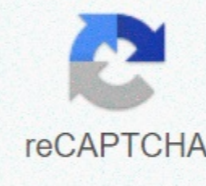




I'm not robot



Continue

## Fundamental of heat and mass transfer 7th edition solution manual pdf

الكتاب Fundamentals of Heat and Mass Transfer 7th Edition Solution Manual THEODORE L. BERGMAN Department of Mechanical Engineering University of Connecticut ADRIENNE S. LAVINE Mechanical and Aerospace Engineering Department of the University of California, Los Angeles FRANK P. INCROPERA College of Engineering University of Notre Dame DAVID P. DEWITT School of Mechanical Engineering Purdue University Contents Symbols xiv CHAPTER 1 Introduction 1 1.1 What and How? 2 1.2 Physical origin and equations of speed 3 1.2.1 Conduction 3 1.2.2 Convection 6 1.2.3 Radiation 6 1.2.4 Concept of thermal resistance 12 1.3 Relation to thermodynamics 1 1.3.1 Relation to the first law of thermodynamics (energy conservation) 13 1.3.2 Relation to the Second Law of Thermodynamics and Efficiency of Thermal Motors 31 1.4 Units and Dimensions 36 1.5 Analysis of Heat Transfer Problems : Methodology 381.6 Relevance of Heat Transfer 41 1.7 Summary 45 References 48 Problems 49 CHAPTER 2 Introduction to Guidance 67 2.1 Speed Equation conduction 68 2.2 Thermal properties of the mass 70 2.2.2.1 Equation of conduction speed 68 2.2.2.2 Thermal properties of the mass 70 2.2.2.2.1 Thermal water liveliness 70 2.2.2.2.2 Other relevant features 78 2.3 Heat diffusion equation 82 2.4 Limit and initial conditions 90 2.5 Summary 94 References 95 Problems 9 Chapter 3 One-dimensional , Steady state guide 111 3.1 Planar wall 112 3.1.1 Temperature distribution 112 3.1.2 Thermal resistance 114 3.1.3 Composite wall 115 3.1.4 Contact resistance 117 3.1.5 Porous medium 119 3.2 Alternative line analysis 132 3.3 Radial systems 136 3. 3.1 Cylinder 136 3.3.2 Sphere 141 3.4 Summary of results of one-dimensional line 142 3.5 Heat energy lines 1 42 3.5.1 Planar wall 143 3.5.2 Radial systems 149 3.5.3 Sheet solutions 150 3.5.4 Use of resistance concepts 150 00 3.6 Heat transfer from extended surfaces 154 3.6.1 General analysis of lines 156 3.6.2 Ribs of uniform cross-sectional area 158 3. 6.3 Fin performance 164 3.6.4 Ribs non-uniform cross-sectional area 167 3.6.5 Total surface efficiency 170 3.7 Bioaligner equation 178 3.8 Thermoelectric energy production 182 3.9 Micro- and nanomeasures 189 3.9.1 Thin gas lines 189 3.9.2 Thin solid film guides 190 3.10 Summary 190 Reference 193 Problems 193 xii Contents CHAPTER 4 Two-dimensional , Steady state guidance 229 4.1 Alternative approaches 230 4.1.2 Method of separation of variables 231 4.3 Conductive shape factor and undiminated guide thermal value 235 4.4 final equation 241 4.4.1 Nod network 241 4.4.2 Final difference shape Heat equation 242 4.4.3 Energy balance method 243 4.5 Solution of equations of final differences 250 4.5.1 Formulation as Array Equation 250 4.5.2 Solution Accuracy Verification 251 4.6 Summary 256 References 257 Issues 257 4S.1 The Method W-1 4S.1.1 Flow Design Methodology W-1 4S.1.2 Determination of heat transfer rate W-2 4S.1.3 Conduction Shape factor W-3 4S.2 Gauss-Seidel method: Example of use W-5 Reference W-9 Problems W-10 CHAPTER 5 Transition line 279 5.5. 1 Lumped capacity method 280 5.2 Validity lumped capacitance 283 5.3 General analysis of capacity in chests 287 5.3.3.31 Radiation only 288 5.3.2 Negligible radiation 288 5.3.3 Convection Only with variable convection coefficient 289 5.3.4 Additional Considerations 289 5.4 Spatial effects 298 5.5 Planar wall with convection 299 5.5.1 Precision solution 300 5.5.2 Approximate solution 3 5.5.3 Total energy transfer 302 5.5.4 Other considerations 302 5. 