

Refrigeration *and* Airconditioning

P.L. Ballaney



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REFRIGERATION AND AIR CONDITIONING

(In SI Units)

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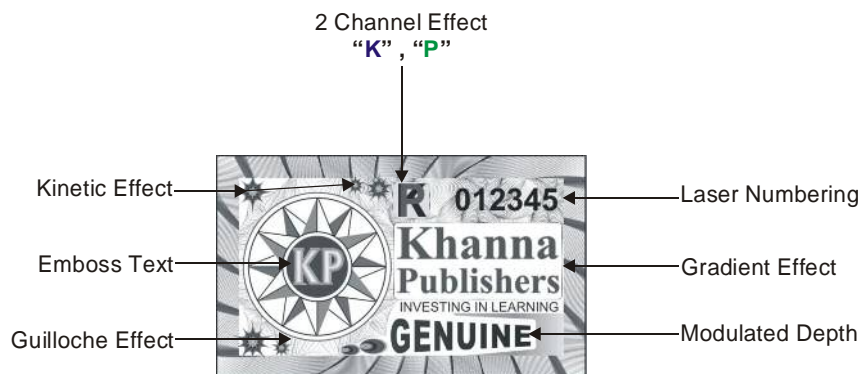
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Thanking you



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DEDICATION

Dedicated to my father, Late Shri Lilaram Ballaney who spent 40 years of his life span in the teaching profession and was known all over Sindhi community as USTAD SAHIB (The Revered Teacher). He always held on to the magnanimous definition of Love.

*“Love is very patient and kind
Never jealous or envious
Never boastful or proud
Never haughty or selfish or rude
Love does not demand its own way
It is not irritable or touchy
It does not hold grudges
And will hardly even notice
When other do it wrong”.*

PREFACE TO THE THIRTEENTH EDITION

Author and the Compiler are indeed very grateful to the reader-student & teacher and also the people in the Refrigeration and Air Conditioning Industry for such a warm welcome to Twelveth Edition of their text book on Refrigeration and Air Conditioning.

The whole of Textbook has been re-cast and updated and extensively revised. A new chapter 18, on Cascade refrigeration and low temperature application including liquifaction of gases has been added. In view of the fact that Evaporative Air Conditioning is staging a come-back, a full chapter on Evaporative air conditioning is introduced.

The very major revision is done on the Chapter 20 (Building Survey and Heat Load Estimate). The chapter is updated and re-written with very profound additions of Tables and Charts and many illustrative solved problems of practical importance. One more chapter has been added on "Application : Food Preservation", with emphasis on Freezing, Freeze-drying and preservation which have assumed importance in the present day demands.

Very comprehensive Tables and Charts for Thermodynamic properties of refrigerants are added as Appendix. The updated charts and tables are given replacing same older ones. In doing so the values given in some problems may marginally differ, though care is taken to give the relevant abstract along side the problem.

Besides, the entire book has been brought to S.I. units which required the re-writing of some topics.

Though kW as the unit of refrigeration is widely used, the use of TR or ton of refrigeration is still very popular and hence, it is adopted in the text book. Author has recommended and used 210 kJ/min or 3.5 kW of refrigeration effect as ton of refrigeration. In the literature some other values like 3.52 kW = 211.2 kJ/min (ASHRAE), 50 kcal/min = 209.34 kJ/min = 3.489 kW in the European continent, and 12000 Btu/hr = 50.4 kcal/min = 211 kJ/min = 3.5167 kW, may be found. Any way 210 kJ/min or 3.5 kW as a round figure should be satisfactory without any major objection.

The contents of the text-book are tailored to suit the requirements of all the accredited Indian Universities for undergraduate course, and AMIE (India) and post-diploma courses in Refrigeration and Air conditioning.

