

ANNA UNIVERSITY, CHENNAI
NON- AUTONOMOUS COLLEGES
AFFILIATED TO ANNA UNIVERSITY
M.E. AERONAUTICAL ENGINEERING
REGULATIONS 2025

PROGRAMME OUTCOMES (POs):

PO	Programme Outcomes
PO1	An ability to independently carry out research /investigation and development work to solve practical problems
PO2	An ability to write and present a substantial technical report/document.
PO3	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 program

PROGRAMME SPECIFIC OUTCOMES (PSOS)

PSO	Programme Specific Outcomes
PSO1	Apply advanced concepts in aerodynamics, propulsion, flight mechanics, and structural analysis to design, analyze, and optimize aircraft systems and components.
PSO2	Utilize modern computational tools, experimental methods, and regulatory standards to solve real-world aerospace engineering problems and support safe, efficient, and innovative aviation technologies.



ANNA UNIVERSITY, CHENNAI

POSTGRADUATE CURRICULUM (NON-AUTONOMOUS AFFILIATED INSTITUTIONS)

Programme: M.E., Aeronautical Engineering

Regulations: 2025

Abbreviations:

BS – Basic Science (Mathematics, Physics, Chemistry)

L – Laboratory Course

ES – Engineering Science (General (**G**), Programme Core (**PC**), Programme Elective (**PE**) & Emerging Technology (**ET**))

T – Theory

SD – Skill Development

LIT – Laboratory Integrated Theory

SL – Self Learning

PW – Project Work

OE – Open Elective

TCP – Total Contact Period(s)

Semester I

S. No.	Course Code	Course Title	Type	Periods Per Week			TCP	Credits	Category
				L	T	P			
1.	MA25C06	Applied Mathematical and Statistical Modelling	T	3	1	0	4	4	BS
2.	AO25101	Aircraft Propulsion	T	3	1	0	4	4	ES (PC)
3.	AO25102	Aircraft Structures	T	3	1	0	4	4	ES (PC)
4.	AO25103	Airplane Aerodynamics	T	4	0	0	4	4	ES (PC)
5.	AO25104	Aerodynamics Laboratory	L	0	0	4	4	2	ES (PC)
6.	AO25105	Propulsion Laboratory	L	0	0	4	4	2	ES (PC)
7.	AO25106	Technical Seminar	-	0	0	2	2	1	SD
Total							26	21	

Semester II

S. No.	Course Code	Course Title	Type	Periods Per Week			TCP	Credits	Category
				L	T	P			
1.		Flight Mechanics and Control	T	3	1	0	4	4	ES (PC)
2.		Programme Elective I	T	3	0	0	3	3	ES (PE)
3.		Programme Elective II	T	3	0	0	3	3	ES (PE)
4.		CFD Applications for Aeronautical Engineering	LIT	3	0	2	5	4	ES (PC)
5.		Advanced Finite Element Methods	LIT	3	0	2	5	4	ES (PC)
6.		Aircraft Structures Laboratory	L	0	0	4	4	2	ES (PC)
7.		Industry-Oriented Course I	-	1	0	0	1	1	SD
8.		Self-Learning Course	-	-	-	-	-	1	-
Total							27	23	

Semester III

S. No.	Course Code	Course Title	Type	Periods Per Week			TCP	Credits	Category
				L	T	P			
1.		Programme Elective III	T	3	0	0	3	3	ES (PE)
2.		Programme Elective IV	T	3	0	0	3	3	ES (PE)
3.		Open Elective	T	3	0	0	3	3	-
4.		Industry Oriented Course II	--	1	0	0	1	1	SD
5.		Industrial Training	---	---	---	---	---	2	SD
6.		Project Work I	---	0	0	12	12	6	SD
Total							22	18	

Semester IV

S. No.	Course Code	Course Title	Type	Periods Per Week			TCP	Credits	Category
				L	T	P			
1.		Project Work II	---	0	0	24	24	12	SD
Total							24	12	

Total Credits for the Programme = 72

PROGRAMME ELECTIVE COURSES (PE)

