

The Revised Course Proposal

of

Industrial Aerodynamics

for

(For B.Tech/ B.Tech-M.Tech (Dual), M.Tech and Ph.D Students)

Submitted by

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and

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Course Name

Industrial Aerodynamics

Proposed Course Instructors

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Semester in which course will be offered

Spring

Justification for Revising the Existing Course

Based on the feedback received from the students, it was desired to have a more detailed course structure with clear objectives underlined, supplemented with a complete list of text and reference books. In turn, to the best of my ability an online survey was made and attempt was made to optimize the syllabus in about 40 lectures. Additionally, since this course is already being floated as an elective for undergraduate student in spring semester, there is a strong feeling in among students to make it available for post-graduate students as well. Also, it should be kept under elective category so that, all the students studying in various streams across the institute can credit and get benefited provided they have already cleared the fluid mechanics course as a prerequisite.

Text Books

- Wind Power Principles, N. G. Calvert, Charles Griffin and Company (1979).
- Building Aerodynamics, T. Lawson, Imperial College Press (2001).
- The Aerodynamics of Heavy Vehicles: Trucks, Buses, and Trains, F. Browand, R. McCallen, J. Ross, Springer (2008).

Reference Books

- Low-Speed Wind Tunnel Testing, Jewel B. Barlow, William H. Rae, Alan Pope, Wiley Publications (1999).
- Wind Tunnel Designs and Their Diverse Engineering Applications, N. A. Ahmed, Intech Publications (2014).

Course Content

The course will comprise of the following 4 major units.

- Unit 1: Standard Atmosphere
- Unit 2: Introduction to Wind Engineering
- Unit 3: Wind Tunnel Testing, Instrumentation and Measurements
- Unit 4: Vehicle and Building Aerodynamics

Prerequisite

- Fluid Mechanics (Students from other than Aerospace Engineering)
- Introduction to Aerodynamics (Students from Aerospace Engineering)

Total number of lectures: 40 (Approx.)

The detailed syllabus of the course is distributed as given below.

Unit 1: Standard Atmosphere (10 Lectures)

- Introduction and Role of Atmosphere in the Aerodynamics
- Composition, Structure and Stability of the Atmosphere
- Characteristics of Atmospheric Boundary Layer
- Parametric Studies in Aerodynamics (Pressure, Density, Temperature, Flow Velocity, Coefficient of Viscosity)
- Dimensional Analysis (Concept of Flow Similarity, Geometric Similarity, Kinematic Similarity, Dynamic Similarity)
- Non-Dimensional Parameters (Mach Numbers, Euler Numbers, Froude Number, Strouhal Number, etc.)

Unit 2: Introduction to Wind Engineering (8 Lectures)

- Definition of Wind
- Geostrophic Wind, Ageostrophic Wind and Ekman Spiral
- Wind Energy Harvesters (Horizontal-Axis and Vertical-Axis Machines)
- Energy Density of Different Rotors, Power Coefficient, and Betz Coefficient

Unit 3: Wind Tunnel Testing, Instrumentation and Measurements (12 Lectures)

- Classification of Wind Tunnels and Methods for Solving Wind Engineering and Industrial Aerodynamics Problems
- Basic Shape Factors for Aerodynamic, Sharp-Nosed, Blunt-Nosed and Bluff Bodies
- Slender body Aerodynamics
- Bluff Body Aerodynamics
- Measurement Techniques (Wind Tunnel Balances, Pressure Measurement Techniques, Factors affecting the Pressure Measurements, Noise Measurements, Pitch and Yaw Measurements)

Unit 4: Vehicle and Building Aerodynamics (10 Lectures)

- Boundary Layers, Separation and Reattachment
- Wake and Vortex Formation
- Power requirements and Drag Coefficients of Automobiles
- Pressure Distribution and Wind Forces on Buildings
- Building Ventilation and Architectural Aspects