



C. U. SHAH UNIVERSITY
Wadhwan City

FACULTY OF: - Technology and Engineering
DEPARTMENT OF: - Automobile Engineering
SEMESTER: -VII
CODE: - 4TE07GDY1
NAME: – Gas Dynamics

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme								
		Th	Tu	Pr	Total		Theory				Practical (Marks)				Total
							Sessional Exam		University Exam		Internal		University		
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr		
4TE07GDY1	Gas Dynamics	3	0	2	5	4	30	1.5	70	3	---	20	30	150	

Objectives:

- To understand the compressible flow fundamentals.
- To study the compressible flow with friction and heat transfer.
- To know the application of normal shock in compressible flow.

Prerequisite:

- Concepts from Fluid Mechanics, Basic Thermodynamic Relations.

Course Outline:

Sr. No.	Course Content	Hours
1	Fundamentals of compressible flow: Energy and momentum equations for compressible fluid flows, various regions of flows, reference velocities, stagnation state, velocity of sound, critical states, Mach number, critical Mach number, types of waves, Mach cone, Mach angle, effect of Mach number on compressibility.	10
2	Isentropic flow with variable area: One dimensional isentropic flow in ducts of varying cross-section- nozzles and diffusers, mass flow rate in nozzles, critical properties and choking, area ratio as function of Mach number, Impulse function, effect of back pressure variation of convergent and convergent divergent nozzles, nondimensional mass flow rate in terms of pressure ratio, area ratio and Mach number, flow through diffusers, use of gas tables.	10
3	Flow Through Ducts: Fanno curve and Fanno flow equations, solution of Fanno flow equations, variation of flow properties, variation of Mach no. with duct length, isothermal flow in constant area duct with friction, tables and charts for Fanno flow. Rayleigh curve and Rayleigh flow equations, variations of flow properties, maximum heat transfer, tables and charts for Rayleigh flow.	10

4	Normal shock : Development of shock wave, governing equations, Prandtl-Mayer relation, Rankine-Hugoniot relation, strength of shock wave, Mach number in the downstream of normal shock, variation of flow parameters across the normal shock, normal shock in Fanno and Rayleigh flows, impossibility of a rarefaction shock, supersonic diffusers.	9
5	Oblique Shock: Concept and theory, Oblique Shock relations, Property variations	6

Learning Outcomes:

- To understand the basic difference between incompressible and compressible flow.
- Solve problems in Rayleigh and Fanno flow.

Books Recommended:

1. Dynamics of compressible flow by **S. M. Yahya**, New Age Publishers, Delhi
2. Fundamentals of compressible fluid dynamics by **P. Balachandran**, PHI Learning, New Delhi
3. Gas Dynamics and Jet Propulsion by **P. Murugaperumal**, Scitech Publication, Chennai.

Reference Books:-

1. Gas Dynamics and Jet Propulsion- **B. L. Singhal**, Macmillan Publishers India Ltd, New Delhi.
2. Gas turbine theory and jet propulsion – **J. K. Jain**, Khanna publishers, New Delhi.
3. Gas Dynamics – **James John and Theo Keith**, Pearson, New Delhi.