Chapters 1 and 2 are merely re-capitulation of the concepts of Thermodynamics and Heat Transfer, chapter 3 i.e. Reversed Carnot Cycle introduces ideal concepts of reversibility in refrigeration cycles, and chapter 4 i.e. Gas cycle Refrigeration logically follows. Chapters 5, 6, 7, 8 deal with Vapour Compressions Cycles in detail, expected to be taught at undergraduate level. Chapters 9, 10, 11 and 12 describe and analyse the four major components i.e. the Compressors, the Condensers, the Expansion devices, and the Evaporators. Chapter 13 i.e. the Matching of Components for practical application logically follows. Chapters 14 and 15 are very important chapters at first level and are practical oriented. In view of the rapid growth of Vapour Absorption Refrigeration which can use low grade energy, a full chapter 16 is added. This chapter has been extensively enlarged and new concepts introduced like combined vapour compression and absorption systems. It gives complete analysis of the system. Similarly at places where steam is readily available, Steam Jet Refrigeration assumes importance and is described and analysed in chapter 17. Advanced treatment with the help of shock wave tables

is avoided looking to the level of the course. Chapter 19 on Thermal Insulation is practical oriented from cooling and heating of Buildings point of view. Remaining chapters fall in the domain of Air Conditioning. Chapter 20 deals with simple Psychrometry-definitions relationships. Chapters 21 to 24, deal with Air conditioning with particular reference to Building survey and heat loads, which has been very largely enlarged, Human Comfort, Advanced Psychrometry, and Moisture Transfer through structure. The treatment of the subject matter is not highly analytical and keeps in view the level of the course. So are the chapters on duct-design, ventilation. Chapters 27, 28 and 29 are very important from the point of view of learning the complete Air Conditioning systems and Ventilation Systems popularly used. Lastly chapter 30 *i.e.* Fans ; and chapter 31 Food Preservation Applications, are added to complete the scope of the text book. Brief reference is also made on the problems of Global Warming Potential (GWP), Ozone Depletion Potential (ODP) and the use of CFC free refrigerants and substitutions under the chapter on Vapour Compression Refrigeration. In fact many more chapters could be added. But the author feels that for the undergraduate, post-diploma and AMIE (India) the topics discussed and the level of discussion is adequate.

Any suggestion to add any additional information and for improvement of the existing information are welcome and will be cordially received and attended to by the Author and the Compiler to make the book more useful.

19th October, 2001

BALLANEYS

(Happy Birthday—AKANKSHA : Beloved Grand daughter)

PREFACE TO THE FIFTEENTH EDITION

In continuation of support and appreciation received from readers to the earlier editions. This edition is being presented with more refinements and clarity of subject.

While a new chapter on Indoor Air Quality, which is gaining importance was being given in brief for making readers aware in last edition ; this edition contains selected fully solved typical numerical problems and multichoice questions of IAS, IES and GATE selected from the previous years question papers to further help students in understanding the subject and preparing them for competitive exams.

It is hoped that this new edition will still continue to serve its purpose.

26th January '2009

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CONTENTS

<i>Chapter</i>	<i>Page</i>
1. Review of Thermodynamics	1—45
1.1. Introduction to S.I. Units	1
1.2. Scope	3
1.3. State	3
1.4. Properties	3
1.5. Specific Weight, ω_s	4
1.6. Specific Volume	4
1.7. Pressure	4
1.8. Process	7
1.9. Cyclic Process	7
1.10. Quasi-static Process	7
1.11. Standard Scale of Temperature	7
1.12. Energy	8
1.13. Potential Energy	8
1.14. Kinetic Energy	9
1.15. Work	9
1.16. Work done during a Quasi-static or Quasi equilibrium Process	10
1.17. $p dV$ Work, a Path Function	11
1.18. Limitations of the use of $\int p dV$	12
1.19. Flow Work	12
1.20. Heat	13
1.21. Specific Heat	13
1.22. (a) Heat—A Path Function	14
1.22. (b) Comparison of Heat and Work	14
1.22. (c) Perfect Gas	15
1.23. Pure Substance—Thermodynamic State	15
1.24. Phase Transformation at Constant Pressure	15
1.25. Summary of Notations Used	16
1.26. Phase Transformation ; p - v - T Data	17
1.27. First Law of Thermodynamics	20
1.28. Energy—Internal Energy	21
1.29. First Law of Thermodynamics Analysis of Non-flow System	22
1.30. Flow Process and Control Volume	28
1.31. Steady Flow Energy Equation	28
1.32. Flow Processes	29
1.33. Throttle Process	29
1.34. Applications of Steady Flow Energy Equation	30
1.35. Second Law of Thermodynamics	33
1.36. Further Classification of Carnot Cycle	37
1.37. Carnot Theorem or Corollary 2	37
1.38. Heat Engine	38
1.39. Thermal Efficiency of Heat Engine	39
1.40. Thermal Efficiency of Heat Pump or Coefficient of Performancy of Heat Pump	39

