JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech in HEATING VENTILATION AND AIR CONDITIONING
Effective from Academic Year 2017- 18 admitted batch

COURSE STRUCTURE AND SYLLABUS

I Semester

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC-1	Advanced Thermodynamics	25	75	4	0	0	4
PC-2	Refrigeration	25	75	4	0	0	4
PC-3	Air-Conditioning	25	75	4	0	0	4
PE-1	1. Renewable Energy Sources 2. Cryogenic Engineering 3. Computational Fluid Dynamics	25	75	**3**	0	0	3
PE-2	1. Equipment Design for Thermal Systems 2. Alternative Refrigerants 3. Cold Storage Technology& Systems	25	75	**3**	0	0	3
OE-1	***Open Elective - I**	25	75	3	0	0	3
Laboratory I	Refrigeration & Air Conditioning Lab	25	75	0	0	3	2
Seminar I	Seminar	100	0	0	0	3	2
Total		**275**	**525**	**21**	**0**	**6**	**25**

II Semester

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC-4	Advanced Heat Transfer	25	75	4	0	1	4
PC-5	Ventilation Systems	25	75	4	0	1	4
PC-6	Heating Systems	25	75	4	0	1	4
PE-3	1. Refrigeration Air Condition Equipment & Control Systems 2. Ducting & A/C Supply systems 3. Energy Storage Systems	25	75	**3**	0	0	3
PE4	1. Energy Conversion Management 2. Automotive Air Conditioning 3. Maintenance of Refrigeration & A/C Equipment	25	75	**3**	0	0	3
OE-2	***Open Elective - II**	25	75	3	0	0	3
Laboratory II	Refrigeration & Air-conditioning Simulation Lab	25	75	0	0	3	2
Seminar II	Seminar-II	100	0	0	0	3	2
Total		**275**	**525**	**21**	**0**	**6**	**25**

III Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Technical Paper Writing	100	0	0	3	0	2
Comprehensive Viva-Voce	0	100	0	0	0	4
Project work Review I	100	0	0	0	22	8
Total	**200**	**100**	0	**3**	22	**14**

IV Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Project work Review II	100	0	0	0	24	8
Project Evaluation (Viva-Voce)	0	200	0	0	0	16
Total	**100**	**200**	**0**	**0**	**24**	**24**

***Open Elective subjects must be chosen from the list of open electives offered by various departments.**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year -I Sem. M. Tech (HV & AC)

ADVANCED THERMODYNAMICS (Professional Core-I)

UNIT -I:

Review of Thermodynamic Laws and Corollaries: Transient flow analysis, Second law thermodynamics, Entropy, Availability and unavailability, Thermodynamic potential. Maxwell relations, Specific heat relations, Mayer's relation. Entropy generation, Irreversibility-Gay Stodal equation.

UNIT-II:

Ideal and Real gases: Equation of state, Real gas behavior, Vander Waal's equation, Generalization compressibility factor. Energy properties of real gases. Vapour pressure, Clausius, Clapeyro equation. Throttling, Joule. Thompson coefficient. Non reactive mixtures of perfect gases. Governing laws, Evaluation of properties, Psychometric mixture properties and psychometric chart, Air conditioning processes, cooling towers. Real gas mixtures.

UNIT- III:

Combustion: Combustion Reactions, Enthalpy of formation. Entropy of formation, Reference levels of tables. Energy of formation, Heat of reaction, Adiabatic flame temperature, Enthalpies, Equilibrium. Chemical equilibrium of ideal gas, The Vant Hoff's equation. The chemical potential and phase equilibrium. The Gibbs phase rule.

UNIT- IV:

Power Cycles: Review binary vapour cycle, co-generation and combined cycles, Second law analysts of cycles. Refrigeration cycles. Thermodynamics of irreversible processes. Introduction, Phenomenological laws, Onsaga Reciprocity relation, Applicability of the Phenomenological relations, Heat flux and entropy production, Thermodynamic phenomena, Thermo electric circuits.

UNIT-V:

Direct Energy Conversion Introduction: Fuel cells, Thermo electric energy, Thermo ionic power generation, Thermodynamic devices magneto hydronamic generations, Photovoltaic cells.