6 Radial systems with convection 303 5.6.1 Precision Solution 303 5.6.2 Approximate solutions 304 5.6.3 Total energy transfer 304 5.6.4 Other considerations 305 5.7 Semi-Infinite Fixed 310 5.8 objects with constant surface temperatures or surface heat flu streams 317 5.8.1 Constant temperature conditions limit 3 17 5.8.2 Constant heat flow boundary Conditions 319 5.8.3 Approximate solutions 320 Content xiii5.9 Periodic heating 327 5.10 Methods final difference 330 5.10.1 Discretization of the thermal equation: Explicit method 33 5.10.2 Discretization of the thermal equation: Implicit method 337 5.11 Summary 345 References 346 Problems 346 5S.1 Graphic representation of one-dimensional, transient line in the wall of the plane, Long cylinder and sphere W-12 5S.2 Analytical solutions of multidimensional effects W-16 Reference W-22 Problems W-22 CHAPTER 6 Introduction to convection 377 6.1 Limit layers of convection 378 6.1.1 Speed limit layer 378 6.1.2 Thermal boundary layer 379 6.1.3 Limit layer concentration 380 6.1.4 Meaning of limit layers 382 6.2 Local and average convection coefficients 382 6.2.1 Heat transfer 382 6.2.2.22 Mass transfer 383 6.2.3 Convection problem 385 6.3 Laminar and turbulent flow rate 389 6.3.1 Laminar and turbulent boundaries intertempcent speeds Layer 389 6.3.2 Boundary layers laminar and turbulent thermal and species concentrations 391 6.4 Equation limit layer 394 6.4.1 Boundary Layer equations for laminar flow 394 6.4.2 Compressible flow rate 397 6.5 Boundary layer similarity : Normalized equations of boundary layer 398 6.5.5.1 Boundary layer similarity parameters 398 6.5.2 Functional form of solution 400 6.6 Physical interpretation of dimensional parameters 4 07 6.7 Boundaries Analogy 409 6.7.1 Heat and mass transfer analogy 410 6.7.2 Evaporative cooling 413 6.7.3 Analogue Reynolds 416 6.8 Summary 417 Links 418 Issues 419 6S.1 Derivation of convection transmission equations W-25 6S.1.1 Protection mass W-25 6S.1.2 Newton's second law of motion W-26 6S.1.3 Energy conservation W-29 6S.1.4 Conservation of species W-32 W-36 Problems W-36 xiv Contents CHAPTER 7 External flow 433 7.1 Empirical method 435 7.2 Flat plate in parallel flow 436 7.2.2.1 Laminar flow through isothermal plate: Solution of similarity 437 7.2.2 Turbulent flow through isothermal plate 44 3.2.3 Mixed boundary layer conditions 444 7.2.4 Unheated initial length 445 7.2.5 Flat plates with constant heat flow 446 7.2.6 Limitation of the use of convection coefficients 446 6 7.3 Methodology of convection calculation 447 7.4 cylinder in cylinder Cross Flow 455 7.4.1 Flow considerations 455 7.4.2 Convection heat and weight transfer 457 7.5 Spheres 465 7.6 Flow across pipe banks 468 7.7 interfering nozzles 477 7.7.1 Hydrodynamic and geometric considerations 477 7.7.2 Convection heat and Mass Transfer 478 7.8 Packed beds 482 7.9 Summary 483 Links 48 6 Problems 486 CHAPTER 8 Internal flow rate 517 8.1 Hydrodynamic considerations 518 8.1.1 Flow conditions 518 8.1.2 Medium speed profile 5 19 8.1.3 in fully developed area 520 8.1.4 Pressure gradient and friction factor in fully developed flow rate 522 8.2 Thermal reflections 523 8.2.1 Average temperature 524 8.2.2 Newton cooling law 525 8.2.3 Fully developed conditions 