<i>Chapter</i>	<i>Page</i>
1.41. Entropy	... 40
1.42. Entropy Changes During Processes	... 40
1.43. Temperature-Entropy Diagram	... 41
2. Introduction to Heat Transfer	46—89
2.1. Conduction Heat Transfer : Fourier's Law of Heat Conduction	... 46
2.2. Thermal Conductivity	... 46
2.3. Conductivity Through a Thick Plane Homogeneous Wall	... 47
2.4. Conductance Through a Thick Plane Homogeneous wall with Conductivity Varying with Temperature	... 48
2.5. Conduction Through a Flat Composite Wall	... 49
2.6. Newton-Rikhman Law	... 52
2.7. Conduction Through Hollow Cylinder (Radial one dimensional heat transfer)	... 55
2.8. Heat Transfer Through Composite Cylinder	... 56
2.9. Heat Transfer by Conduction Through Sphere	... 60
2.10. Heat Exchanger	... 63
2.11. Logarithmic Mean Temperature Difference	... 64
2.12. Heat Convection : Dimensional Analysis	... 69
2.13. Forced Convection	... 69
2.14. Free Convection Heat Transfer	... 72
2.15. Radiation Heat Transfer	... 73
2.16. Absorption, Reflection and Transmission of Radiation	... 73
2.17. Concept of Black Body	... 74
2.18. Monochromatic Total Emissive Power	... 74
2.19. Planck's Law	... 74
2.20. Stefan Boltzman Law	... 75
2.21. Relation Between Emissivity and Absorptivity	... 75
2.22. Concept of Grey body	... 76
2.23. Heat Exchange Between Surfaces Separated by Non-absorbing Media	... 76
2.24. Heat Transfer Co-efficient for Radiation	... 77
3. Reversed Carnot Cycle	90—114
3.1. Carnot Theorem as Applied to Reservoir Carnot Cycle	... 90
3.2. Reversed Carnot Cycle	... 91
3.3. Reversed Carnot Cycle (Vapour as Working Substance)	... 95
3.4. Effect of Temperature	... 100
3.5. Refrigerating Effect and Unit of Refrigerant	... 102
3.6. Heat Pump	... 102
4. Gas Cycle Refrigeration	115—171
4.1. Air Refrigerator	... 115
4.2. Reversed Brayton Cycle	... 125
4.3. Brayton Refrigeration Cycle with Regenerative Heat Exchanger	... 129
4.4. Air Cycle for Air Craft	... 131
4.5. Air Refrigeration Cycle for Air Craft with Ram Compression	... 135
4.6. Additional Comment on Aircraft Refrigeration Cycles	... 143

<i>Chapter</i>		<i>Page</i>
4.7.	Boot-Strap and Boot-Strap Evaporation Type	... 145
4.8.	Reduced Ambient System	... 147
4.9.	Regenerative Cooling System	... 148
4.10.	Comparison of Air Cooling System	... 149
<hr/>		
5.	Simple Vapour Compression Refrigeration System	172—267
<hr/>		
5.1.	Concept Development	... 172
5.2.	Vaporisation of the Fluid	... 172
5.3.	Controlling the Vaporising Temperature	... 172
5.4.	Vaporising at Sub-atmospheric Pressure	... 173
5.5.	Maintaining the Constant Mass in Evaporator	... 173
5.6.	Salvaging the Refrigerant	... 174
5.7.	p-h Charts for Refrigerants	... 175
5.8.	Simple Saturated Cycle	... 176
5.9.	Analysis of Vapour Compression Refrigeration Cycle, Simple Saturated Cycle	... 178
5.10.	Unit of Refrigeration	... 179
5.11.	Reversed Carnot Cycle for Vapour	... 182
5.12.	Effect of Suction Temperature and Condensing Temperature on Cycle Performance	... 184
5.13.	Actual Refrigerating Cycle	... 185
5.14.	The Effect of Sub-cooling the liquid	... 186
5.15.	The Effect of Super-heating the Suction Vapour	... 188
5.16.	Super-heating Without Useful Cooling	... 189
5.17.	Super-heating Which Produces Useful Cooling	... 190
5.18.	The Effect of Pressure Losses etc.	... 207
5.19.	Liquid Suction Heat Exchangers	... 221
5.20.	History of Refrigeration—Global Concerns	... 245
5.21.	The Ozone Depletion Issue	... 246
5.22.	R-134a and R-12 compared	... 248
5.23.	Performance Results of R-134a and R-12 compared	... 260
<hr/>		
6.	Properties of Common Refrigerants	268—284
<hr/>		
6.1.	Introduction	... 268
6.2.	Requirements for Refrigerants	... 268
6.3.	Identifying Refrigerants by Number	... 268
6.4.	Classification of Refrigerants	... 270
6.5.	Group One Refrigerants	... 271
6.6.	Group Two Refrigerants	... 274
6.7.	Group Three Refrigerants	... 275
6.8.	Comparison of Refrigerants	... 275
6.9.	Miscellaneous Properties	... 279
6.10.	Heat Transfer Comparison of the Refrigerants	... 279
6.11.	Refrigerant Selection	... 280
6.12.	Brines	... 281
6.13.	Brine Selection	... 281

