

# GUJARAT TECHNOLOGICAL UNIVERSITY

## B.E. SEMESTER : VIII

### MECHANICAL ENGINEERING

Subject Name: **GAS DYNAMICS**

Sr. No.	Course Contents	Total Hrs
1.	<b>Fundamentals of compressible flow:</b> Continuity, momentum and energy equation, control volume, sonic velocity, Mach number and its significance, Mach waves, Mach cone and Mach angle, Von Karman rules of supersonic flow, static and stagnation states, relationship between stagnation temperature, pressure, density and enthalpy in terms of Mach number, stagnation velocity of sound, reference speeds, various regions of flow, Effect of Mach number on compressibility.	09
2.	<b>Isentropic flow with variable area:</b> 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, non-dimensional mass flow rate in terms of pressure ratio, area ratio and Mach number, flow through diffusers, use of gas tables.	10
3.	<b>Flow in constant area duct with friction (Fanno flow):</b> 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.	08
4.	<b>Flow in constant area duct with heat transfer (Rayleigh flow):</b> Rayleigh curve and Rayleigh flow equations, variations of flow properties, maximum heat transfer, tables and charts for Rayleigh flow.	08
5.	<b>Normal shock :</b> 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.	09
6.	<b>Wind tunnel:</b> Types of wind tunnels.	01

**Term Work:** The term work shall be based on the topics mentioned above.

**Practical / Oral:** The candidate shall be examined on the basis of term-work.

#### Textbooks:

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

#### Reference Books:

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