Course Title	**Applied Mathematics**	Semester	I
Course Code	MVJMAE11	CIE	50
Total No. of Contact Hours	40 L: T: P: 3:0:0	SEE	50
No. of Contact Hours/week	4	Total	100
Credits	3	Exam. Duration	3 Hrs.

The course objective is to:

- Acquire Knowledge of Numerical Differentiation and Integration
- Understand Tensors and the Algebra of Tensors
- Gain Knowledge of Optimization Techniques
- Understand the Application of Variational Methods

Module 1	**L3, L4**	8 Hrs.

Numerical Differentiation & Integration

Numerical Differentiation – Formulae for derivatives, differentiation via interpolation, Richardson`s extrapolation.

Numerical Integration: Composite numerical integration, Romberg integration, Inherent errors in numerical integrations; Newton-Cotes quadrature formula; Euler-Maclaurin formula; Adaptive quadrature method, Gaussian quadrature, Multiple integrals.

Applications: Analysis techniques in Aeronautical field

Self-study topic: Method for undetermined coefficients

Module 2	**L3, L4**	8 Hrs.

Multilinear Algebra:

Review of linear algebra-vector spaces, linear transformation, Eigen bases. Multilinearity. Tensor as a generalized concept of a vector in a Euclidean space. Tensor ranks, properties of matrix ranks, properties of multilinear rank, algebraic computational complexity. Contravariant and covariant vectors and mixed tensors; symmetric and skew- symmetric tensors. Addition and scalar multiplication. Outer and Inner products of tensors; Quotient law.

Applications: Flow simulation, Structural analysis, Stability & Control of flight vehicles

Self-study topic: Application-Inertia tensor, stress tensor, contravariance of stress tensor.

Module 3	**L3, L4**	8 Hrs.

Optimization Techniques: Unconstrained optimization- Category of optimization methods. Optimality condition (univariate/multi-variate). Single variable optimization, maxima/minima of a function, Unimodel-Fibonacci method. Polynomial based method. Multivariable optimization. Steepest decent method, conjugate gradient method. Optimization algorithm (analytical, and numerical). Constrained optimization- Lagrange method, Augmented Lagrange technique. Applications: Aerodynamic optimization, Structural optimization, Multi-disciplinary optimization Self study topics: Quadratic programming		
Module 4	**L3, L4**	8 Hrs.
Variational Methods-I: Euler Lagrange necessary condition for an extremum and constraints. Euler Lagrange multiplier theorem for many constraints, and proof of the theorem. Application of Euler-Lagrange multiplier theorem in calculus of variations. Problems with fixed end points & variable end points. Application: Development and Solution of Differential equations Video		
Module 5	**L3, L4**	8 Hrs.
Variational Methods-II: Use of second variation in Extremum problems, necessary and sufficient conditions for extremum. Du Bois-Reymond`s theorem. Function of several variables, Dirichlet` principle. Application: Development and Solution of Differential equations. Self study topics: Eigenvalue problem formulation as a variational problem.		

Course outcomes:

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

CO1	Analyze flow field and aero-structures, aero systems related problems.
CO2	Perform Flow simulation, Structural analysis, Stability & Control of flight vehicles
CO3	Evaluate Multi-disciplinary optimal solutions
CO4	Develop and solve object orientated differential equations for several variables.

Text Books:	
1.	Ray M Bowen & C._C.Wang, `Introduction to Vectors and Tensors, Vol1: Linear & Multilinear Algebra,1976.
2.	Kevin W. Cassel,` Variational Methods with Applications in Science & Engineering, Cambridge University Press,2013.
Reference Books:	
3.	D James Benton, `Numerical Calculus: Differentiation & Integration`,2018, ISBN-13:978-1980680901
4.	Jorge Nocedal & Stephen J. Wright, 'Numerical Optimization`, Springer,2006

CO,PO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	0	0	0	0	0	0	1	0	3	3
CO2	3	2	2	3	0	0	0	0	0	0	0	1	3	2
CO3	2	2	2	3	0	0	0	0	0	0	1	0	2	2
CO4	3	3	2	3	0	0	0	0	0	0	0	1	3	3

High,3, Medium,2, Low,1

Course Title	AERODYNAMICS	Semester	1
Course Code	MVJMAE12	CIE	50
Total No. of Contact Hours	40 L: T: P: 3 : 0: 2	SEE	50
No. of Contact Hours/week	5	Total	100
Credits	4	Exam. Duration	3 Hrs.