S. No.	Course Code	Course Title	Periods Per Week			Total Contact Periods	Credits
			L	T	P		
1.		Rocketry and Space Mechanics	3	0	0	3	3
2.		Avionics	3	0	0	3	3
3.		Aerospace Materials for Aeronautical Engineering	3	0	0	3	3
4.		Aircraft Engine Repair and Maintenance	3	0	0	3	3
5.		Experimental Aerodynamics	3	0	0	3	3
6.		Computational Heat Transfer for Aeronautical Engineering	3	0	0	3	3
7.		Mechanics of Composite Materials	3	0	0	3	3
8.		Introduction to Aerospace Engineering	3	0	0	3	3
9.		Industrial Aerodynamics	3	0	0	3	3
10.		Theory of Elasticity and Plasticity	3	0	0	3	3
11.		Helicopter Aerodynamics	3	0	0	3	3
12.		Airworthiness Standards and Certification	3	0	0	3	3
13.		Combustion in Jet and Rocket Engines	3	0	0	3	3
14.		Advanced Propulsion Systems	3	0	0	3	3
15.		Analysis of Composite Structures	3	0	0	3	3
16.		Airframe Repair and Maintenance	3	0	0	3	3
17.		Aircraft Systems Engineering	3	0	0	3	3
18.		Flight Instrumentation	3	0	0	3	3
19.		Experimental Stress Analysis	3	0	0	3	3
20.		NDT Methods	3	0	0	3	3
21.		Aircraft Structural Mechanics	3	0	0	3	3
22.		Multifunctional Materials and their Applications	3	0	0	3	3
23.		Aeroelasticity	3	0	0	3	3

S. No.	Course Code	Course Title	Periods Per Week			Total Contact Periods	Credits
			L	T	P		
24.		Theory of Boundary Layers	3	0	0	3	3
25.		Aircraft Control Engineering	3	0	0	3	3
26.		High Speed Jet Flows	3	0	0	3	3
27.		Hypersonic Aerodynamics	3	0	0	3	3
28.		Navigation, guidance and Control for Space vehicles	3	0	0	3	3
29.		Air Traffic Control	3	0	0	3	3
30.		Hypersonic Propulsion	3	0	0	3	3
31.		Aircraft Regulations and Certifications	3	0	0	3	3
32.		Vibration and Structural Dynamics	3	0	0	3	3
33.		Wind Tunnel Testing	3	0	0	3	3

Semester I

MA25C06	Applied Mathematical and Statistical Modelling	L 3	T 1	P 0	C 4
Course Objectives: • To equip students with advanced mathematical techniques, specifically Fourier Transforms, for formulating and solving partial differential equations that model fundamental mechanical engineering phenomena such as heat transfer, vibrations, and fluid flow. • To provide a strong foundation in statistical inference, enabling students to estimate population parameters (like material properties and process capabilities) from experimental data and assess the quality and reliability of these estimators. • To enable students to design efficient, structured experiments and apply appropriate statistical tests to make valid, data-driven decisions for comparing processes, optimizing designs, and solving complex engineering problems.					
Fourier Transform: Definitions, Properties, Transform of elementary functions, Dirac delta function, Convolution theorem, Parseval's identity, Solutions to partial differential equations: Heat equation, Wave equation, Laplace and Poisson's equations. Estimation Theory: Unbiasedness, Consistency, Efficiency and sufficiency, Maximum likelihood estimation, Method of moments. Testing of Hypothesis: Sampling distributions, Small and large samples, Tests based on Normal, t, Chi square, and F distributions for testing of means, variance and proportions, Analysis of r x c tables, Goodness of fit, independent of attributes. Design of Experiments: Analysis of variance, One way and two-way classifications, Completely randomized design, Randomized block design, Latin square design, 2² Factorial design.					
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%.					
References: 1. Andrews, L. C., & Shivamoggi, B. K. (2003). Integral transforms for engineers. Prentice Hall of India. 2. Devore, J. L. (2014). Probability and statistics for engineering and the sciences, Cengage Learning. 3. Johnson, R. A., Miller, I., & Freund, J. (2015). Miller and Freund's probability and statistics for engineers, Pearson Education Asia.					
E-resources: 1. https://www.edx.org/learn/probability-and-statistics/massachusetts-institute-of-technology-probability-the-science-of-uncertainty-and-data 2. https://www.itl.nist.gov/div898/handbook/ 3. https://ocw.mit.edu/courses/2-830j-control-of-manufacturing-processes-sma-6303-spring-2008					

