

AERODYNAMICS AND PROPULSION LABORATORY

I Semester: AE								
Course Code	Category	Hours / Expt			Credits	Maximum Marks		
AAEB12	Core	L	T	P	C	CIA	SEE	Total
		-	-	2	1	30	70	100
Contact Classes: Nil		Tutorial Classes: Nil		Practical Classes: 24			Total Classes: 24	
<p>COURSE OBJECTIVES: The course should enable the students to:</p> <ol style="list-style-type: none"> I. Understand the behavior of flow properties over different models using subsonic wind tunnel. II. Demonstrate experimentally the pressure distribution over circular, symmetric and cambered airfoils and evaluate lift and drag. III. Illustrate flow visualization studies at low speeds over different aerodynamic bodies. IV. Understand the basics of propulsion, working principles of reciprocating engines, performance estimation based on rotation angles, and components of engine and their functions. V. Knowledge about the operation of valves, ports and their functioning in four stroke and two stroke engines. VI. Calculation of percentage of carbon residue and flash and fire point temperatures of a Lubricating Oil. <p>COURSE OUTCOMES (COs):</p> <p>CO 1: Implement the computational fluid dynamic and computational aerodynamic fundamentals by using advanced solvers.</p> <p>CO 2: Understand the flow properties of flat plate, nozzle and cylinder to demonstrate Reynolds number.</p> <p>CO 3: Differentiate the flow properties around symmetrical and cambered airfoil.</p> <p>CO 4: Analyse the coefficient of pressure, lift, drag and moment for different bodies for different flow conditions.</p> <p>CO 5: Visualize the flow around the different bodies under supersonic conditions.</p> <p>COURSE LEARNING OUTCOMES (CLOs):</p> <p>The students should enable to:</p> <ol style="list-style-type: none"> 1. Understand the behavior of flows around different structured objects. 2. Understand the aerodynamic properties of flow over an airfoil. 3. Differentiate the flow properties around symmetrical and cambered airfoil 4. Understand the aerodynamic properties for flow through cylinder. 5. Observe the properties at separation region and wake region of circular cylinder at different Reynolds numbers 6. Analyze the coefficient of pressure, lift, drag and moment for different bodies for different flow conditions. 7. Compare the efficiency of blower test rig for 3 different vane settings. 8. Observe flow properties and compare the computation results with experimental results 9. Analyze thermal, propulsive and overall efficiency of turbo jet cycle. 10. Compare calorific value of different fuels and materials using digital bomb calorimeter and optimizing astute fuels 11. Analyze propeller efficiency and thrust availability using propeller test rig at various blade pitch 								

	angles.
	12. Examine work, power and Thrust requirement in gas turbine- combustion power input, work heat relationship.
	13. Understand T-S, H-S diagrams for the gas turbine and compare efficiencies of non-ideal engine components.
LIST OF EXPERIMENTS	
Week-1	CALIBRATION AND PRESSURE DISTRIBUTION-CYLINDER
Calibration of subsonic wind tunnel, Pressure distribution over cylinder.	
Week-2	PRESSURE DISTRIBUTION AND FLOW VISUALIZATION -SYMMETRIC, CAMBERED AIRFOIL
Pressure distribution and flow visualization over symmetric, cambered airfoil	
Week-3	FORCE MEASUREMENT
Force measurement using wind tunnel balance.	
Week-4	WAKE ANALYSIS
Wake analysis over a cylinder and airfoils	
Week-5	FLOW OVER A FLAT PLATE
Flow over a flat plate	
Week-6	BLOWER TEST RIG
Efficiency of blower test rig for 3 different vane settings.	
Week-7	GAS TURBINE PARAMETERS CALCULATION
Calculation of work, power and Thrust requirement in gas turbine- combustion power input, work heat relationship.	
Week-8	GAS TURBINE EFFICIENCY AND PERFORMANCE DIAGRAMS
Elucidate T-S, H-S diagrams for the gas turbine and compare efficiencies of non-ideal engine components.	
Week-9	GAS TURBINE EFFICIENCY CALCULATIONS
Calculation of thermal, propulsive and overall efficiency of turbo jet cycle.	
Week-10	NOZZLE PERFORMANCE
Calculation of various nozzle performance with airflow	
Week-11	CALORIFIC VALUE OF DIFFERENT FUELS
Calculation of calorific value of different fuels and materials using digital bomb calorimeter and optimizing astute fuels	
Week-12	PROPELLER TEST RIG
Calculation of propeller efficiency and thrust availability using propeller test rig at various blade pitch angles.	
Reference Books:	
1. L. J. Clancy, —Aerodynamics”, Pitman, 1st Edition, 1986.	
2. Alan pope, —Low Speed Wind Tunnel Testing”, John Wiley, 2nd Edition, 1999.	
3. N. M. Komerath, —Low Speed Aerodynamics”, Extrovert, 1st Edition, 2012.	