Course objective is to:

- Gain knowledge of incompressible flows over aerofoil
- Understand aerofoil and wing aerodynamic characteristics and theory of lift generation
- Learn about high speed flows over aerofoils
- Acquire knowledge of potential flow equations and its applications
- Acquire knowledge of Unsteady Flows

Module 1	L1,L2,L3	8 hrs

Basics of Aerodynamics: Properties of fluids, Characteristics of Atmosphere, Type of fluid flows, Generation of Lift, Drag and Moment, Incompressible flows over airfoils, calculation of lift and drag from measured pressure distribution, Streamlined and bluff-body, Reynolds number and Mach number, Conservation law of mass and momentum, Euler and Bernoulli's equations, pitot-tube measurement of airspeed. Pressure coefficient. Streamlines, path lines and streak lines. Angular velocity, vorticity, circulation Stream function, velocity potential and their relationship. Governing equation for irrotational and incompressible fluid flow.

Laboratory Sessions/ Experimental learning:

Flow over an aerofoil: Pressure distribution and Force at various angles of attack

Applications

Applicable in standardAirplane Design

Module 2	L1,L2,L3,	8 hrs

Aerodynamics of Airfoils and Wings: Airfoil nomenclature and classification, Low speed aerodynamic characteristics of symmetric and cambered airfoils, Centre of pressure, aerodynamic centre and aerodynamic moment, Concept of point vortex, line vortex and vortex sheet, Kutta condition, Kelvins circulation theorem and starting vortex, Classical thin airfoil theory and symmetric airfoil. Finite wing nomenclature. Incompressible flow over wing, vortex filament, bound vortex, horse shoe vortex, downwash, induce angle of attack and drag. Type of drag. Biot-Savart law and Helmholtzs vortex theorem. Prandtls lifting line theory and limitations. Elliptic lift distributions, expression for induced angle of attack and induce drag. Two dimensional and three dimensional wings lift curve slope and effect of aspect ratio. High lift devices.

Laboratory Sessions/ Experimental learning:

Flow over the various wing configurations **Applications**

Applicable in standardAirplane Design

Module 3	L1,L2,L3	8 hrs

High speed Aerodynamics: Fundamentals of thermodynamic concepts, conservation of energy. Speed of sound, Mach wave and Mach angle. Normal shock wave, Oblique shock wave, Expansion fan, Prandtl-Meyer expansion. Family of shocks. Flow through convergent divergent nozzle. Hodograph and pressure turning angle. Rankine- Hugoniot relation.

Laboratory Sessions/ Experimental learning:

Flow Visualisation at high speeds

Applications

Applicable in standardAirplane Design

Module 4	L1,L2,L3	8 hrs

Compressible flow over airfoil: Full velocity potential equation. Small perturbationtheory. Linearized velocity potential equation and boundary conditions. Pressure coefficient for small perturbation. Prandtl- Glauret compressibility correction. Critical Mach number, Drag Divergence Mach Number, Sound barrier. Transonic area rule, supercritical airfoil, swept wing and delta wing.

Laboratory Sessions/ Experimental learning:

Estimation Compressible flow pressure distribution and thereby estimate Drag Divergence Mach number for the given aerofoil

Applications

Applicable in standardAirplane Design

Module 5	L1,L2	8 hrs

Unsteady Aerodynamics-Aerofoils undergoing small amplitude heave & pitch motion. Effect of harmonically oscillating aerofoils on resulting forces & moments. Unsteady analysis of separated aerodynamic flow. Unsteady loads acting of aircraft.Transition to turbulent flow in aerodynamics.