AO25101	Aircraft Propulsion	L	T	P	C
		3	1	0	4
Course Objectives: This course aims to provide students with a foundational understanding of aircraft and rocket propulsion systems. It covers various propulsion types, propeller theories, and the working principles of components like inlets, nozzles, compressors, turbines, and combustion chambers. Students will also be introduced to modern electric propulsion technologies.					
Elements of Aircraft Propulsion: Classification of power plants, Methods of aircraft propulsion, Propulsive efficiency, Specific fuel consumption, Thrust and power- Factors affecting thrust and power-Illustration of working of Gas turbine engine, Characteristics, advantages and disadvantages of turboprop, turbofan and turbojet, Ram jet, Scram jet –flight regimes diagram for different power-plants, Methods of Thrust augmentation.					
Activity: Categorize different propulsion systems (turbojet, turbofan, etc.).					
Propeller Theories: Momentum theory, Blade element theory, combined blade element and momentum theory, Propeller co-efficient, propeller power losses, propeller performance parameters, prediction of static thrust- and in flight thrust and power, negative thrust, prop fans, ducted propellers, propeller noise, propeller selection, propeller charts, UAV propellers and applications					
Activity: Calculate SFC and propulsive efficiency for different engines, compare Propulsion Efficiency Calculation under various conditions.					
Inlets, Nozzles and Combustion Chambers: Impact of Flight Mach Number on Inlet Duct Geometry, Subsonic and supersonic inlets,Supersonic Inlet Types, Relation between minimum area ratio and external deceleration ratio, Starting problem in supersonic inlets, Modes of inlet operation, jet nozzle, Efficiencies, Over expanded, under and optimum expansion in nozzles ,Thrust reversal. Classification of Combustion chambers, Combustion chamber performance, Flame tube cooling, Flame stabilization - Afterburner.					
Activity: Design a supersonic inlet based on flight Mach number, optimize geometry for efficiency.					
Axial And Centrifugal Flow Compressors and Fans: Introduction to Axial flow compressor, centrifugal compressors, geometry, twin spools, three spools, stage analysis- velocity polygons, degree of reaction, radial equilibrium theory, Compressor Design Parameters, Compressor instability, performance maps					
Activity: Analyze multi-stage axial compressors using velocity triangles, design a centrifugal compressor and calculate key performance parameters.					
Turbines: Introduction to Turbines, Radial & axial flow turbines, Practical application, Blade Geometry, Compressor Turbine Matching- velocity polygons, stage analysis, performance maps, thermal limit of blades and vanes, Turbine Cooling methods					

Activity: Match turbine power with compressor power requirements, research and present different turbine cooling techniques.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology and weightage:

Quiz (5%), Project (10%), Assignment (10%), Practical (25%), Review of Question papers (IES, SSC, GATE) (20%), Internal Examinations (30%)

References:

1. Hill, P. G., & Peterson, C. R. (2009). Mechanics & thermodynamics of propulsion (2nd ed.). Pearson Education.
2. Oates, G. C. (1985). Aerothermodynamics of aircraft engine components. AIAA Education Series.
3. Cohen, H., Saravanamuttoo, H. I. H., Rogers, G. F. C., Straznicky, P., & Nix, A. (2017). Gas turbine theory (7th ed.). Pearson Education Canada.
4. Gill, W. P., Smith, H. J., & Ziurys, J. E. (1980). Fundamentals of internal combustion engines as applied to reciprocating, gas turbine & jet propulsion power plants. Oxford & IBH Publishing Co.
5. Farokhi, S. (2014). Aircraft propulsion (2nd ed.). John Wiley & Sons Ltd.

E-Resources:

<https://nptel.ac.in/courses/101101002>

<https://nptel.ac.in/courses/112104117>

<https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-01-unified-engineering-i-ii-iii-iv-fall-2005-spring-2006/>

<https://ocw.mit.edu/resources/res-16-001-ocw-scholar-introduction-to-aerospace-engineering-and-design-spring-2012/lecture-notes/>

