



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

AERODYNAMICS AND PROPULSION LABORATORY								
IV Semester: AE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AAED12	Core	L	T	P	C	CIA	SEE	Total
		-	-	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 45			Total Classes: 45			
Prerequisite: Aerodynamics and Propulsion								

I. COURSE OVERVIEW:

The aerodynamics and propulsion laboratory course typically involves hands-on experiments and practical applications to reinforce the theoretical concepts learned in aerodynamics and propulsion courses. The lab is designed to provide students with a deeper understanding of the principles related to the behaviour of aerodynamic concepts and propulsion systems used in aircrafts. This course offers a wide range of applications in aerodynamics and propulsion such as measurement of lift, drag, moment, boundary layer and thrust measurements. It forms an essential cornerstone for aerospace engineers, plays a pivotal role in the efficient design and testing of various aircraft components.

II. COURSE OBJECTIVES:

The students will try to learn:

- I. The wind tunnel calibration and associated instrumentation.
- II. The measurement of lift and drag coefficients of various aerodynamic components
- III. The measurement of performance characteristics of compressor, blower, propeller and nozzle
The thrust measurement and performance calculation of gas turbine engine.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

- CO1 Make use of various calibration techniques for assessing the flow quality in wind tunnel test section.
- CO2 Examine the pressure distribution over airfoil, cylinder and flat plate for predicting their aerodynamics characteristics.
- CO3 Utilize the six-component force balancer for deducing the forces and moments of aircraft model and hence obtaining the aircraft performance and stability.
- CO4 Determine the pressure, temperature across each component gas turbine engine for predicting its thrust and performance characteristics.
- CO5 Examine the performance characteristics of compressor, blower, propeller and nozzle for their efficient design
- CO6 Identify the flash point, fire point and calorific value of different fuels for their suitability in aerospace applications.

IV. COURSE CONTENT

Week-1: CALIBRATION OF SUBSONIC WIND TUNNEL

Determine the true speed and flow angularity

Week-2: PRESSURE DISTRIBUTION OVER CYLINDER

Measure the pressure distribution over a circular cylinder

Week-3: PRESSURE DISTRIBUTION OVER SYMMETRICAL AIRFOIL

Determine the pressure coefficient, lift and drag coefficient

Week-4: WAKE ANALYSIS

Determine the drag coefficient of a circular cylinder

Week-5: FORCE MEASUREMENTS

Determine the lift, drag, side force and moment

Week-6: FLOW OVER A FLAT PLATE

Determine the boundary layer thickness at different station

Week- 7: GAS TURBINE PARAMETERS CALCULATION

Estimate the thrust output CM14 – axial flow gas turbine engine.

Week -8: GAS TURBINE PERFORMANCE DIAGRAMS AND EFFICIENCY

Estimate the actual thermodynamic cycle experienced by the flow and engine efficiency

Week-9: GAS TURBINE COMPONENT EFFICIENCY

Estimate the efficiencies of intake, compressor, combustion chamber, turbine and nozzle

Week- 10: BLOWER TEST RIG

Estimate the discharge, suction head, delivery head and efficiency

Week- 11: CENTRIFUGAL COMPRESSOR

Estimate the discharge, suction head, delivery head and efficiency of the centrifugal compressor

Week-12: NOZZLE PERFORMANCE

Estimate the discharge, head, efficiency, thrust, wall pressure distribution

Week-13: PROPELLER TEST RIG

Estimate the thrust, mass flow rate of air, torque, efficiency

Week-14: BOMB CALORIMETER

Determine calorific value and specific heat Capacity of JP-4/Kerosene

V. TEXT BOOKS:

1. Alan pope, “Low Speed Wind Tunnel Testing”, John Wiley, 2nd edition, 1999.

VI. REFERENCE BOOKS:

2. Mattingly J.D., “Elements of Propulsion: Gas Turbines and Rocket”, AIAA, 1991.

VII. ELECTRONICS RESOURCES:

1. www.loc.gov/rr/scitech/tracer-bullets/aerodynamicstb.html
2. www.myopencourses.com/subject/aerodynamics-2

VIII. MATERIALS ONLINE

1. Course template
2. Lab manual

