ME496: GAS DYNAMICS AND PROPULSIVE SYSTEM
CREDITS = 3 (L=3, T=0, P=0)

Course Objective:

1. To analyze compressible flow through constant and variable area duct
2. To analyze propulsive system by applying principles of Fluid mechanics.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
L	T	P	C	Theory		Practical		Total Marks
				ESE	CE	ESE	CE	
3	0	0	3	70	30	0	0	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Fundamentals of Compressible Flow:** Basic equations of compressible flow, stagnation states, Mach wave and Mach cones, effect of Mach number on compressibility.	06
2	**Flow through variable area duct:** One dimensional isentropic flow in duct of varying cross sectional area; nozzles and diffusers; critical properties and choking.	10
3	**Normal shock waves:** Development of shock wave, thickness of shock wave, strength of shockwave, Prandtl relation, Rankine- Hugoniot relation, variation of flow parameter across the normal shock.	06
4	**Flow in constant area duct with friction (Fanno flow):** Fanno flow equation and its solution, relation of flow properties with length, experimental coefficient of friction.	06
5	**Flow in constant area duct with heat transfer (Rayleigh flow):** Rayleigh flow equations, variation of flow properties, maximum heat transfer.	06

Unit No.	Topics	Teaching Hours
6	**Theory of jet propulsion:** Operating principle of Propulsive systems; Propulsive, Thermal and Overall efficiency, specific fuel consumption, thrust equation and cycle analysis; performance of ram jet, turbojet, turbofan and turboprop engines.	08
	TOTAL	**42**

List of References:

1. S. M. Yahya, "*Fundamentals of Compressible flow with Aircraft and Rocket Propulsion*", New age international Publication.
2. P. Balachandran, "Fundamentals *of Compressible fluid dynamics*", PHI Learning, New Delhi.
3. E. Rathakrishnan, *" Gas Dynamics*", *Second Edition*, PHI Learning Pvt Ltd,
4. P. Murugaperumal, "Gas *Dynamics and Jet Propulsion*", Scitech Publication, Chennai.
5. The Ascher H. Shapiro, "*Dynamics and thermodynamics of Compressible fluid flow Volume-I"*, The Ronald Press Company, New York.
6. J. D. Anderson, "*Modern Compressible Flow*", 3 rd Edition, McGraw Hill, 2003.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Outline governing equations of compressible fluid flow.
2. Analyze one dimensional compressible flow through variable area duct.
3. Analyze compressible flow having normal shock.
4. Apply governing equations to compressible flow through constant area duct with friction.
5. Apply governing equations to compressible flow through constant area duct with heat transfer.
6. Interpret propulsive systems for their working and application.