<i>Chapter</i>	<i>Page</i>
7. Compound Vapour Compression System	285—317
7.1. Introduction	... 285
7.2. Removing Flash Gas	... 285
7.3. Inter Cooling	... 286
7.4. Compound Compression with Water Inter-cooling	... 289
7.5. Compound Compression with Liquid Flash Cooler	... 294
7.6. Compound Compression with Flash Inter Cooler	... 298
7.7. Effect of Volumetric Efficiency on Multistaging.	... 307
7.8. Optimum Interstage Pressure in Multistage Vapour Compression System	... 314
8. Multiple Evaporator and Compressor System	318—339
8.1. Application	... 318
8.2. One Compressor Systems	... 318
8.3. Individual Compressors	... 325
8.4. Compound Compression	... 330
9. Refrigerants Compressors	340—412
9.1. Introduction	... 340
9.2. Types of Compressors	... 340
9.3. Reciprocating Compressor (Positive Displacement Compressors)	... 341
9.4. Mechanical Details (Reciprocating Air Compressor)	... 343
9.5. Single-Stage Compressor : Equation for Shaft Work	... 345
9.6. Isothermal Efficiency—Adiabatic Efficiency	... 348
9.7. Clearance and Clearance Volume	... 350
9.8. Equation of Work from the Conventional p-V Diagram with Clearance Volume	... 350
9.9. Volumetric Efficiency	... 351
9.10. Factors Affecting Total Volumetric Efficiency	... 353
9.11. Compound Compression with Inter-cooling	... 356
9.12. Compressor Description	... 359
9.13. Performance of Refrigerant Reciprocating Compressors	... 361
9.14. Rotary Compressors	... 373
9.15. Centrifugal Compressor	... 381
9.16. Pressure Co-efficient and Slip Factor	... 389
9.17. Surging	... 391
9.18. Performance of Centrifugal Compressors	... 391
9.19. Capacity Control—Centrifugal Compressors	... 396
9.20. Performance of Reciprocating and Centrifugal Compressors Compared	... 397
9.21. Lubrication	... 405
10. Condenser	413—427
10.1. Introduction	... 413
10.2. Water-cooled Condensers	... 413
10.3. Heat Rejection Rates	... 414
10.4. Condenser Heat Transfer	... 414
10.5. Condensing Co-efficient	... 416

