Bharathidasan University

(Accredited by NAAC at 'A' level)
Tiruchirappalli – 620 024

Curriculum for Diploma in Refrigeration and Air conditioning

2006-2007

S.No.	Semester	CODE	SUBJECT	Exam.Hrs	TM
1	I SEM		Engineering Thermodynamics and Heat Transfer	3	100
2			Design of Refrigeration and Air conditioning systems	3	100
3			Refrigeration and Air conditioning Lab	3	100
4	II SEM		Food processing, Preservation and Transport	3	100
5			Design of condensers, Evaporators and Cooling towers	3	100
6			Erection and Maintenance of Refrigeration & Air conditioning systems	3	100
				TOTAL	600

ENGINEERING THERMODYNAMICS AND HEAT TRANSFER

1. BASIC CONCEPT AND LAW OF THERMODYNAMICS

Basic concepts - concept of continuum, macroscopic approach, thermodynamic systems. Property, state, path and process. Zeroth law of thermodynamics. Concept of ideal and real gases. First law of thermodynamics — internal energy, specific heat capacities, enthalpy. Second law of thermodynamics — Kelvin's and Clausius statements of second law. Reversibility and irreversibility. Carnot cycle, reversed carnot cycle, efficiency, COP.

2. PROPERTIES OF PURE SUBSTANCE AND THERMO DYNAMIC RELATIONS

Properties of pure substances — Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule.Gas mixtures — Properties of ideal and real gases, equation of state, Avagadro's law. Dalton's law of partial pressure, Joule Thomson Coefficient.

3. CONDUCTION, CONVECTION AND RADIATION

Basic Concepts — Mechanism of Heat Transfer — Conduction, Convection and Radiation — General Differential equation of Heat Conduction — Fourier Law of Conduction - Free Convection. Basic Concept - Laws of Radiation — Stefan Boltzman Law, Kirchoff Law - Black Body Radiation —Grey body radiation Shape Factor Algebra.

4. PSYCHROMETRY AND HEAT EXCHANGERS

Psychrometry and psychrometric charts, property calculations of air vapour mixtures. Psychrornetric process — Sensible heat exchange processes. Latent heat exchange processes. Types of Heat Exchangers — LMTD Method of heat Exchanger Analysis — Effectiveness —Fouling Factors.

5. MASS TRANSFER

Basic Concepts — Diffusion Mass Transfer — Fick's Law of Diffusion — Steady state Molecular Difftision.

TEXT BOOKS

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 1998.
2. Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer" New Age International, 1995.

REFERENCES

1. Holman.J.P., "Thermodynamics", 3d Ed. McGraw-Hill, 1995.
2. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
3. Kothandaraman C.P "Fundamentals of Heat and Mass Transfer" New Age International, New Delhi, 1998

DESIGN OF REFRIGERATION AND AIRCONDITIONING SYSTEMS

1. REFRIGERATION CYCLES

Evolving Vapor Compression Cycle from Basic Carnot Cycle — Analysis Multipressure Systems, Cascade Systems. Air Refrigeration Cycles.

2. SYSTEMS COMPONENTS AND ACCESSORIES

Types of Evaporators, Compressors, Condensors, Expansion Devices, Functional Aspects of the above components Driers / Filters, Receiver, Accumulator. Functional Aspects of the above accessories.

3. REFRIGERANTS AND ELECTRICAL COMPONENTS & CONTROLS

Classification of Refrigerants, Refrigerant Properties, Oil Compatibility, Blends, Eco Friendly Refrigerants.Starting and Running Circuits, Relay Types and Controls.

4. PSYCHROMETRY AND SYSTEM DESIGN

Moist Air Properties, use of Psychrometric Chart, Various Psychrometric Processes, Air Washer, Adiabatic Saturation.Air conditioning Processes — RSHF, Summer Air conditioning, Winter Air conditioning, Bypass Factor. Applications with specified ventilation air quantity — use of ERSHF.

5. AIR DISTRIBUTION, FANS AND CHILLED WATER CIRCUITS

Flow through Ducts, Static & Dynamic Losses, Air Outlets, Duct Design — Equal Friction Methods.Indoor Air Quality, Thermal Insulation, Fans & Duct System Characteristics, Fan Arrangement.Water Piping in Chilled Water Systems, Condensers and Cooling Towers.

TEXT BOOKS

1. Arora and Domkundwar., A Course in Refrigeration and Air conditioning, Dhanpat rai & co, 2002
2. C P Arora., Refrigeration and Air conditioning. Tata McGraw-Hill Pub. Company, New Delhi, 2004.