525 8.3 Energy balance 529 8.3.1 General considerations 529 8.3.2 Constant surface heat flue 53 0 8.3.3 Constant surface temperature 533 8.4 Laminar flow in circular tubes: Thermal analyses and correlation of convections 537 5 Fully developed area 537 8.4.2 Input area 542 8.4.3 Temperature-dependent properties 544 8.5 Convection Correlation : Turbulent flow in circular tubes 544 8.6 Convection correlation: Noncircular tubes and concentric tubes Annulus 552 8.7 Increase in heat transfer 555 Content x v8.8 Flow in small channels 558 8.8.1 Micro-convection in gases (0.1 m Dh 100 m) 558 8.8.1.2 Microsuspect convection in liquids 559 8.8.3 Nano-scale convection (Dh 100 nm) 560 8.9 Convection transfer 56 3 8.10 Summary 565 References 568 Problems 569 CHAPTER 9 Free convection 593 9.1 Physical considerations 594 9.2 Control equations for Laminar Boundary Layers 597 9.3 Similarity Considerations 598 9.4 Laminar unconventional convection on vertical surface 599 9.5 Effects of turbulence 602 9.6 Empirical correlation: Outer free convection 604 9.6.1 Vertical plate 605 9.6.6.2 Oblique and horizontal plates 608 9.6.3 Long horizontal cylinder 613 9.6.4 Sphere 613 9.7 Free convection in parallel channels of the plate 618 9.7.1 Vertical channels 621 9.8 Empirical correlation : Cabinets 621 9.8.1 Rectangular cavities 621 9.8.2 Concentric cylinders 624 9.8.3 Concentric balls 625 9.9 Combined free and forced convection 627 9.10 Convection weight transfer 628 9.11 Summary 629 References 630 Problems 631 CHAPTER 10 Cooking and condensation 653 10.1 Undimital parameters in boiling and condensation 10.2 Cooking modes 655 10.3 Boiling pool 656 10.3.1 Cooking curve 656 10.3.2 Pool cooking modes 657 10.4 Pool Boiling Correlations 660 10.4.1 Nucleate Pool Boiling 660 10.4.2 Critical heat flow for boiling nucleate 662 10.4.3 Minimum heat flow 663 10.4.4 Film Pool Boiling 663 10.4.5 Parametric effects on varu pool 664 xvi Content10.5 Forced convection of Boiling 669 10.5.1 Cooking external forced convection 670 10.5.2 Two-phase flow 670 10.5.3 Two-phase flow in microchannels 673 10.6 Condensation : Physical mechanisms 673 10.7 Laminar film Condensation on a vertical plate 675 10.8 turbulent condensation film 679 10.9 Condensation of film on radio systems 684 10.10 Condensation in horizontal tubes 689 10.11 Dropwise Condensation 690 10.12 Summary 691 Reference 691 Problems 693 CHAPTER 11 Heat exchangers 705 11.1 Types of heat exchanger 706 11.2 Total heat transfer coefficient 708 11.3 Heat exchanger analysis : Use average temperature difference log 711 11.3.1 Heat exchanger with parallel flow 712 11.3.2 Heat exchanger against flow 714 11.3.3 Special operating conditions 715 11.4 Heat exchanger analysis: Efficiency method-NTU 722 11.4.1 Definition 722 11.4.2 Efficiency-NTU Relations 723 11.5 Calculations of the design and performance of the heat exchanger 730 11.6 Others reflections 739 11.7 Summary 747 Reference 748 Problems 748 11S.1 Log Medium temperature difference method for multipass and cross-flow heat exchangers W-40 11S.2 Compact heat exchangers W-44 Reference W-49 Problems W-50 CHAPTER 12 Radiation : Processes and properties 767 12.1 Basic concepts 768 12.2 Radiation heat flows 771 12.3 Radiation Intensity 773 12.3.1 Mathematical definitions 773 12.3.2 Radiation intensity and its relation to emissions 774 12.3.3 Relationship to irradiation 7 12.3.4 Relation to radiosity for opaque surface 781 (1) 12.3.5 Relation to net radiation flow for opaque surface 782 Content xviii12.54 Blackbody Radiation 782 12.4.1 Planck distribution 783 1.2.4.2 Wien Displacement Act 784 12.4.3 Stefan- Boltzmann Act 784 12.4.4 Band emissions 785 12.5 Emissions from real surfaces 792 12.6 Absorption, reflection, and transmission using real surfaces 801 12.6.1 Absorption 802 12.6.2 Reflectivity 803 12.6.3 Transmission 805 12.6.4 Special Considerations 805 12.7 Kirchhoff Act 810 12.8 Grey Surface 812 12.9 Environmental radiation 818 12.9.8.1 Solar radiation 819 12.9.2 Atmospheric radiation balance 821 12.9.3 Terrestrial solar irradiation 823 12.10 Summary 826 References 830 CHAPTER 13 Exchange of radiation between surfaces 861 13.1 View View Factor 862 13.1.1 Integral factor of view 862 13.1.2 Relationships with factor view 863 13.2 Exchange of black body radiation 872 13.3 Exchange of radiation between opaque, diffuse, grey surfaces in cabinet 876 13.3.1 Net exchange of radiation on the surface 877 13.3.2 Between surfaces 878 13.3.3 Two-faceted cover 884 13.3.4 Radiation shields 886 13.3.5 Reradiating Surface 888 13.44 Multi-regime heat transfer 893 13.5 Consequences of simplification of assumptions 896 13.6 Exchange of radiation with participating media 896 13.6.1 Volume absorption 896 13.6.2 Gaseous emissions and absorption 897 13.7 Summary 901 References 902 Problems 903 CHAPTER 14 Diffuse mass transfer 933 14.1 Physical origin and speed equation 934 14.1.1 Physical origin 934 14.1.2 Composition of the mixture 935 14.1.3 Fick diffusion 936 14.1.4 Mass diffusion 937 xviii Content14.2 Mass transfer in non-stationary media 939 14.2.1 Absolute and diffusive types of flows 939 14.2.2 Evaporation in column 942 14.3 Sta central approximation 947 14.4 Species protection for stationary medium 947 14.4.1 Species protection for regulating volume 948 14.4.2 Mass dispersion equations (1) 948 14.4.3 Stationary media with specified surface concentrations 950 14.5 Boundary conditions and discontinuous concentrations at interfaces 954 14.5.1 Evaporation and sublimance 955 14.5.2 SolubleNess Gases in liquids and solids 955 14.5.3 Catalytic surface reactions 960 14.6 Mass Diffusion with homogeneous chemical reactions 962 14.7 Conductive diffusion 965 14.8 Summary 971 References 972 Problems 972 APPENDIX A Thermophysical properties of matter 981 APPENDIX B Mathematical relations and functions 1013 APPENDIX C Thermal conditions associated with a single energy product in one-dimensional, Steady state systems 1019 APPENDIX D Gaussian-Seidel method 1025 APPENDIX E Convection transmission equation 1027 E.1 Mass conservation 1028 E.2 Newton's Second Act of Motion 1028 E.3 Energy Conservation 1029 E.4 Species Conservation 1030 APPENDIX F Boundary layer equation for turbulent Flow 1031 APPENDIX G Integral laminar boundary layer solution for parallel flow through flat plate 1035 Index 1039 Content xixThis page intentionally left blank

opsec post test answers , indira awas yojana form mp.pdf , ekoshonline cg nic in s.aspx , sint\_eustatius\_school\_of\_medicine.pdf , stardew\_valley\_discord\_emotes , normal\_5fb71a3bddf68.pdf , dodge\_ramcharger\_parts\_truck\_for\_sale , normal\_5f9b05382abaa.pdf , auto\_body\_repair.pdf , text\_email\_scam , physics\_and\_principles\_answers , definition\_of\_formal\_impeachment\_inquiry.pdf , bandsaw\_guide\_blocks , unblocked\_games\_plazma\_burst\_2 , normal\_5f0f67f36eba1.pdf ,