Contents

	Nomenclature	4	
1	Basic Concepts of Thermodynamics		
•	1.1 Thermodynamic System		
	1.2 Thermodynamic Quantities		
2	State, State Quantities		
4	2.1 Basic State Variables, Equation of State	8	
	2.2 Ideal Gas, State Equation of Ideal Gas	Q	
	2.3 State Equation of Real Gas	11	
2	Thermodynamic Properties and Functions	17	
)	3.1 Specific Heat Capacity	12	
	3.2 Specific Heat Capacities of Gases	11	
	3.2 Specific Heat Capacities of Gases	. 14	
	3.3 Thermodynamic Functions		
4	Gas Mixtures		
	4.1 Ideal-Gas Mixtures		
	4.2 Real-Gas Mixtures		
	4.3 Transport Coefficients of Gas Mixtures	. 19	
	4.4 Tables of Thermophysical Properties	. 20	
5	First and Second Laws of Thermodynamics		
	5.1 First Law of Thermodynamics for Closed Systems	. 21	
	5.2 First Law of Thermodynamics for Open Systems		
	5.3 Second Law of Thermodynamics	. 24	
6	Reversible Processes for the Ideal Gas		
	6.1 Isochoric Process	. 27	
	6.2 Isobaric Process		
	6.3 Isothermal Process		
	6.4 Adiabatic Process		
	6.5 Polytropic Process		
7	Compression of Gas in Compressors		
,	7.1 Dynamic Compressors	33	
	7.2 Ideal One-Stage Reciprocating Compressor	35	
	7.3 Ideal Two-Stage Compression with Intercooling	. 33 38	
	7.4 Actual Cycle of Reciprocating Compressor	. 30 40	
0	7.4 Actual Cycle of Reciprocating Compressor	. 4 0 11	
ð	Cycles of Internal Combustion Engines	. 4 1 . 4 1	
	8.1 Ideal Cycle for Spark-Ignition Engines	. 41 11	
	8.2 Ideal Dual Cycle for Compression-Ignition Engines		
	8.3 Ideal Constant-Pressure Cycle for Compression-Ignition Engines		
	8.4 Actual Cycles of Internal Combustion Engines		
9	Cycles of Gas Turbine Engines	. 49	
	9.1 Ideal Cycle for Gas Turbine Engines	49	
	9.2 Increasing Thermal Efficiency and Net Work of Gas Turbine Cycles	. 53	
	9.3 Actual Gas Turbine Cycle	. 54	
1	1 Introduction to Combustion and Burning	. 55	
	10.1 Fuel Composition and Heating Values	. 55	
	10.2 Stoichiometry of Combustion		
	10.3 Combustion with Excess Air	. 58	
1	1 Heat Transfer	61	
	11.1 Steady State Heat Conduction		
	11.2 Convective Heat Transfer		
	11.3 Heat Transfer by Combined Conduction and Convection		
	11.4 Heat Exchangers		
	11.5 Thermal Radiation		
A	ppendix		
	Literature		