<https://www.grc.nasa.gov/www/k-12/airplane/bgp.html>

<https://www.grc.nasa.gov/www/k-12/airplane/shortp.html>

<https://www.coursera.org/learn/aircraft-propulsion>

<https://www.edx.org/course/fundamentals-of-turbomachinery>

	Description of CO	PO	PSO1	PSO2
CO1	Understand the basic principles of various aircraft propulsion systems, including turboprop, turbojet, turbofan, and ramjet engines.	PO1 (3), PO3 (2)	3	2
CO2	Analyze and calculate the performance of propellers using momentum and blade element theories and predict their thrust and power.	PO1 (3), PO2 (2)	3	2
CO3	Evaluate the working and design of inlets, nozzles, and combustion chambers in relation to engine performance and thrust augmentation.	PO1 (3), PO3 (2)	3	2
CO4	Understand and apply the principles of axial and centrifugal flow compressors, turbines, and their performance characteristics in engine design.	PO1 (3), PO3 (3)	3	3

AO25102	Aircraft Structures	L	T	P	C
		3	1	0	4
Course Objectives: This course aims to equip students with the ability to determine structural loads acting on aircraft components, understand stressed skin construction, analyze beam bending and shear flow in structural elements, and evaluate the behaviour of thin plates under various loading conditions. It also introduces key design philosophies and airworthiness considerations in aircraft structural design.					
Aircraft Structural Loads and Load Factor Analysis: Loads Acting on an Aircraft, Balancing Tail Loads, Determination of the Load Factor during Symmetric Maneuvers, Inertia Loads, Function of Aircraft Wing & Fuselage Components Airworthiness Requirements, Construction of the V-n Diagram, Effect of Gust Activity: Calculate load factor during symmetric maneuvers and create a V-n diagram, Calculate additional loads on wings and fuselage during gust encounters.					
Stressed Skin Design and Structural Materials: Materials Used for Aircraft Construction, Structural Components of an Aircraft & Their Functions, Safe Life vs Fail Safe Design, Certification Standards, Principles of Damage Tolerance, Prediction of Fatigue Strength, Basic Principles of Fatigue & Fracture Mechanics Activity: Choose appropriate materials for aircraft components based on properties like strength and fatigue resistance, predict fatigue life of a wing spar based on loading cycles and damage tolerance principles.					
Beam Theory, Bending: Bending Moment and Shear Force, Generalized Theory of Pure Bending, Stresses in Beams of Symmetrical and Unsymmetrical Sections, Neutral Axis Determination, Box Beam Analysis, Deflection of Beams, Stresses in Composite Beams, Sandwich Beams, Sizing of Wing Spar Activity: Calculate bending stress and shear force in beams of different cross-sections. Calculate deflection of beams under various loading conditions.					
Shear Flow: Shear Flow in Thin-Walled Beams, Determination of the Shear Centre Position in Symmetrical and Unsymmetrical Cross-Sections, Structural Idealization, Flexural Shear Flow in Box Beams, Shear flow due to Combined Bending & Torsion, Torsion of Thin-Walled Open Sections Stress Shear Flow Analysis of Aircraft Components, Thin-Webbed Tapered Beams Activity: Calculate shear flow in thin-walled beams like wing spars. determine shear center location in unsymmetrical cross-sections.					
Thin Plate Structures and Buckling Behaviour: Pure Bending of Thin Plates, Thin Plates Under Combined Loading, Stress Resultants, Buckling of Thin Plates in Compression, Plate Buckling Coefficient, Ultimate Strength of Stiffened Sheets, Effective Sheet Width, Needham Method, Gerard Method, Instability of Thin-Walled Columns, Local Buckling & Crippling, Analysis of Tension Field Beams.					

Activity: Calculate critical buckling load for thin plates under compressive loads, Use Needham or Gerard methods to calculate effective sheet width in stiffened plates.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology and weightage:

Quiz (5%), Project (10%), Assignment (10%), Practical (25%), Review of Question papers (IES, SSC, GATE) (20%), Internal Examinations (30%)

References:

1. Curtis, H. D. (1997). Fundamentals of aircraft structural analysis. WCB-McGraw Hill.
2. Rivello, R. M. (2007). Theory and analysis of flight structures (4th ed.). McGraw Hill.
3. Donaldson, B. K. (2008). Analysis of aircraft structures: An introduction (2nd ed.). Cambridge University Press.
4. Bruhn, E. H. (1985). Analysis and design of flight vehicle structures. Tri-State Offset Company.
5. Peery, D. J., & Azar, J. J. (2012). Aircraft structures. McGraw-Hill.