REFERENCES:

1. Thermodynamics/Holman/ McGraw Hill.
2. Basic and Applied Thermodynamics/ P.K. Nag/ TMH
3. Thermodynamics/Sonnatag & Van Wylen / John Wiley & Sons
4. Thermodynamics for Engineers/Doolittle-Messe/ John Wiley & Sons
5. Engg. Thermodynamics/PL. Dhar / Elsevier
6. Irreversible Thermodynamics/HR De Groff.
7. Applied Thermodynamics – R. K. Rajput – Laxmi Publications
8. Engineering Thermodynamics/Chatopadyaya

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year -I Sem. M.Tech (HV&AC)

REFRIGERATION (Professional Core-II)

UNIT- I:

Vapour Compression System: Analysis of vapour compression refrigeration cycle Reverse Carnot Cycle for vapour. Effect of suction temperature and condensing temperature on cycle performance. Practical refrigeration cycle, Sub cooled liquid and super heated vapour refrigeration cycles, their effect on performance. Multi-pressure system. Removal of flash gas, inter cooling. Compound compression-Multi vapour- Cascade system- dry ice system

UNIT -II:

Vapour Absorption System: Simple vapour Absorption system-Actual vapour absorption cycle-representation on enthalpy concentration h-c diagram, Water lithium bromide absorption system. Electrolux refrigerator- Aqua Ammonia Refrigeration System – Enthalpy Concentration Diagram

UNIT-III:

Aircraft Refrigeration: Thermodynamic Cycle – Different systems – Analysis – Comparison

Un Conventional Refrigeration: Thermoelectric refrigeration system, Vortex refrigeration system, Pulse refrigeration.

UNIT-IV:

Steam jet water vapour system: Analysis and Excercises

Industrial Refrigeration: Chemical and process industries, Diary plants, Petroleum Refineries

UNIT-V:

Refrigerants: Primary and secondary refrigerants. Designation of refrigerants, Desirable properties of refrigerants such as solubility in water and lubricating oil. Material compatibility, Toxicity, Flammability, Thermodynamic properties of refrigerants, Inorganic, Halocarbon refrigerants. Secondary refrigerants. Refrigerants mixtures, Need for Alternate refrigerants – Retrofitting aspects

REFERENCES:

1. Principles of Refrigeration / Roy. J. Dossat
2. Refrigeration and Air Conditioning / F. Stoecker & Jerold. W. Jones./ MGH Intrl 1982
3. Refrigeration and Air Conditioning / C.P Arora./ TMG).
4. Refrigeration and Air Conditioning /Manohar Prasad.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year -II Sem. M.Tech (HV&AC)

AIR CONDITIONING (Professional Core-III)

UNIT - I:

Psychrometry: Properties of moist air. Important Psychrometry properties, Dry bulb temperature, Humidity ratio, degree of saturation, Dew point temperature and Enthalpy, Psychometric chart and ASHRAE chart.

UNIT - II:

Applied Psychrometry: Psychrometric processes in air conditioning equipment, Mixing, Bypass factor, Heating and dehumidifying coils, Air washers. Cooling by dry and wet coils, Use of hygroscopic solution in air washers, Adiabatic dehumidifiers. Humidifiers, Water injection. Steam injection.

UNIT- III:

Comfort Air Conditioning and Cooling Load Calculations: Sensible and Latent Heat Loads - sensible heat factor. Use of Effective and grand sensible heat factor, Relationship between ESHF, ADP and BF. Representation of All Fresh Air, Recirculated air, Bypassed Air and High Latent Heat Load systems on Psychrometric Chart

UNIT- IV:

Air Conditioning Systems: Summer, winter and year round air Conditioning system, Hot and dry outdoor conditions. Hot and humid outdoor conditions. Winter air conditioning system. Year round air conditioning system.

UNIT - V:

Selection of outside and inside design conditions: Thermodynamics of human body. Body regulation process against heat and cold. Comfort & Comfort chart, Effective temperature, Factors governing optimum effective temperature, Design considerations.

Air conditioning control systems: Basic elements of the control system, Temperature, Humidity & Pressure controls, Refrigeration, Room thermostat.

