

Department of Aerospace Engineering , IIT Madras

Course Title	Physical Gas Dynamics	Course No	AS 530			
Department	Aerospace	Structure	L	T	P	C
			3	0	0	3
Offered for	MTech/MS/PhD	Status	Elective			
Faculty	Dr. S R Chakravarthy Dr. T M Muruganandam Prof. R I Sujith	Type	New			
Pre-requisite	COT	To take effect from	July 2008			
Submission date	Date of approval by DCC	Date of approval by BAC	Date of approval by Senate			
Mar 06 2008	Mar 07 2008					
1. Objectives	To give conceptual understanding of thermo-physical properties of gases, behavior of simple gases in equilibrium and non-equilibrium situations. It is intended as a primer to advanced courses viz. High temperature gas dynamics (AS568) or Combustion, explosion and detonation (AS564)					
2. Course Contents	Introductory Kinetic theory (definition of pressure and temperature from microscopic viewpoint, Mean free path, transport processes) Equilibrium kinetic theory (Maxwell's distribution, collision rate) Chemical equilibrium (Effective collision rate, Law of mass action, activation energy) Chemical thermodynamics (Gibb's relations, Mixture of perfect gases, van't Hoff's relation) Statistical thermodynamics (Macroscopic and microscopic descriptions, Quantum energy states, energy modes of molecules, Boltzman's relation, contribution of internal structure) Equilibrium gas properties (Ideally dissociating gas, Ionisation equilibrium, Properties of equilibrium air) Non-Equilibrium Kinetic Theory (Boltzman equation, entropy and equilibrium, Collision cross sections) Flow with translational non-equilibrium (Bhatnagar-Gross-Krook model for translational non-equilibrium, Chapman-Enskog solution, Transport properties as nonequilibrium phenomena, Linearised Couette flow)					
3. Text Books	W G Vincenti and C H Kruger, Jr., Introduction to Physical Gas Dynamics , Kreiger Publishing Co., Malabar, Florida, USA (1986). ISBN 0882753096					
4. References	J.D. Anderson Jr., Hypersonic and High Temperature gas dynamics , McGraw Hill (1989) or AIAA publication (2000). ISBN 156347459X K Denbigh, The principles of chemical equilibrium , Cambridge University press, (1993), ISBN0521281504 T.K. Bose, High Temperature Gas Dynamics: an Introduction for Physicists and Engineers , Springer (2004). ISBN 3540408851 J.O. Hirschfelder, C.F. Curtiss, and R.B. Bird, Molecular theory of gases and liquids , Wiley-Interscience; Rev Ed edition (1964) 0471400653					