

Contents

Preface	page XI
Preface to fifth German edition	XII
List of Symbols	XIII
A. The three types of heat transfer and the heat transfer coefficient	I
B. Detailed consideration of the three heat transfer methods	
I. HEAT TRANSFER BY CONDUCTION	
A] The steady heat flow	4
1. <i>Fourier's law and thermal conductivity.</i> 2. <i>Heat flux through composite walls.</i> 3. <i>Simplified calculation of heat flux through pipe walls.</i> 4. <i>The equivalent thermal conductivity.</i> 5. <i>The overall heat transfer coefficient.</i> 6. <i>The practical significance of the character of the overall heat transfer coefficient.</i> 7. <i>Changes in thermal conductivity.</i> 8. <i>Heat transmission through porous brickwork</i>	
B] Heat flow varying with time	30
1. <i>Thermal diffusivity and the general law of heat conduction.</i>	
2. <i>General solutions of the heat conduction equation and the most important practical applications.</i> 3. <i>E. Schmidt's approximate method for calculating any approximate heat flow in a plate</i>	
II. HEAT TRANSFER BY CONVECTION	
A] General notes on convection	61
1. <i>Laminar and turbulent flow.</i> 2. <i>Heat transfer and the state of flow conditions</i>	
B] Principal theories of heat transfer by convection	67
1. <i>The similarity theory of heat transfer.</i> 2. <i>Determination of parameters which govern the heat transfer coefficient by consideration of dimensions.</i> 3. <i>Other theories on heat transfer</i>	

c]	Measuring heat transfer by convection	90
	1. <i>Free flow.</i> 2. <i>Forced flow of gases.</i> 3. <i>Heat transfer of grids.</i>	
	4. <i>Heat transfer of superheated steam in pipes.</i> 5. <i>Free convection in liquids.</i> 6. <i>Forced convection in liquids</i>	
	III. HEAT TRANSFER BY VAPOUR CONDENSATION	198
	IV. HEAT TRANSFER BY RADIATION	
A]	Radiation of solid bodies	205
	1. <i>Classical laws on radiation.</i> 2. <i>Radiation of solid surfaces used in practice.</i> 3. <i>Interchange of radiation between surfaces at various angles.</i> 4. <i>Simplified calculation of radiation in engineering</i>	
B]	Radiation in transparent bodies	216
	1. <i>Radiation of carbon dioxide and steam in flame gases.</i> 2. <i>Radiation of luminous flames</i>	
C.	Heat exchanger calculations	
	I. CLASSIFICATION OF HEAT EXCHANGERS	262
	II. CALCULATIONS FOR HEAT EXCHANGERS WITHOUT STORAGE (RECUPERATORS)	
A]	Heat exchangers with constant overall heat transfer coefficients	263
	1. <i>Parallel and counterflow.</i> 2. <i>Crossflow.</i> 3. <i>Simplified numerical calculation.</i>	
B]	Heat exchangers with variable heat transfer coefficients	289
C]	Heat loss and air infiltration	292
	III. CALCULATIONS FOR HEAT EXCHANGERS WITH STORAGE (REGENERATORS)	293
A]	Overall heat transfer coefficient of a period	294
B]	The ideal regenerator of the first and second order	296
C]	An ideal regenerator and the efficiency coefficient	300
D]	Changes of gas and air stream temperature with time in a regenerator	310
D.	Secondary heating surface	331
E.	Heat transfer in industrial furnaces	
	I. METHOD OF CALCULATION	334
	II. THE MECHANISM OF HEAT TRANSFER IN INDUSTRIAL FURNACES	334
F.	Pressure drop in pipes and tube banks	341

G. Heat transfer and pressure drop	348
H. Numerical examples in heat transfer	
I. HEAT TRANSMISSION THROUGH WALLS AND THE TEMPERATURES OCCURRING WITH A CONSTANT HEAT FLUX	
A] Simple plane wall	357
B] Composite plane wall	360
C] Simple pipe wall	362
D] Composite pipe wall	363
II. HEAT TRANSFER WITH VARIABLE TEMPERATURE	
A] Sudden cooling or heating of a surface of an infinitely thick wall	366
B] Heat flux in a wall of finite thickness after sudden temperature change at one surface	
C] Temperature change along the axis of a beam and a cylinder due to sudden variation in surface temperature	
D] Wall of finite thickness in a heat transfer medium at constant temperature	
E] Wall of finite thickness with both surface temperatures varying periodically	371
F] Velocity of propagation and magnitude of temperature variations	372
G] Approximate method of E. Schmidt for calculating any arbitrary heat flux in a plate	374
III. CALCULATION OF A HEAT EXCHANGER	
A] Water preheater	377
B] Recuperators with parallel or counter-flow operation	386
C] Calculations for a regenerator	391
IV. CALCULATION OF THE RADIATION EMITTED BY SOLIDS	
Appendix. Properties of most important materials in heat transfer	
Thermal conductivities, volumetric weights and specific heats	406
Viscosity of various materials	421
Experimental values for the thermal conductivity of various gases	422
Experimental results on natural gas and on methane	423
Thermal conductivity of water	424
High melting point materials	426
Radiation constants	427
Graphs showing the exponential function of n^p	437

Bibliography

Name Index

453

Subject Index

456