<i>Chapter</i>	<i>Page</i>
10.6. Fouling Factor	... 416
10.7. Water-side Co-Efficient	... 416
10.8. Desuperheating	... 417
10.9. Finned Tubes	... 417
10.10. Economic Condenser Operation	... 421
10.11. Air Cooled Condenser	... 421
10.12. Evaporative Condenser	... 423
11. Expansion Device	428—443
11.1. Introduction	... 428
11.2. Capillary Tube	... 428
11.3. Matching of Compressor and Capillary Tube	... 429
11.4. Thermostatic Expansion Valve	... 431
11.5. Externally Equalised Valves	... 432
11.6. Performance of Thermostatic Expansion Valve	... 437
11.7. Automatic Expansion Valve or Constant Pressure Valve	... 438
11.8. Float Valves	... 439
11.9. High Pressure Valve	... 440
12. Evaporators	444—453
12.1. Introduction	... 444
12.2. Boiling and Pool Boiling in Natural Convection Systems	... 444
12.3. Forced Convection Evaporation in Tubes	... 446
12.4. Types of Evaporators	... 449
12.5. Flooded Evaporator	... 449
12.6. Liquid Chiller	... 450
12.7. Direct Expansion Coil Evaporator	... 450
12.8. Overall Performance	... 451
13. Matching Components in Vapour Compression System	454—461
13.1. Introduction	... 454
13.2. Compressor Data	... 454
13.3. Condenser Data	... 455
13.4. Expansion Device Data	... 456
13.5. Evaporator Data	... 456
13.6. Condensing Unit	... 457
13.7. Condensing Unit—Evaporator Matching	... 458
14. Installation Vapour Compression Refrigeration System	462—472
14.1. Tools	... 462
14.2. Installation Operation	... 462
14.3. Evacuation and Dehydration	... 462
14.4. Removing the Air or Evacuation	... 463
14.5. Dehydration	... 464
14.6. Testing for Leaks using Refrigerant Charge	... 465
14.7. Charging the System	... 466

<i>Chapter</i>	<i>Page</i>
14.8. Charging Through the Suction Valve	... 467
14.9. Charging Through Discharge Valve	... 468
14.10. Charging Through the Charging Valve	... 469
14.11. Adding Oil	... 470
15. Multiple Unit Installation	473—482
15.1. Introduction	... 473
15.2. Control Valves for Multiple Units	... 473
15.3. Important Points for Multiple Installation	... 476
15.4. Solenoid Valves in Multiple Installation	... 477
15.5. Installation	... 478
15.6. Multiple Condensing Units	... 480
16. Absorption Refrigeration	483—546
16.1. Introduction	... 483
16.2. Absorption Refrigeration System	... 484
16.3. Simple Absorption System	... 484
16.4. Practical Vapour Absorption System	... 485
16.5. Simple Electrolux System. Domestic Unit	... 486
16.6. Electrolux Refrigerator Improved Version	... 487
16.7. Theoretical Absorption Refrigeration System	... 489
16.8. Basic Correlation of Aqua-Ammonia Mixture	... 491
16.9. Advantages of Absorption Refrigeration Over Compression Refrigeration	... 493
16.10. Elementary Properties of Binary Mixtures	... 500
16.11. Temperature Concentration Diagram (t-c)	... 501
16.12. Enthalpy Concentration Diagram (h-c)	... 502
16.13. Elementary Steady Flow Process with Binary Mixtures	... 503
16.14. Rectification of Binary Mixtures	... 511
16.15. Simple Analysis of Aqua-Ammonia Vapour Absorption Refrigeration Cycle with h-c Chart (Assuming Degasification Factor for Generator-rectifier-dephlegmator)	... 515
16.16. Analysis of Vapour Absorption Refrigeration System (Alternate : By plotting Principal Operating line based on Basnjakovic's assumption)	... 528
16.17. Lithium Bromide-Water Absorption System	... 533
16.18. Analysis of Simple Absorption System (LiBr-water)	... 533
16.19. LiBr-Water Absorption Refrigeration Cycle with Heat Exchanger	... 536
16.20. Large Tonnage Lithium Bromide Water Equipment	... 540
16.21. Double Effect Vapour Absorption Refrigeration System	... 542
16.22. Combined Vapour Absorption and Vapour Compression System	... 543
17. Steam Jet Refrigeration	547—571
17.1. Introduction	... 547
17.2. System Components	... 547
17.3. Analysis of Steam-jet Refrigeration System	... 551
17.4. Approximate Analysis	... 554

