

**Department of Aerospace Engineering , IIT Madras**

Course Title	<b>High Temperature Gas Dynamics</b>	Course No	<b>AS 568</b>			
Department	<b>Aerospace</b>	Structure	L	T	P	C
			<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
Offered for	MTech/MS/PhD	Status	<b>Modification</b>			
Faculty	Dr. T M Muruganandam Dr. S R Chakravarthy Prof. R I Sujith	Type	<b>Elective</b>			
Pre-requisite	<b>AS530 or COT</b>	To take effect from	Jan 2009			
Submission date	Date of approval by DCC	Date of approval by BAC	Date of approval by Senate			
Sep 23 2008						
1. Objectives	<p>To give conceptual understanding of equilibrium and non-equilibrium processes in a gas (energy exchange between molecules) and their effect on macroscopic flow of gases.</p> <p>This advanced course assumes the basic knowledge of thermo-physical properties of gases, their behavior in equilibrium (AS530) and some basic gas dynamics like isentropic flow, shocks, frictional flow, flow with heating, etc.</p>					
2. Course Contents	<p>Review of equilibrium gas properties, non-equilibrium and non-equilibrium kinetic theory.</p> <p>Equilibrium flow (Steady shocks, nozzle flow, Prandtl-Meyer flow, Frozen flow)</p> <p>Vibrational and Chemical rate processes (Vibrational rate equation, chemical rate equation, local relaxation times, small departures from equilibrium)</p> <p>Flow with Vibrational and chemical non-equilibrium (Equilibrium and frozen flow, non-linear equations, acoustic equations, speed of sound, sound propagation, small departures from uniform flow, linearised normal shock wave, dispersed shock wave, nozzle flow, MOC)</p> <p>Flow with translational non-equilibrium (transport properties, Bulk viscosity, structure of shock wave, linearised Couette flow)</p> <p>Radiative transfer in gases (Equation of radiative transfer, radiative equilibrium, radiation-solid surface interaction, Emission and absorption of radiation)</p> <p>Flow with radiative non-equilibrium (Basic non-linear equations, grey-gas, 1D equations, normal shock wave)</p>					
3. Text Books	W G Vincenti and C H Kruger, Jr., <b>Introduction to Physical Gas Dynamics</b> , Kreiger Publishing Co., Malabar, Florida, USA (1986). ISBN 0882753096					
4. References	<p>J.D. Anderson Jr., <b>Hypersonic and High Temperature gas dynamics</b>, McGraw Hill (1989) or AIAA publication (2000). ISBN 156347459X</p> <p>T.K. Bose, <b>High Temperature Gas Dynamics: an Introduction for Physicists and Engineers</b>, Springer (2004). ISBN 3540408851</p> <p>J.O. Hirschfelder, C.F. Curtiss, and R.B. Bird, <b>Molecular theory of gases and liquids</b>, Wiley-Interscience; Rev Ed edition (1964) 0471400653</p>					