E-Resources:

<https://nptel.ac.in/courses/101106042>
<https://nptel.ac.in/courses/101106153>
<https://ocw.mit.edu/courses/1-050-solid-mechanics-fall-2004/>
<https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-036-structural-mechanics-spring-2003/>
<https://www.nasa.gov/centers/glenn/about/fs21grc.html>
<https://ntrs.nasa.gov/>

Other Resources:

Interactive simulation platforms:

<https://amesweb.info/SectionalProperties/Shear-Flow-Thin-Walled-Section.aspx>

	Description of CO	PO	PSO1	PSO2
CO1	Determine the structural loads acting on aircraft components, analyze the load factors, and construct V-n diagrams.	-	-	-
CO2	Understand stressed skin construction, the use of materials in aircraft, and apply damage tolerance and fatigue strength predictions.	PO1 (3), PO2 (2)	3	2
CO3	Analyze beam bending, shear flow, and stress distribution in thin-walled beams, and evaluate structural components under combined loading conditions.	PO1 (3), PO2 (2)	3	2
CO4	Apply principles of plate theory to analyze the buckling and stability of thin plates, including the design of tension field beams and stiffened sheets.	PO1 (3), PO3 (3)	3	3

AO25103	Airplane Aerodynamics	L	T	P	C
		4	0	0	4
Course Objectives: • To gain insights into the basics of fluid flow, its model and tool to solve the fluid flow problems. • To be familiar with the conservation laws of fluid dynamics, and how to apply them to practical fluid flows. • To gain knowledge on elementary flows to combine and form realistic flows with suitable assumptions. • To analyse incompressible flow over three-dimensional bodies like wing and so on. • To gain knowledge on the basic concepts of viscous flows, boundary layers to practical flows					
Fundamentals of Aerodynamics and Fluid Flow: Aerodynamic force and moments, lift and Drag coefficients, Centre of pressure and aerodynamic centre, Coefficient of pressure, moment coefficient, Application of conservation of mass, momentum, energy to fluid flows Point source and sink, doublet, Free and Forced Vortex, Uniform parallel flow, combination of basic flows, Pressure and Velocity distributions on bodies with and without circulation in ideal and real fluid flows, Magnus effect. Activity: Calculate lift and drag coefficients for different shapes, Study the effect of rotation on aerodynamic forces using a rotating cylinder or simulation.					
Incompressible Flow Theory and Thin Airfoil Concepts: Conformal Transformation, Karman, Trefftz profiles, Kutta condition, Kelvin's Circulation Theorem and the Starting Vortex, Thin aerofoil Theory and its applications. Vortex line, Horse shoe vortex, Biot, Savart law, lifting line theory, effect of aspect ratio. Activity: Apply thin airfoil theory to calculate lift distribution on an airfoil, Use the Kutta condition to simulate flow around a thin airfoil and calculate induced lift.					
Compressible Flow Fundamentals: Compressibility, Isentropic flow through nozzles, Normal shocks, Oblique and Expansion waves, moving shock waves, Rayleigh and Fanno Flow, Potential equation for compressible flow, small perturbation theory, Transonic flow Theory, Prandtl- Glauert Rule, Linearized supersonic flow, Method of characteristics. Activity: Analyze normal and oblique shock waves, calculating pressure, temperature, and velocity, Apply isentropic theory to analyze flow properties in a nozzle.					
High-Speed Aerodynamics: Airfoils, Wings, and Configurations: Critical Mach number, Drag divergence Mach number, Shock stall, super critical airfoils, transonic area rule, swept wings (ASW and FSW), Supersonic airfoils, Shock-Expansion Theory, Wave drag, Delta wings. Activity: Use the transonic area rule to reduce wave drag in an aircraft design, Apply shock-expansion theory to calculate lift and drag for supersonic airfoils.					

Viscous Flow and Boundary Layer Theory: Introduction to viscous flow, concept of boundary layer, Adverse effect of Boundary Layer, Laminar and turbulent Boundary Layers, Prediction of Skin friction drag, Blasius Theory, Boundary Layer Separation, Transition and Control.