<i>Chapter</i>	<i>Page</i>
17.5. Performance of Steam-jet Refrigeration System	... 557
17.6. Equilibrium Concentration	... 564
18. Introduction to Cascade Refrigeration Systems and Low Temperature Refrigeration	572—608
18.1. Low Temperature	... 572
18.2. Limitation of Vapour Compression System for Low Temperature Production	... 572
18.3. Cascade Staging	... 573
18.4. Solid Carbon Dioxide or Dry Ice	... 583
18.5. Principles of Production	... 584
18.6. Three State System with Water and Flash Inter-cooling	... 585
18.7. Production of Low Temperature	... 588
18.8. Cryogenic System	... 589
18.9. Joule-Thomson Co-efficient	... 589
18.10. Joule-Thomson-Co-efficient and Inversion Curve	... 589
18.11. The Joule-Thomson Co-efficient in terms of p, v, T and Cp data	... 591
18.12. The Liquefaction of Gases	... 592
18.13. Hampson-Linde system for Gas Liquefaction	... 592
18.14. Claude System of Gas Liquefaction	... 595
18.15. Liquefaction of Hydrogen	... 601
18.16. Liquefaction of Helium	... 602
18.17. Additional Comments Linde Cycle or Joule-Thomson Cycle	... 603
19. Thermal Insulation	609—617
19.1. Definition	... 609
19.2. Mechanism of Insulation—Mass Insulation	... 609
19.3. Types of Insulation Materials	... 610
19.4. Properties of Insulating Materials	... 611
19.5. Effect of Various Parameters on Thermal Properties	... 611
19.6. Insulating Materials	... 613
19.7. A Few Insulated Systems	... 613
19.8. Economic Insulation Thickness	... 616
20. Psychrometry	618—682
20.1. Principles of Psychrometry	... 618
20.2. Enthalpy of Moist Air	... 624
20.3. Psychrometric Chart	... 629
20.4. Conservation of Mass and Conservation of Energy applied to Psychrometric Processes	... 633
20.5. Mixing of Air Streams	... 634
20.6. Sensible Heating Process, Sensible Cooling Process	... 637
20.7. By-pass Factor	... 639
20.8. Humidification Process-Dehumidification Process	... 640
20.9. Sensible Heat Factor	... 642
20.10. Cooling and Dehumidification	... 642
20.11. Room or Conditioned Space Sensible Heat Factor	... 644

<i>Chapter</i>	<i>Page</i>
20.12. Grand Sensible Heat Factor	... 646
20.13. Effective Surface Temperature	... 649
20.14. Cooling and Humidification	... 652
20.15. Humidifying Efficiency	... 652
20.16. Heating and Humidification	... 654
20.17. Heating and Dehumidification (Adiabatic Dehumidification)	... 655
20.18. Summer Air Conditioning	... 657
20.19. Room Sensible Heat Factor (Geometrical Construction)	... 665
20.20. Winter Air Conditioning	... 667
<hr/>	
21. Building Survey and Heat Load Estimate	683—767
<hr/>	
21.1. Introduction	... 683
21.2. Building Survey	.. 683
21.3. Location of Equipment and Services	.. 684
21.4. Air Conditioning Load Estimate	... 685
21.5. Extra-terrestrial Solar Energy Intensity and Distribution	... 686
21.6. Direct, Diffuse and Ground Radiation	... 687
21.7. Standard Solar Radiation Tables	... 688
21.8. Alternative Method	... 690
21.9. Haze Factor	... 692
21.10. Definitions of Solar and Surface Angles	... 692
21.11. Derivations of Solar and Surface Angles	... 693
21.12. Solar Time	... 697
21.13. Calculation of the Intensity of Direct Radiation on a Surface	... 699
21.14. Solar Heat Gain Through Glass	... 704
21.14. (a) Steady State Heat Transfer Through Glass	... 705
21.15. Glass Area in Sun	... 706
21.15. (a) Table For Solar Heat Gain Through Ordinary Glass	... 721
21.16. Heat Flow Through Structures	... 722
21.17. Sol-air Temperature	... 735
21.18. Concept Development Heat Flow Through Structure-Equivalent Temperature Difference Method	... 740
21.18. (a) Heat Gain Through Interior Surfaces	... 747
21.19. Heat Sources in Conditioned Spaces—Heat Load Due to Human Occupancy	... 748
21.20. Air Conditioning Load Due to Solar Gain Through Glass	... 755
21.21. Heat Storage, Diversity and Stratification	... 755
21.20. Ventilation and Infiltration	... 758
21.21. Types of Air Exchanges	... 758
<hr/>	
22. Applied Psychrometry (Advanced)	768—796
<hr/>	
22.1. Concept Development	... 768
22.2. Effective Sensible Heat Factor (Alternate)	... 771
22.3. Cooling And Dehumidification	... 772
22.4. Cooling and Dehumidification—High Latent Load Application	... 774
22.5. Cooling with Humidification	... 777
22.6. Sensible Cooling	... 781