REFERENCES:

1. Refrigeration & Air Conditioning / C.P. Arora / TMH
2. Refrigeration & Air Conditioning / Arora & Domkundwar / Dhanpat Rai & Co.
3. Refrigeration & Air Conditioning / R C Arora / PHI / 2012
4. Hand Book of Air Conditioning System Design / Carrier
5. Refrigeration & Air Conditioning / S.C. Jain / Chand and Co.
6. ASHRAE Hand Book / Volume 1& 2.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year -I Sem. M. Tech (HV & AC)

RENEWABLE ENERGY SOURCES (Professional Elective-I)

UNIT - I

Introduction to renewable energy resources, Energy Scenario, Survey of energy resources. Classification and need for conventional energy resources.

Solar Energy: The Sun-sun-Earth relationship, Basic matter to waste heat energy circuit, Solar Radiation, Attention, Radiation measuring instruments.

Solar Energy Applications: Solar water heating. Space heating, Active and passive heating. Energy storage. Selective surface. Solar stills and ponds, solar refrigeration, Photovoltaic generation.

UNIT - II

Geothermal Energy: Structure of earth, Geothermal Regions, Hot springs. Hot Rocks, Hot Aquifers. Analytical methods to estimate thermal potential. Harnessing techniques, Electricity generating systems.

UNIT - III

Direct Energy Conversion: Nuclear Fusion: Fusion, Fusion reaction, P-P cycle, Carbon cycle, Deuterium cycle, Condition for controlled fusion, Fuel cells and photovoltaic. Thermionic & thermoelectric generation, MHD generator.

Hydrogen Gas as Fuel: Production methods, Fuel condition, Properties, I.C. Engines applications, Utilization strategy, Performances.

UNIT- IV

Bio-energy: Biomass energy sources. Plant productivity, Biomass wastes, aerovic and Anaerobic bioconversion processed, Raw metrical and properties of bio-gas, Bio-gas plant technology and status, the energetics and economics of biomass systems, Biomass gasification

UNIT-V

Wind Energy: Wind, Beaufort number, Characteristics, Wind energy conversion systems, Types, Betz model. Interference factor. Power coefficient, Torque coefficient and Thrust coefficient, Lift machines and Drag machines. Matching, Electricity generation.

Energy from Oceans: Tidal energy. Tides. Diurnal and semi-diurnal nature, Power from tides, Wave Energy, Waves, Theoretical energy available. Calculation of period and phase velocity of waves, Wave power systems, Submerged devices. Ocean thermal Energy, Principles, Heat exchangers, Pumping requirements, Practical considerations.

REFERENCES:

1. Non-conventional Energy Resources – Khan – McGraw Hill
2. Energy Resources Utilization and Technologies – Y Anjaneyulu and Francis Tuluri, BS Publications
3. Solar Energy – Sukhatme & Nayak – McGraw Hill
4. Renewable Energy Resources/ John Twidell & Tony Weir/Taylor & Francis/2nd edition
5. Alternative Energy Sources & Systems – Steeby – Cengage Learning
6. Energy Resources Utilization & Technologies – Y. Anjaneyulu & T. Francis – BS Publications
7. Renewable Energy Resources- Basic Principles and Applications/ G.N. Tiwari and M.K. Ghosal/ Narosa Publications
8. Renewable Energy Sourse – Tasneem & S.A. Abbasi - PHI
9. .Non-conventional Energy Resourses-Sawhney-PHI

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year -I Sem. M. Tech (HV & AC)

CRYOGENIC ENGINEERING (Professional Elective-I)

UNIT - I:

Introduction to Cryogenic Systems: Mechanical Properties at low temperatures. Properties of Cryogenic Fluids.

Gas Liquefaction: Minimum work for liquefaction. Methods to protect low temperature. Liquefaction systems for gages other than Neon. Hydrogen and Helium.

UNIT - II:

Liquefaction Systems for Neon, Hydrogen and Helium: Components of Liquefaction systems. Heat exchangers. Compressors and expanders. Expansion valve, Losses in real machines.

UNIT- III:

Gas Separation and Purification Systems: Properties of mixtures, Principles of mixtures, Principles of gas separation, Air separation systems.

UNIT-IV:

Cryogenic Refrigeration Systems: Working Medium, Solids, Liquids, Gases, Cryogenic fluid storage & transfer, Cryogenic storage systems, Insulation, Fluid transfer mechanisms, Cryostat, Cryo Coolers

UNIT-V:

Applications: Space technology, In-Flight air separation and collection of LOX, Gas industry, Biology, Medicine, Electronics.

