

COURSE CODE	COURSE TITLE	L	T	P	C
1152AE126	INDUSTRIAL AERODYNAMICS	3	0	0	3

**Course Category:**

Program Elective

**a. Preamble :**

This course deals with the various applications of aerodynamics on non-aeronautical uses such as road vehicle, building aerodynamics and problems of flow induced vibrations.

**b. Prerequisite Courses:**

Fluid Mechanics

**c. Related Courses:**

- Wind Engineering

**d. Course Educational Objectives :**

- To understand the concept of atmosphere boundary layer
- To familiarize with non-aeronautical applications of aerodynamics

**e. Course Outcomes :**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Describe the atmospheric wind and its elements.	K2
CO2	Explain wind energy harvesting using different methods	K3
CO3	Develop flow control techniques for vehicle aerodynamics	K3
CO4	Explain effects of wind loading on building and urban planning.	K3
CO5	Explain wind structure induced vibration	K3

**f. Correlation of COs with POs :**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	H				H	H			
CO2	H		H	H				H	H			
CO3	H		H	H				H	H			
CO4	H	H	H	H				H	H			
CO5	H	H	H	H				H	H			

H- High; M-Medium; L-Low

**g. Course Content :**

**UNIT I ATMOSPHERE**

**9**

Types of winds, Causes of variation of winds, Atmospheric boundary layer, Effect of terrain on gradient height, Structure of turbulent flows.

## **UNIT II WIND ENERGY COLLECTORS            9**

Horizontal axis and vertical axis machines, Power coefficient, Betz coefficient by momentum theory – Piezo wind energy collectors – various bladeless wind energy harvesting methods.

## **UNIT III VEHICLE AERODYNAMICS            9**

Power requirements and drag coefficients of automobiles, Effects of cut back angle, Aerodynamics of trains and Hovercraft, Various drag reduction and optimization techniques, flow control and its applications

## **UNIT IV BUILDING AERODYNAMICS            9**

Pressure distribution on low rise buildings, wind forces on buildings. Environmental winds in city blocks, Special problems of tall buildings, Building codes, Building ventilation and architectural aerodynamics, urban planning and human comfort.

## **UNIT V FLOW INDUCED VIBRATIONS            9**

Effects of Reynolds number on wake formation of bluff shapes, Vortex induced vibrations, Galloping and stall flutter, Vibration of stay cables under wind load.

**Total : 45 Hrs**

### **Learning Resources**

#### **i. Text Books :**

1. M.Sovran (Ed), “Aerodynamics and drag mechanisms of bluff bodies and road vehicles”, Plenum press, New York, 1978.
2. P. Sachs, “Winds forces in engineering”, Pergamon Press, 1978.

#### **.ii. Reference:**

1. R.D. Blevins, “Flow induced vibrations”, Van Nostrand, 1990. 2. N.G. Calvent, “Wind Power Principles”, Charles Griffin & Co., London, 1979