REFERENCE

1. Carrier Air conditioning Co., Handbook of Air conditioning systems design, McGraw-Hill, 1985.

REFRIGERATION AND AIR CONDITIONING LAB

1. Determination of COP of a Vapour compression refrigeration system
2. Determination of COP of a Vapour absorption refrigeration system
3. Experiments on air-conditioning system
4. Performance test on single/two stage reciprocating air compressor
5. Maintenance and Troubleshooting of Domestic Refrigerator
6. Maintenance and Troubleshooting of Split Air-Conditioning system
7. Maintenance and Troubleshooting of Window Air-Conditioning system
8. Maintenance and Troubleshooting of Automotive Air-Conditioning system
9. Maintenance and Troubleshooting of Water Cooling system
10. Electrical sequence of refrigerating system
11. Electrical sequence of Air-Conditioning system

FOOD PROCESSING, PRESERVATION AND TRANSPORT

1. INTRODUCTION

Microbiology of Food Products, Mechanism of Food Spoilage, Refrigeration Technologies of Food Products. Thermodynamic Properties, Cooling Process and Heat Transfer Parameters of Food Products.

2. PROCESSING AND PRESERVATION

Food Processing Techniques, Standard Norms for Processing, Plant Layout, Preservation of Milk, Butter, Fruits, Vegetables, Meat Products. Environment Friendly Food Processing Techniques.

3. FREEZING AND DRYING

Precooling, Quick Freezing, Freeze Drying Principles, Techniques and Equipments, Cold Storage and Freezers. Freezing and Drying Limitations.

4. COLD STORAGE DESIGN AND INSTRUMENTATION

Design, Selection, Matching, Installation and Maintenance of Cold Storages & Freezers. Insulation, Instrumentation and Control.

5. TRANSPORT

Refrigerated Transportation, Refrigerated Containers and Trucks.

TEXT BOOK

1. Arora and Domkundwar., A Course in Refrigeration and Air conditioning, Dhanpat rai & co, 2002

REFERENCES

1. Alan Rodes, Principles of Industrial Microbiology, Pregmon International Pub., 1989.
2. Arora C.P., Refrigeration and Air conditioning II Ed. McGraw-Hill, Pub., 2000.

DESIGN OF CONDENSERS, EVAPORATORS & COOLING TOWERS

1. INTRODUCTION : Principles of heat transfer, Types of heat exchangers, Standard Representation, Parts description, TEMA Classifications, Applications

2. DESIGN OF CONDENSERS : Estimation of heat transfer coefficient, Fouling factor, Friction factor. Design procedures, Designing different types of condensers, BIS Standards.

3. DESIGN OF EVAPORATORS : Different types of evaporators, Design procedure and Selection procedure.

4. DESIGN OF COOLING TOWERS : Types of Cooling towers, Analytical design procedures, Tower Characteristics.

5. COMPUTER AIDED DESIGN OF THERMAL SYSTEMS : Principles of CAD, Drafting and Flowcharting.

TEXT BOOK

1. Arora and Domkundwar., A Course in Refrigeration and Air conditioning, Dhanpat rai & co, 2002
2. Ozisik, M.N., Design of Heat exchangers, condensers and evaporators, John Wiley, New York, 1985.

REFERENCES

1. Kern K.H., Process heat transfer, McGraw-Hill, 1984.
2. Nicholas Cheremisioff, Cooling tower, Ann Arbor Science pub. 1981.

ERECTION AND MAINTENANCE OF REFRIGERATION AND AIR-CONDITIONING EQUIPMENTS

1. INTRODUCTION : Refrigeration and air-conditioning plant layout, parameters affecting the location.

2. ERECTION OF R&AC SYSTEMS : Erection methodology, foundation, padding, network analysis, critical path, interconnections; safety precautions, air handling equipments. Maintenance procedures.

3. TESTING OF EQUIPMENTS : Testing of compressors, condensers, evaporators, cooling towers, motors, controls, test rings, ISI standards. Testing of control systems, circuitry and trouble shooting, condition monitoring.

4. TOTAL PREVENTIVE MAINTENANCE : TPM Principles, Corrective and preventive measures and Reliability analysis.

5 MAINTENANCE SCHEDULES : Studies on different maintenance schedules followed by various industries

TEXT BOOK

1. Arora C.P., Refrigeration and Air conditioning II Ed. McGraw-Hill, Pub., 2000.
2. ASHRAE Hand book on Refrigeration & Air conditioning, Published by ISHRAE, Bangalore, 1998.

REFERENCES

1. Althouse A.D. and Turnquist C.H., Modern refrigeration and air-conditioning, Good Heart-Wilcoz Co Inc., 1980.
2. Nelson C.W., Commercial and Industrial refrigeration, McGraw-Hill, 1982.