REFERENCES:

1. Cryogenic Systems/ R.F. Barren/ Oxford University Press
2. Cryogenic Engineering- Thomas Flynn- CRC Press-2nd Edition
3. Cryogenic Research and Applications: Marshal Sitting/ Von Nostrand/ Inc. New Jersey
4. Cryogenic Heat Transfer/ R.F.Baron
5. Cryogenic Engineering Edit / B.A. Hands/ Academic Press, 1986
6. Cryogenic Engineering/ R.B. Scottm Vin Nostrand/ Inc. New Jersey, 1959
7. Experimental Techniques in Low Temperature Physics- O.K. White, Oxford Press, 1968
8. Cryogenic Process Engineering/ K. D. Timmerhaus *&* TM Flynn/ Plenum Press, 1998
9. Hand Book of Cryogenic Engineering – J.G. Weisend –II, Taylor and Francis, 1998

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year -I Sem. M. Tech (HV & AC)

COMPUTATIONAL FLUID DYNAMICS (Professional Elective-I)

UNIT - I:

Introduction to Numerical Methods - Finite Difference, Finite Element and Finite Volume Methods – Classification of Partial Differential Equations – Solution of Linear Algebraic Equations – Direct and Iterative Approaches

Finite difference methods: Taylor's series – FDE formulation for 1D and 2D steady state heat transfer problems – Cartesian, cylindrical and spherical co-ordinate systems – boundary conditions – Un steady state heat conduction – Errors associated with FDE - Explicit Method – Stability criteria – Implicit Method – Crank Nickolson method – 2-D FDE formulation – ADI – ADE

UNIT - II:

Finite Volume Method: Formation of Basic rules for control volume approach using 1D steady heat conduction equation – Interface Thermal Conductivity - Extension of General Nodal Equation to 2D and 3D Steady heat conduction and Unsteady heat conduction

UNIT - III:

FVM to Convection and Diffusion: Concept of Elliptic, Parabolic and Hyperbolic Equations applied to fluid flow – Governing Equations of Flow and Heat transfer – Steady 1D Convection Diffusion – Discretization Schemes and their assessment – Treatment of Boundary Conditions

UNIT - IV:

Calculation of Flow Field: Vorticity& Stream Function Method - Staggered Grid as Remedy for representation of Flow Field - Pressure and Velocity Corrections – Pressure Velocity Coupling - SIMPLE & SIMPLER (revised algorithm) Algorithm.

UNIT - V:

Turbulent Flows: Direct Numerical Simulation, Large Eddy Simulation and RANS Models

Compressible Flows: Introduction - Pressure, Velocity and Density Coupling.

REFERENCES:

1. Numerical heat transfer and fluid flow – S.V. Patankar (Hemisphere Pub. House)
2. An Introduction to Computational Fluid Dynamics – FVM Method – H.K. Versteeg, W. Malalasekhara (PHI)
3. Computational Fluid Flow and Heat Transfer – Muralidharan & Sundarajan (Narosa Pub)
4. Computational Fluid Dynamics – Hoffman and Chiang, Engg Education System
5. Computational Fluid Dynamics – Anderson (TMH)
6. Computational Methods for Fluid Dynamics – Ferziger, Peric (Springer)
7. Computational Fluid Dynamics, T.J. Chung, Cambridge University
8. Computaional Fluid Dynamics – A Practical Approach – Tu, Yeoh, Liu (Elsevier)
9. Text Book of Fluid Dynamics, Frank Chorlton, CBS Publishers

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year -I Sem. M. Tech (HV & AC)

EQUIPMENT DESIGN FOR THERMAL SYSTEMS (Professional Elective-II)

UNIT -I:

Classification Of Heat Exchangers: Introduction, Recuperation & regeneration, Tabular heat exchangers, Double pipe, shell & tube heat exchanger, Plate heat Exchangers, Gasketed plate heat exchanger. Spiral plate heat exchanger, Lamella heat exchanger, Extended surface heat exchanger, Plate fin and Tabular fin.

Basic Design Methods of Heat Exchanger: Introduction, Basic equations in design, Overall heat transfer coefficient, LMTD method for heat exchanger analysis, Parallel flow, Counter flow. Multipass, cross flow heat exchanger design calculations:

UNIT-II:

Double Pipe Heat Exchanger: Film coefficient for fluids in annulus, fouling factors, Calorific temperature, Average fluid temperature, The calculation of double pipe exchanger, Double pipe exchangers in series parallel arrangements.