Activity: Calculate boundary layer thickness over a flat plate using Blasius' solution, Simulate and compare laminar and turbulent boundary layer characteristics.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology and weightage: Quiz (5%), Project (10%), Assignment (10%), Practical (25%), Review of Question papers (IES, SSC, GATE) (20%), Internal Examinations (30%)

References:

1. Anderson, J. D. (2010). Fundamentals of aerodynamics (5th ed.). McGraw-Hill Education.
2. Rathakrishnan, E. (2013). Gas dynamics (5th ed.). Prentice Hall of India.
3. Shapiro, A. H. (1982). Dynamics & thermodynamics of compressible fluid flow. Ronald Press.
4. Houghton, E. L., & Caruthers, N. B. (2003). Aerodynamics for engineering students (5th ed.). Butterworth-Heinemann.
5. Zucrow, M. J., & Anderson, J. D. (1989). Elements of gas dynamics. McGraw-Hill Book Co.
6. Rae, W. H., & Pope, A. (1999). Low speed wind tunnel testing (3rd ed.). John Wiley Publications.

E-Resources

<https://nptel.ac.in/courses/101101025>

<https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-100-aerodynamics-fall-2010/>

<http://aero.stanford.edu/fundamentals.html>

http://www.aero.iitb.ac.in/nptel/notes/Aero_Dynamics.pdf

<https://ntrs.nasa.gov/>

<http://www.aero.und.edu/aero/library/>

Other Resources:

Interactive simulation platforms:

<https://www.grc.nasa.gov/www/k-12/airplane/foil4.html>

<http://www.mh-aerotools.de/airfoils/javafoil.html>

	Description of CO	PO	PSO1	PSO2
CO1	Understand and apply the fundamentals of aerodynamics and fluid flow, including aerodynamic forces, moments, and conservation laws in fluid dynamics.	PO1 (3), PO2 (2), PO3 (3)	3	3
CO2	Analyze incompressible flow over aerodynamic bodies and apply thin airfoil theory, Kutta condition, and vortex theories to calculate lift and drag.	PO1 (3), PO2 (2)	3	3
CO3	Knowledge of compressible flow, including shock waves, oblique and expansion waves, and the transonic flow theory for high-speed aerodynamic applications.	PO1 (3), PO2 (2)	3	3
CO4	Understand viscous flow and boundary layer theory, predict drag, and explore laminar/turbulent boundary layers and their control methods for aerodynamic optimization.	PO1 (3), PO3 (2)	3	3

AO25104	Aerodynamics Laboratory	L 0	T 0	P 4	C 2
Course Objectives: This course aims to provide students with practical knowledge of subsonic and supersonic wind tunnel operations and fundamental aerodynamic principles involving inviscid, incompressible fluids. It enables students to calculate key aerodynamic characteristics of different bodies, understand and distinguish between laminar and turbulent flow behaviour, and gain hands-on experience with flow visualization techniques in subsonic regimes.					
List of Experiments: 1. Calibration of subsonic wind tunnel. 2. Pressure distribution over a smooth cylinder. 3. Pressure distribution over a rough cylinder. 4. Pressure distribution over a symmetric aerofoil section. 5. Pressure distribution over a cambered aerofoil section. 6. Pressure distribution over a wing of cambered aerofoil section. 7. Force and moment measurements using wind tunnel balance. 8. Wake measurements behind a bluff body. 9. Velocity boundary layer measurements over a flat plate. 10. Force measurements on aircraft model using wind tunnel balance. 11. Moment measurements on aircraft model using wind tunnel balance. 12. Calibration of supersonic wind tunnel. 13. Subsonic flow visualization studies *Minimum 10 Experiments need to conduct from the above Laboratory Equipments Required 1. Subsonic wind tunnel 2. Rough and smooth cylinder 3. Symmetrical and Cambered aerofoil 4. Wind tunnel balance 5. Schlieren system 6. Pressure Transducers 7. Supersonic wind tunnel 8. Blower 9. Testing models like flat plate, bluff body					
Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%					
Assessment Methodology: Quiz (5%), Project (10%), Assignment (10%), Practical (25%), Review of Question papers (IES, SSC, GATE) (20%), Internal Examinations (30%)					

E-Resources:

