu.be/8-30-oIeUuM?si=DSArHrukcmXNA40m
2	https://youtu.be/QmQ12gSz5CY?si=vYSgD15-fVBRs71_
3	https://youtu.be/PuDtLbPokSE?si=r9sTbZE6UKWUR-sf

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