Applications

Applicable in unsteady flow analysis

Course outcomes: Upon completion of the course, students will be able to:	
CO1	Solve aerodynamic problems related to pressure distribution
CO2	Estimate the lift coefficient of an arbitrary wing configuration
CO3	Evaluate compressible one dimensional flows through varying area ducts
CO4	Analyse problems related to normal and oblique shock wave
CO5	Analyse unsteady flows

Text books:	
1.	Fundamentals of Aerodynamics ,John D. Anderson, McGraw-Hill publication, 5th edition and 2010
2.	Modern compressible flow, John D. Anderson , McGraw-Hill publication, 3rd edition and 2002
3.	Rathakrishnan.E., Gas Dynamics, Prentice Hall of India, 5th edition, 2013

Reference Books:	
1.	Anderson J.D., Introduction to Flight, McGraw Hill, 1987
2.	McCormick B.W., Aerodynamics, Aeronautics and Flight Mechanics, John Wiley & Sons New York, 1979.
3.	Anderson J.D., Foundation of Aerodynamics, McGraw Hill Book Co, New York, 1985.

Aerodynamics Lab

Sl No	**Experiment Name**	**RBT Level**	**Hours**
1	Calibration of test section of subsonic wind tunnel	L1, L2, L3	03
2	Smoke flow visualization studies on a two dimensional airfoil at different angles of incidence at lowspeeds.	L1, L2, L3	03
3	Tuft flow visualization on a wing model at different angles of incidence at low speeds: identify zones of attached and separated flows.	L1, L2, L3	03

4	Surface pressure distribution around building models in multiple model arrangement.	L1, L2, L3	03
5	Surface pressure distributions on a cambered wing airfoil at different angles of incidence and estimation of lift and pressure drag.	L1, L2, L3	03
6	Calculation of total drag of a two-dimensional wing of cambered airfoil at low incidence using pitot-static probe wake survey.	L1, L2, L3	03
7	Measurement of a typical boundary layer velocity profile on the tunnel wall (at low speeds) using a pitot probe and calculation of boundary layer displacement and momentum thickness in the presence of a circular cylinder model.	L1, L2, L3	03
8	Study the effect of blockage ratio on drag & pressure distribution of a circular cylinder	L1, L2, L3	03
9	Study of pressure distribution on a hemispherical object.	L1, L2, L3	03
10	Measurement of turbulence level in low speed wind tunnel.	L1, L2, L3	03
11	Study of wake behind wing under reverse flow condition at various angels of attack and compare it with normal flow conditions.	L1, L2, L3	03
12	Conduct a series of test to obtain the stagnation pressure response of pitot probe in a wind tunnel for varied yaw angle and obtain the response curve in terms of error (percentage of velocity head to yaw angle).	L1, L2, L3	03
13	To determine longitudinal static stability derivative of an aircraft configuration model at various angles of attack and slip angles.	L1, L2, L3	03
14	To determine lateral and directional static stability derivative of an aircraft configuration model at various angles of attack and side slips.	L1, L2, L3	03

CO,PO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	0	0	0	0	0	0	0	0	3	1
CO2	3	3	2	2	0	0	0	0	0	0	0	0	3	1
CO3	3	3	3	3	0	0	0	0	0	0	0	0	3	1
CO4	3	3	3	3	0	0	0	0	0	0	0	0	3	1
CO5	3	3	3	2	0	0	0	0	0	0	0	0	3	1

High 3, Medium 2, Low 1

Course Title	Aerospace Propulsion	Semester	III
Course Code	MVJMAE13	CIE	50
Total No. of Contact Hours	50 L : P : SDA : 3 : 00:01	SEE	50
No. of Contact Hours/week	04	Total	100
Credits	3	Exam. Duration	3 Hrs.

Course Learning Objectives:

- Identify the various types of gas turbine engines.
- To analyze the fuel and fuel systems for gas turbine engines.
- To study and analyze propeller aerodynamic theories and rocket propulsion.
- Distinguish between different types of rocket engines and aircraft engines.
- Carry out engine performance analysis and health monitoring.

Module 1	L1,L2	8 Hrs.

Introduction to Gas Turbine Engines: Atmospheric Properties. Turbojet, Turbofan, Turboprop, Turbo-shaft Engine Construction and Nomenclature, theory and performance, introduction to compressors, turbines, combustors, and after burners for aircraft engines.

Applications:

Module 2	L1,L2,	8 Hrs.

