

CONTENT

	Page
Authors' preface	15
Acknowledgements	17
Chapter 1 – Context of Equipment Studies	
1.1 Introduction	19
1.2 Relationship to Other subjects	20
1.3 The Aims of Equipment Design	22
1.4 Cooking Tests	22
Chapter 2 – Mass and Heat Balances	
2.1 Introduction	25
2.2 Mass (Materials) Balances	26
2.3 Heat (Energy) Balances	31
2.4 Combustion Calculations	35
2.5 Heat Lost in and Volume of Combustion Products	38
2.6 Significance of Combustion Calculations	39
2.7 Thermal Tests on Equipment	40
2.8 The Thermal Efficiency of Catering Equipment	41
2.9 Problems	46
2.10 References	47
Chapter 3 – Fluid Flow	
3.1 Introduction	49
3.2 Newtonian Fluids	49
3.3 Non-Newtonian Fluids	51
3.4 Bernoulli's Equation	52
3.5 Boundary Layers	55
3.6 Flow characterisation	56
3.7 Friction Losses in Pipes and Fitting	58
3.8 External Flows	62
3.9 Flows of Gases in Catering Equipment	64
3.10 Pumps	68
3.11 Fans	69
3.12 Mechanical Separations	70
3.13 Nomenclature	72
3.14 Problems	73
3.15 References	74
3.16 Further Reading	74
Chapter 4 – Conduction	
4.1 Introduction	75
4.2 Steady-State Conduction : Single Wall	75
4.3 Steady-State Conduction : Composite Wall	77
4.4 Insulation of Equipment	80
4.5 Steady-State Conduction : Extended Surfaces	81
4.6 Unsteady-State Conduction : Diffusivity	85
4.7 Unsteady-State Conduction : Schmidt's Method	86
4.8 Unsteady-State Conduction : Published Charts	92
4.9 Griddles / Fry Plates	98
4.10 Heat Pipes	101
4.11 Nomenclature	104
4.12 Problems	104
4.13 References	106

Chapter 5 – Convection		
5.1	Introduction	107
5.2	The Thermal Boundary Layer	108
5.3	Local and Average Convection Coefficients	114
5.4	Dimensional Analysis of Convection	117
5.5	Boiling and Condensing Fluids	120
5.6	Applications of Convection Heating	123
5.7	Nomenclature	155
5.8	Problems	155
5.9	References	157
Chapter 6 – Radiation		
6.1	Introduction	159
6.2	Concepts and Laws of Radiation	161
6.3	Radiation in Catering Equipment	165
6.4	Radiation Interchange Between Surfaces	167
6.5	Radiation from Gases	172
6.6	Grey Gas in an Enclosure	172
6.7	Applications of Radiant Heating	174
6.8	Nomenclature	178
6.9	Problems	179
6.10	References	180
6.11	Further Reading	180
Chapter 7 – Microwaves		
7.1	Introduction	181
7.2	The Power Equation	183
7.3	The Penetration Equation	184
7.4	Design and Construction of Batch Ovens	186
7.5	Use of Microwave Ovens	189
7.6	Safety of Microwave Ovens	190
7.7	Calculation of Heating Effects by Microwaves	191
7.8	Nomenclature	197
7.9	Problems	198
7.10	References	198
7.11	Further Reading	198
Chapter 8 – Freezing and Thawing		
8.1	Introduction	199
8.2	Freezing and Defrosting Curves	199
8.3	Calculation of Freezing and Thawing Times	202
8.4	Refrigeration Cycle	206
8.5	Freezing and Chilling Equipment	209
8.6	Thawing Equipment	211
8.7	Nomenclature	212
8.8	Problems	213
8.9	References	214
8.10	Further Reading	214
Chapter 9 – Multi-Mode Heat-Transfer		
9.1	Introduction	215
9.2	Traditional Cooking Equipment	215
9.3	Newer Cooking Equipment	218
9.4	A General Computer Model	219
9.5	Review of computer-Modelling Literature	230
9.6	Nomenclature	236
9.7	References	237

Chapter 10 – Mass Transfer	
10.1 Introduction	239
10.2 Simple Mass Transfer	240
10.3 Drying	243
10.4 Leaching Processes	249
10.5 Absorbtion Processes	251
10.6 Migration Processes	251
10.7 Nomenclature	251
10.8 Problems	251
10.9 References	252
10.10 Further Reading	252
Chapter 11 – Energy Sources and Control	
11.1 Introduction	253
11.2 Composition and Properties of Gas	253
11.3 Burner Design	257
11.4 Electrical Heating	261
11.5 Temperature Measurement and Control	265
11.6 Pressure Control	271
11.7 Gas Ignition	274
11.8 Flame Failure Devices	277
11.9 Control Systems	279
11.10 Safety	283
11.11 References	284
11.12 Further Reading	284
Chapter 12 – Mechanical Preparation Processes	
12.1 Introduction	285
12.2 Size Reduction	285
12.3 Mixing	291
12.4 Forming Processes	296
12.5 Nomenclature	297
12.6 References	297
12.7 Further Reading	297
Chapter 13 – Food-Holding Equipment	
13.1 Introduction	299
13.2 Chilled and Frozen Storage Equipment	300
13.3 Warm-Holding Equipment	302
13.4 References	304
Chapter 14 – Food-Handling Equipment	
14.1 Introduction	305
14.2 Kitchen Equipment	305
14.3 Containers and Packaging	306
14.4 Serveries	307
14.5 Vending Machines	309
14.6 Tray Distribution Systems	312
14.7 References	313
14.8 Further Reading	313
Chapter 15 – Dishwashers	
15.1 Introduction	315
15.2 Sinks	317
15.3 Batch Dishwashers	317
15.4 Continuous Dishwashers	318
15.5 Consumables	319
15.6 References	320
Appendix A Fluid-Flow Charts and Data	321

Appendix B	Unsteady-State Conduction Charts	327
Appendix C	Convection Correlations	341
Appendix D	Radiation Charts and Data	349
Appendix E	Mass-Transfer Correlations	361
Appendix F	Properties of Water	363
Appendix G	Properties of Solid Foods	365
Appendix H	Properties of Liquid Foods	377
Appendix I	Properties of fuel Gases, air and Combustion Products	387
Appendix J	Properties of Construction Materials	393
Solutions to Problems		397
Index		439