

COURSE CODE	COURSE TITLE	L	T	P	C
1152AE139	Transonic Aerodynamics	3	0	0	3

**Course Category:**

Programme Elective

**a. Preamble :**

This course aims to explore the physics of transonic flow region.

**b. Prerequisite Courses:**

Compressible flow aerodynamics

**c. Related Courses:**

Hypersonic Aerodynamics

**d. Course Educational Objectives :**

- To understand the fundamental principles of transonic aerodynamics

**e. Course Outcomes :**

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

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Explain basic Concepts and Properties of Transonic flow	K2
CO2	Explain Linearized Theory for Thin Airfoils	K3
CO3	Solve transonic expansion procedures	K3
CO4	Apply transonic airfoil theory to solve problems	K3
CO5	Explain experiments in transonics	K3

**f. Correlation of COs with POs:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H			H				H				
CO2	H			H				H				
CO3	H			H				H				
CO4	H			H				H				
CO5	H			H				H				

H- High; M-Medium; L-Low

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Concepts and Properties of Transonic flow-Fundamental Equations-Similarity rule.		
<b>UNIT II</b>	<b>LINEARIZED THEORY</b>	<b>9</b>
Equations of Acoustics. Galilean Transformation - Uniform Translation. Slender Body Theory - Acoustics. Exact Equations of Planar Flow; Shock Waves and Entropy Jump. Linearized Theory for Thin Airfoils.		
<b>UNIT III</b>	<b>TRANSONIC EXPANSION PROCEDURES</b>	<b>9</b>
Simple Solutions, Integral Relations - Expansion Procedure for Steady Flow Past Airfoils. Expansion Procedure Applied to the Basic System of Equations. Expansion Procedures for Jet Flows. Transonic Similarity Rules. Hodograph Equations for Planar Flow. Simple Waves, Shock Waves, Detachment. Nozzle Flow, Branch Lines, Limit Lines. Subsonic and Sonic Jets. Transonic Slender Bodies; Expansion Procedure, Area Rule. Lift and Drag Integrals. Unsteady Transonic Flow.		
<b>UNIT IV</b>	<b>TRANSONIC AIRFOIL THEORY</b>	<b>9</b>
Problem Formulation. Nose Singularity. Shock Waves at a Curved Surface. Numerical MethodsTSP equations - Solution Methods - Physical Plane, Steady Flow. Airfoils at Sonic Velocity. The Stabilization Law.		
<b>UNIT V</b>	<b>TRANSONIC WIND TUNNELS</b>	<b>9</b>
Wind tunnels- Wide slots, Narrow slots- slotted walls - Slotted walls with perforated Cover PlatesTransonic testing with wing flow Technique-Movable walls, Slotted walls, Perforated walls.		

**TOTAL: 45**

**REFERENCES:**

1. Cole and Cook, "Transonic Aerodynamics", 1st Edition,1975.
2. Bernhard H.Goethert "Transonic Wind tunnel Testing" Pergamon Press,1961.
3. K. Gottfried Guderley," The theory of transonic flow", Pergamon Press, 1962