Fuel and Fuel Systems for Gas Turbine Engines: Fuel specification, fuel properties, liquid fuel handling and treatment, heavy fuels, fuel gas handling and treatment, equipment for removal of particulate and liquids from fuel gas systems, fuel heating, cleaning of turbine components, fuel economics, operating experience, heat tracing of piping systems. Types of heat tracing systems, storage of liquids.

Module 3	L1,L2	8 Hrs.

Engine Air Frame Integration: Engine Performance theory, Propeller theory – pusher and tractor mode. Thrust vectoring nozzles.

Introduction to Rocket Propulsion and Space Mission: Classification and fundamentals. Fuels and propellants. Rocket combustion processes. Introduction to Space mission. Fuel cells for space

mission.		
Module 4	L1,L2	8 Hrs.
Solid Propellant Rocket Description: Performance Estimation, Flame spread, and Ignition transient. Mechanical characterization of propellants. Grain design. Burn rate estimation. **Liquid Propellant Rocket Description:** Performance estimation. Injectors. Cooling systems. Combustion instabilities. **Hybrid Propellant Rocket Description**: Performance estimation, Mission requirements, and Power plant selection. Cryogenic engines. Ramjet and Scramjet engines, introduction to Electric propulsion.		
Module 5	L1,L2	8 Hrs.
Engine Performance and Health Monitoring: Performance and Matching of modules of gas turbines turbomachine aerothermodynamics, aerothermal equations, efficiencies, dimensional analysis, compressor performance characteristics, turbine performance characteristics, and Engine health monitoring techniques.		

Course outcomes: Upon completion of the course, students will be able to:	
CO1	An ability to independently carry out research /investigation and development work to solve practical problems.
CO2	An ability to write and present a substantial technical report/document.
CO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor's program
CO4	Acquire technical competence, comprehensive knowledge, and understanding of the methodologies and technologies associated with Aerospace Engineering. Apply knowledge to identify, formulate, and analyze complex engineering problems.
CO5	Having the ability to apply knowledge of science, mathematics, engineering & technology for the development of Aerospace Propulsion technologies.

Text Books:	
1.	Aerospace Propulsion, Dennis G Shepherd, American Elsevier Publishing Co Inc NY.

2.	Rocket Propulsion Elements, George P Sutton and Donald M Ross, John Wiley & Sons NY
3.	Gas turbine by V Ganeshan, TMH Publication 2018
Reference Books:	
1.	Aircraft power plants, Michael J Kroes and Thomas W Wild, Macmillan/McGraw Hill NY.
2.	Aircraft Gas Turbine Engine Technology, E. Irwin Treager, 3rd Edition, 1995, 'ISBN-002018281
3.	Mechanics & Thermodynamics of Propulsion, Hill, P.G. , Peterson, C.R. Addison, Wesley Longman INC, 1999.

CO,PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	0	0	0	0	0	0	0	0	3	1
CO2	3	3	2	2	0	0	0	0	0	0	0	0	3	1
CO3	3	3	3	3	0	0	0	0	0	0	0	0	3	1
CO4	3	3	3	3	0	0	0	0	0	0	0	0	3	1
CO5	3	3	3	2	0	0	0	0	0	0	0	0	3	1

High,3, Medium,2, Low,1

Course Title	Aircraft Performance Engineering	Semester	I
Course Code	MVJMAE14	CIE	50
Total No. of Contact Hours	40 L : T : P :: 3 : 0: 0	SEE	50
No. of Contact Hours/week	4	Total	100
Credits	3	Exam. Duration	3 Hrs.

The course objective is to:

- Understand the fundamentals of Engine Performance.
- Acquire knowledge on Aero engine off design performance and analysis
- Acquire knowledge on Aircraft Performance

Module 1	L1, L2	08 Hrs.

Introduction to Aero Engine Performance Analysis: Fundamentals of Aero Engine Performance: Overview of thermodynamic cycles, efficiency, and performance metrics. Gas Turbine Engines: Analysis of various gas turbine cycles (Brayton cycle, turbojet, turbofan, etc.).Performance Parameters: Specific thrust, specific fuel consumption (SFC), thermal efficiency, and propulsive efficiency.

Module 2	L3	08 Hrs.

