Table of Contents

- Part 1 Introduction
- Chapter 1 Thermofluids
- Chapter Objectives
- Nomenclature
- Greek and other symbols
- 1.1 What is Thermofluids?
- 1.2 Thermodynamics, fluid mechanics, and heat transfer
- 1.3 Dimensions and units
- 1.4 Organization of the book
- Problems
- References
- Chapter 2 Energy and thermodynamics
- Chapter Objectives
- Nomenclature
- 2.1 The study of energy
- 2.2 The conservation of energy
- 2.3 The quality of energy
- 2.4 Thermodynamic systems
- 2.5 Thermodynamic state, equilibrium, and properties
- Problems
- References
- Chapter 3 Moving fluids
- Chapter Objectives
- Nomenclature
- Greek and other symbols
- 3.1 What is a fluid?
- 3.2 The continuum fluid
- 3.3 Nature thrives in moving fluids
- 3.4 What is viscosity?
- 3.5 Newtonian fluids
- 3.6 A classification of fluid motions
- 3.7 Fluid mechanics textbooks
- Problems
- References
- Chapter 4 The transfer of thermal energy
- Chapter Objectives
- Nomenclature
- Greek and other symbols
- 4.1 What is thermal energy?
- 4.2 Specific heats
- 4.3 Heat transfer versus thermodynamics
- 4.4 The three heat transfer mechanisms

- Problems
- References
- Part 2 An Ecological View on Engineering Thermodynamics
- Chapter 5 The four laws of ecology
- Chapter Objectives
- Nomenclature
- 5.1 What is ecology?
- 5.2 The four laws of ecology
- 5.3 Animal thermoregulation
- 5.4 Learning from intelligent designs
- Problems
- References
- Chapter 6 The first law of thermodynamics
- Chapter Objectives
- Nomenclature
- Greek and other symbols
- 6.1 Energy
- 6.2 Thermodynamic systems
- 6.3 Heat and work transfer
- 6.4 Conservation of energy
- 6.5 Moving boundary work
- 6.6 Enthalpy
- 6.7 Thermodynamic cycle
- Problems
- References
- Chapter 7 The second law of thermodynamics
- Chapter Objectives
- Nomenclature
- Greek and other symbols
- 7.1 Introduction
- 7.2 One-way energy flow
- 7.3 Entropy
- 7.4 Heat source and sink
- 7.5 Heat engine
- 7.6 Reverse heat engines
- Problems
- References
- Part 3 Environmental and Engineering Fluid Mechanics
- Chapter 8 Fluid statics
- Chapter Objectives
- Nomenclature
- Greek and other symbols
- 8.1 What is pressure?
- 8.2 Fluid statics

- 8.3 Hydrostatic pressure
- 8.4 Measuring pressure
- 8.5 Hydrostatic force on a surface
- 8.6 Buoyancy
- Problems
- References
- Chapter 9 Bernoulli flow
- Chapter Objectives
- Nomenclature
- Greek and other symbols
- 9.1 Streamline, streakline, and pathline
- 9.2 Streamline, streamtube, and Bernoulli's Wig
- 9.3 The Bernoulli equation
- 9.4 Bernoulli's pressures
- 9.5 Flow rate measurements
- 9.6 Energy line and hydraulic grade line
- Problems
- References
- Chapter 10 Dimensional analysis
- Chapter Objectives
- Nomenclature
- Greek and other symbols
- 10.1 Dimensional homogeneity
- 10.2 Scaling and dimensional analysis
- 10.3 Buckingham Pi theorem
- 10.4 Prevailing nondimensional parameters in fluid mechanics
- 10.5 Some remarks on dimensional analysis
- Problems
- References
- Chapter 11 Internal flow
- Chapter Objectives
- Nomenclature
- Greek and other symbols
- 11.1 Flow in a channel
- 11.2 The Reynolds number and the type of pipe flow
- 11.3 Developing pipe flow
- 11.4 Fully developed horizontal pipe flow
- 11.5 Fully developed inclined pipe flow
- 11.6 Energy conservation and head loss in pipe flow
- 11.7 Major and minor losses in pipe flow
- Problems
- References
- Chapter 12 External flow
- Chapter Objectives

- Nomenclature
- Greek and other symbols
- 12.1 Everyday external flow
- 12.2 Lift and drag
- 12.3 Boundary layer
- 12.4 Flat plate boundary layer development
- 12.5 Bluff body aerodynamics
- Problems
- References
- Part 4 Ecophysiology-flavored Engineering Heat Transfer
- Chapter 13 Steady conduction of thermal energy
- Chapter Objectives
- Nomenclature
- 13.1 Fourier's law of heat conduction
- 13.2 From electric resistance to thermal resistance
- 13.3 One-dimensional heat conduction in cylindrical coordinates
- 13.4 Heat conduction radially through a sphere
- 13.5 Steady conduction through multilayered walls
- 13.6 Multilayered inhomogeneous walls
- Problems
- References
- Chapter 14 Transient conduction of thermal energy
- Chapter Objectives
- Nomenclature
- Greek and other symbols
- 14.1 A lumped system with homogeneous temperature
- 14.2 Biot number
- 14.3 One-dimensional transient problems
- 14.4 Semi-infinite solid
- Problems
- References
- Chapter 15 Natural convection
- Chapter Objectives
- Nomenclature
- Greek and other symbols
- 15.1 Natural convection and thermals
- 15.2 Thermal expansion and buoyancy force
- 15.3 Nondimensional parameters in natural convection
- 15.4 The classical Rayleigh–Bernard convection
- 15.5 Continuous thermal plumes and buoyant jets
- 15.6 Free convection along a vertical plate
- 15.7 Other free convection cases
- Problems
- References

- Chapter 16 Forced convection
- Chapter Objectives
- Nomenclature
- Greek and other symbols
- 16.1 What is the force behind forced convection?
- 16.2 The convection heat transfer coefficient
- 16.3 Forcing heat to convect from a flat surface
- 16.4 Primary parameters in forced convection
- 16.5 Nusselt number, Reynolds number, and Prandtl number
- 16.6 Nu–Re–Pr relationships
- 16.7 Relating heat convection with flow shear at the wall
- 16.8 Forced convection around a circular cylinder
- 16.9 Other nondimensional parameters of forced convection
- 16.10 Internal forced convection
- Problems
- References
- Chapter 17 Thermal radiation
- Chapter Objectives
- Nomenclature
- Greek and other symbols
- 17.1 The radiating Sun
- 17.2 All bodies above absolute zero radiate heat
- 17.3 Absorptivity, transmissivity, and reflectivity
- 17.4 View or shape factors
- 17.5 Further reading on thermal radiation
- Problems
- References
- Chapter 18 Heat exchangers
- Chapter Objectives
- Nomenclature
- Greek and other symbols
- 18.1 Nature thrives by exploiting effective heat exchangers
- 18.2 Counter-flow, parallel-flow, and crossflow heat exchangers
- 18.3 Moving along a constant-temperature passage
- 18.4 Heat exchange between a hot stream and a cold stream
- 18.5 Log mean temperature difference
- 18.6 Heat exchanger effectiveness and number of transfer units