<https://www.grc.nasa.gov/www/k-12/airplane/windtun.html>
<https://nptel.ac.in/courses/101101025>
<https://www.youtube.com/watch?v=Ti4i-DIzfhY>
<https://ocw.mit.edu/courses/16-100-aerodynamics-fall-2010/>
<https://www.grc.nasa.gov/www/k-12/airplane/foil3.html>
<https://www.youtube.com/watch?v=2GxLzr1U1fU>
<https://www.nasa.gov/sites/default/files/atoms/files/windtunnelbasics.pdf>
<https://nptel.ac.in/courses/112106189>
<https://www.efunda.com/formulae/fluids/wake.cfm>
https://www.youtube.com/watch?v=_iJcM13HVuA
<https://www.me.umn.edu/courses/me4001/smoke.html>
<https://www.grc.nasa.gov/www/k-12/airplane/tunrst.html>

	Description of CO	PO	PSO1	PSO2
CO1	Perform experiments to calibrate subsonic and supersonic wind tunnels, measure pressure distributions, and evaluate aerodynamic forces and moments in subsonic regimes.	PO1 (3), PO2 (2), PO3 (2)	3	3
CO2	Analyze aerodynamic characteristics (pressure, force, moment) of bodies like cylinders, aerofoils, and aircraft models using wind tunnel testing methods.	PO1 (3), PO2 (2)	3	3
CO3	Conduct flow visualization techniques and measure velocity boundary layers to study laminar and turbulent flow characteristics in subsonic flows.	PO1 (3), PO3 (2)	3	3
CO4	Analyze and interpret aerodynamic data from experiments, including wake measurements, force and moment data, and boundary layer studies, to draw meaningful conclusions.	PO1 (3), PO2 (2), PO3 (3)	3	3

AO25105	Propulsion Laboratory	L	T	P	C
		0	0	4	2
Course Objectives: This lab course provides hands-on experience with pressure distribution in inlets and nozzles, compressor blade testing, and flow visualization of supersonic jets. It also introduces cold flow studies and data interpretation using software tools.					
List of Experiments: 1. Wall pressure measurements of a subsonic diffuser. 2. Cascade testing of compressor blades. 3. Pressure distribution on a cavity model. 4. Wall pressure measurements on non-circular combustor. 5. Wall pressure measurements on converging nozzle. 6. Wall pressure measurements on convergent-divergent nozzle. 7. Total pressure measurements along the jet axis of a circular subsonic jet. 8. Total pressure measurements along the jet axis of a circular supersonic jet. 9. Cold flow studies of a wake region behind flame holders. 10. Wall pressure measurements on supersonic inlets. 11. Flow visualization on supersonic jets.					
*Minimum 10 Experiments need to conduct from the above					
Laboratory Equipments Required 1. Subsonic wind tunnel 2. High speed jet facility 3. Blower 4. Pressure scanner 5. Schlieren system 6. Nozzle and cavity models					
Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%					
Assessment Methodology: Quiz (5%), Project (10%), Assignment (10%), Practical (25%), Review of Question papers (IES, SSC, GATE) (20%), Internal Examinations (30%)					
E-Resources: https://www.grc.nasa.gov/www/k-12/airplane/incompress.html https://nptel.ac.in/courses/112104118 https://arc.aiaa.org/doi/10.2514/6.2001-2918 https://ntrs.nasa.gov/api/citations/19920008884/downloads/19920008884.pdf https://www.grc.nasa.gov/www/k-12/airplane/nozzler.html https://nptel.ac.in/courses/112106189					

<https://ocw.mit.edu/courses/16-100-aerodynamics-fall-2010/>
<https://ntrs.nasa.gov/citations/19930092576>
<https://ntrs.nasa.gov/citations/19940021516>
<https://ntrs.nasa.gov/citations/19720018946>
<https://www.youtube.com/watch?v=RrQ2p41XoJ0>

	Course Outcome (CO)	PO	PSO1	PSO2
CO1	Measure and analyze pressure distribution in various subsonic and supersonic flow devices, including diffusers, nozzles, and combustors.	PO1 (3), PO2 (2), PO3 (2)	3	3
CO2	Perform cascade testing of compressor blades and analyze the aerodynamic properties and performance of different blade configurations.	PO1 (3), PO2 (2), PO3 (2)	3	3
CO3	Conduct cold flow studies, including wake region analysis and pressure measurements in supersonic jets, and interpret the data using computational tools.	PO1 (3), PO3 (2)	3	3
CO4	Use flow visualization techniques, such as Schlieren and pressure scanning systems, to study supersonic and subsonic flows and interpret the results.	PO1 (3), PO2 (2), PO3 (3)	3	3