Component-Level Performance Analysis: Compressor and Turbine Performance: Characteristics

efficiency, and matching of components. Combustion Chamber Analysis: Heat addition, pressure loss, and efficiency Engine Performance Modeling: Integration of component performance to predict overall engine performance.		
Module 3	L3,L4	08 Hrs.
Advanced Topics in Aero Engine Performance: Off-Design Performance: Analysis of engine performance at different operating conditions (altitude, speed, etc.). Transient Performance: Engine behavior during start-up, acceleration, and deceleration. Case Studies: Performance analysis of modern aero engines, including afterburning turbojets and high-bypass turbofans.		
Module 4	L3	08 Hrs.
Aircraft Performance: Fundamentals and Steady-Level Flight: Basics of Aircraft Performance: Forces acting on an aircraft, equations of motion, and energy methods. Steady-Level Flight: Lift-to-drag ratio, minimum drag, and maximum range and endurance. Power Required and Available: Thrust, power curves, and flight envelope.		
Module 5	L5	08 Hrs.
Aircraft Performance: Maneuvering and High-Speed Flight: Climb Performance: Rate of climb, ceiling, and climb optimization. Takeoff and Landing Performance: Factors affecting takeoff and landing distances, performance under different conditions. High-Speed Flight: Performance analysis in transonic, supersonic, and hypersonic regimes.		

Course outcomes: Upon completion of the course, students will be able to:	
CO1	Understand the aero engine performance
CO2	Understand the functions of various engine components performance
CO3	Apply the knowledge of engine performance in off design aero engines
CO4	Understand and apply the aircraft performance
CO5	Analyse the Component-Level Performance Analysis

Text books:	
1.	"Mechanics and Thermodynamics of Propulsion" by Philip G. Hill and Carl R. Peterson, Pearson, ISBN: 978-

	0201146592.
2.	"Aircraft Performance & Design" by John D. Anderson Jr., McGraw-Hill Education, ISBN: 978-0070019715.
Reference Books:	
1	"Jet Propulsion: A Simple Guide to the Aerodynamics and Thermodynamic Design and Performance of Jet Engines" by Nicholas Cumpsty, Cambridge University Press.
2	"Gas Turbine Theory" by H.I.H. Saravanamuttoo, G.F.C. Rogers, and H. Cohen, Pearson
3	"Flight Performance of Fixed and Rotary Wing Aircraft" by Antonio Filippone, Butterworth-Heinemann.

CO,PO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	2	2	2	0	0	0	0	0	0	0	2	2
CO2	1	1	2	2	2	0	0	0	0	0	0	0	2	2
CO3	2	1	1	1	1	0	0	0	0	0	0	0	2	3
CO4	3	1	2	1	3	0	0	0	0	0	0	0	2	3
CO5	2	2	3	2	2	0	0	0	0	0	0	0	2	3

High,3, Medium,2, Low,1

Course Title	AIRFRAME STRUCTURAL ANALYSIS	Semester	I
Course Code	MVJMAE15	CIE	50
Total No. of Contact Hours	50 L : T : P :: 3 : 1:0	SEE	50
No. of Contact Hours/week	4	Total	100
Credits	3	Exam. Duration	3 Hrs.

The course objective is to:

- Comprehend the fundamentals knowledge of structural analysis of airframe parts.
- Acquire the knowledge of Airworthiness and Airframe loads.
- Understand the Bending of open and closed, thin-walled beams.
- Understand the Shear of beams and Structural idealization.
- Acquire the knowledge on Stress Analysis of Aircraft Components.

Module 1	L1,L2,L3	08 Hrs.