<i>Chapter</i>	<i>Page</i>
22.7. Spray Characteristics	... 782
22.8. Evaporative Cooling used with Split System	... 785
22.9. Heating and Humidification—With Spray	... 786
22.9. Critical Loading Conditions	... 791
22.11. Partial Load	... 793
23. Human Comfort	797—804
23.1. Factors Influencing Human Comfort	... 797
23.2. Concept of Effective Temperature	... 797
23.3. Factors Governing Optimum Effective Temperature	... 802
24. Evaporative Air Conditioning	805—821
24.1. Introduction	... 805
24.2. Application Potential of Evaporative Cooling	... 805
24.3. General Application of Direct Evaporative Cooling	... 806
24.4. Indirect Evaporative Cooling	... 807
24.5. Indirect Evaporative Cooling System	... 808
24.6. Indirect/Direct Combination of Evaporative Cooling	... 812
24.7. Regenerative Evaporative Cooling System	... 813
24.8. Industrial Applications	... 815
24.9. Theory and Performance of Indirect Evaporative Cooling	... 817
24.10. Thermodynamics of Plate Type Indirect Evaporative Cooling Unit	... 817
25. Moisture Transfer	822—838
25.1. Fick's Law	... 822
25.2. Moisture Transfer Through Solid Wall	... 822
25.3. Convective Mass Transfer	... 823
25.4. Direct Contact Processes	... 824
25.5. Direct Contact : Air Washer with Pumped Recirculation	... 827
26. Pressure Losses and Duct Sizing	839—859
26.1. Continuity Equation	... 839
26.2. Bernoulli's Equations	... 839
26.3. Pressure Losses	... 840
26.4. Variation of Pressure Losses Along a Duct	... 843
26.5. System Resistance	... 844
26.6. Duct Sizing	... 845
27. Ventilation Systems	860—865
27.1. Natural Ventilation System	... 860
27.2. Mechanical	... 860
27.3. Extraction System	... 861
27.4. Supply or Pressure System	... 862
27.5. Combined Supply and Extraction System	... 862
27.6. Air Distribution Extraction System	... 862
27.7. Air Supply System	... 863

<i>Chapter</i>	<i>Page</i>
28. Air Conditioning Systems and Applications	866—875
28.1. Scope	... 866
28.2. Factors for Consideration	... 866
28.3. Space and Building	... 867
28.4. System Components	... 867
28.5. Types of Systems	... 868
28.6. Systems and Application	... 870
29. All-Air Systems	876—890
29.1. Conventional Systems	... 876
29.2. Constant Volume Induction System	... 880
29.3. Multi-zone Unit System	... 882
29.4. Dual Duct System	... 883
29.5. Variable Volume, Constant Temperature System	... 886
29.6. Dual Conduit System	... 887
30. Fans	891—898
30.1. Definitions	... 891
30.2. Similarity Laws	... 891
30.3. Theoretical Expression (Recapitulation)	... 892
30.4. Fan and System	... 894
31. Applications : Introduction to Food Preservation	899—917
31.1. Theories and Methods of Chilling, Freezing and Freeze Dehydration	... 899
31.2. Modified Plank's Equation for Calculating Freezing Time	... 905
31.3. Types of Freezers	... 907
31.4. Freeze Drying	... 909
31.5. Typical Examples of Food Processing by Refrigeration	... 910
31.6. Candy Manufacture	... 910
31.7. Beverage Processes	... 911
31.8. Bakery Products	... 913
31.9. Meat Products	... 914
31.10. Poultry Products	... 915
31.11. Fishery Products	... 915
31.12. Fruits and Vegetables	... 917
32. Indoor Air Quality (IAQ)	918—921
Appendix I—Solved Numerical Problems of IES, IAS and GATE Exams.	922—974
Appendix II—Solved Multichoice Objective Questions of IAS and IES Exams.	975—1002
Appendix III—Refrigerant Tables and Charts	1005—1042
Appendix IV—Injection of Fuel in Spark Ignition Engines (Petrol Engine)	1043—1050
Fall of Carburetor	1043—1050
Interconversion Tables	1051—1054
Selected References	1055
Index	1056—1059