Fundamentals of Structural Analysis: Stress, Equations of equilibrium, Plane stress, Plane strain, Boundary conditions, Determination of stresses on inclined planes, statically determinate, indeterminate systems. Euler buckling of columns.		
Module 2	**L2,L3,L4**	08 Hrs.
Structural components of aircraft: Loads on structural components, Function of structural components, Fabrication of structural components, Airworthiness: Factors of safety-flight envelope, Load factor determination. Airframe loads, Aircraft inertia loads, Symmetric manoeuvre loads, Gust loads, Safe life and fail-safe structures, Designing against fatigue, Fatigue strength of components, Prediction of aircraft fatigue life.		
Module 3	**L2,L3,L4**	08 Hrs.
Bending of open and closed, thin-walled beams: Symmetrical bending, Unsymmetrical bending, Deflections due to bending, Calculation of section properties, Applicability of bending theory, Temperature effects.		
Module 4	**L2,L3,L4**	08 Hrs.
Shear of beams: General stress, strain and displacement relationships foropen and single cell closed section thin-walled beams, Shear of open section beams, Shear of closed section beams. **Structural idealization:** Idealization of a panel, Effect of idealization on the analysis of open and closed section beams, Deflection of open and closed section beams.		
Module 5	**L2,L3,L4**	08 Hrs.
Stress Analysis of Aircraft Components: Wing spars and box beams, Tapered wing spar, Open and closed section beams, Beams having variable stringer areas. Fuselages: Bending, Shear, Torsion, Cut-outs in fuselages. Wings: Three-boom shell, Bending, Shear, Cut-outs in wings, Fuselage frames and wing ribs: Fuselage frames, Wing ribs.		
Course outcomes: Upon completion of the course, students will be able to:		

CO1	Apply fundamental concepts of structural analysis to airframe parts
CO2	Demonstrate the knowledge of Airworthiness and Airframe loads.
CO3	Understand the Bending of open and closed, thin-walled beams.
CO4	Understand the Shear of beams and Structural idealization
CO5	Acquire the knowledge on Stress Analysis of Aircraft Components.

Text Book:	
1.	Megson, T.H.G., Aircraft Structures for Engineering Students, Sixth Edition, Elsevier - 2016
Reference Books:	
2.	Perry D J & Azar J J , Aircraft Structures, 2nd edition, McGraw Hill N.Y, 2016
3.	BruhnE.F., Analysis and Design of Flight Vehicles Structures, Tri-Stateoffset Co.USA,1985

CO,PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	1	-	-	-	-	-	-	-	1	2
CO2	3	3	3	1	2	-	-	-	-	-	-	-	3	2
CO3	3	3	3	3	1	-	-	-	-	-	-	-	1	2
CO4	3	3	3	3	1	-	-	-	-	-	-	-	1	2
CO5	3	3	3	3	1	-	-	-	-	-	-	-	1	2

High,3, Medium,2, Low,1

Course Title	Propulsion Laboratory	Semester	I
Course Code	MVJMAEL16	CIE	50
Total No. of Contact Hours	50 L : T : P :: 3 : 1:0	SEE	50
No. of Contact Hours/week	5	Total	100
Credits	4	Exam. Duration	3 Hrs.

The course objective is to:

- Familiarization with various propulsion experimental facilities
- Familiarize with different propulsion experiments and measurement techniques
- Conduct the test, acquire the data and analyze and document

SL NO	NO Experiments

1	Cascade testing of a model of turbine blade row and study of wake survey
2	Estimation of propeller performance
3	Forced Convective heat transfer on a flat surface
4	Measurement of Burning Velocity of a Premixed Flame
5	Determination of heat of combustion of aviation fuels
6	Measurement of static overall pressure rise & rotor static pressure rise & fan overall efficiency through axial flow fan unit
7	Effect of inlet flow distortion on measurement of static overall pressure rise & rotor static pressure rise & fan overall efficiency through axial flow fan unit
8	Study of Jet Engine characteristics (thrust, static and total pressures, temperatures, exhaust velocity & fuel consumption)
Demonstration Experiments (For CIE) if any	
9	Performance studies on 2-dimensional diffuser (Stable flow and separated flow)
10	Free and wall jet experimental studies
11	Natural convective heat transfer over an aero foil wing model
12	Measurement of Nozzle flow setup

Course outcomes: Upon completion of the course, students will be able to:	
CO1	Demonstrate various experimental facilities
CO2	Apply the knowledge to use of different sensors and measurement techniques
CO3	Perform the test, acquire the data and analyze and document

Suggested Learning Resources:

- Propulsion lab Manual

CO, PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	0	0	0	0	0	0	0	0	3	1
CO2	3	3	2	2	0	0	0	0	0	0	0	0	3	1
CO3	3	3	3	3	0	0	0	0	0	0	0	0	3	1

High 3, Medium 2, Low 1