Shell & Tube Heat Exchangers: Tube layouts for exchangers, Baffle heat exchangers, Calculation of shell and tube heat exchangers, Shell side film coefficients, Shell side equivalent diameter, The true temperature difference in a 1-2 heat exchanger. Influence of approach temperature on correction factor. Shell side pressure drop, Tube side pressure drop, Analysis of performance of 1-2 heat exchanger and design of shell & tube heat exchangers, Flow arrangements for increased heat recovery, the calculation of 2-4 exchangers.

UNIT-III:

Condensation of Single Vapours: Calculation of horizontal condenser, Vertical condenser, De-Super heater condenser, Vertical condenser-sub-Cooler, Horizontal Condenser-Sub cooler, Vertical reflux type condenser. Condensation of steam.

UNIT-IV:

Vaporizers, Evaporators and Reboilers: Vaporizing processes, Forced circulation vaporizing exchanger, Natural circulation vaporizing exchangers, Calculations of a reboiler. Extended Surfaces: Longitudinal fins. Weighted fin efficiency curve, Calculation of a Double pipe fin efficiency curve. Calculation of a double pipe finned exchanger, Calculation of a longitudinal fin shell and tube exchanger.

UNIT-V:

Direct Contact Heat Exchanger: Cooling towers, relation between wet bulb & dew point temperatures, The Lewis number and Classification of cooling towers, Cooling tower internals and the roll of fill, Heat Balance. Heat Transfer by simultaneous diffusion and convection, Analysis of cooling tower requirements, Deign of cooling towers, Determination of the number of diffusion units, Calculation of cooling tower performance.

REFERENCES:

1. Process Heat Transfer/D.Q.Kern/ TMH
2. Heat Exchanger Design/ A.P.Fraas and M N. Ozisicj/ John Wiley & sons, New York.
3. Cooling Towers / J.D. Gurney

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year -I Sem. M. Tech (HV & AC)

ALTERNATIVE REFRIGERANTS (Professional Elective-II)

UNIT-I:

Refrigeration cycles– analysis: Development of Vapor Compression Refrigeration Cycle from Reverse Carnot Cycle- conditions for high COP-deviations from ideal vapor compression cycle, Multipressure Systems, Cascade Systems-Analysis.

UNIT-II:

Refrigerants: Classification of Refrigerants, Designation of Refrigerants, Desirable properties of refrigerants including solubility in water and lubricating oil, material compatibility, toxicity, flammability, leak detection, cost, environment and performance issues. Thermodynamic properties of refrigerants. Synthetic and natural refrigerants. Comparison between different refrigerants vis a vis applications. Special issues and practical implications. Montreal Protocol and the Kyoto Protocol

UNIT-III:

Refrigerant Mixtures

Introduction, The Need for replacement refrigerants, Binary mixtures- composition, temperature-composition, and enthalpy-concentration diagram, refrigerant mixtures, evaluation of thermodynamic properties, zeotropic and azeotropic mixtures, temperature glide. Charging procedure and Safety rules for the preparation of refrigerant mixtures. Advantages and limitations of refrigerant mixtures.

UNIT-IV:

Assessment of Natural Refrigerants:

Opportunities for the application of natural refrigerants, Use of hydrocarbons as working fluids in heat pumps and refrigeration equipment, Conversion of various HCFC-22 systems to hydrocarbon, Experimental assessment of HC-290 as a substitute to HCFC-22 in a window air conditioner

UNIT-V:

Tools & Servicing Practices

Tools: Different Types of Refrigeration Tools, Evacuation and Charging Unit , Recovery and Recycling Unit , Vacuum Pumps.

Servicing Practices: Contaminants-Moisture, on-condensables, Servicing RAC systems-Evacuation, Purging, Leak detection,

REFERENCE BOOKS:

1. Natural Refrigerants Sustainable Ozone- and Climate-Friendly Alternatives to HCFCs, Proklima International, 2008
2. Refrigeration & Air Conditioning Technology, By William C. Whitman, William M. Johnson, John A.
3. Refrigeration and Air Conditioning by C P Arora, McGraw-Hill edition
4. Alternatives to HCFCs in the Refrigeration and Air conditioning Sector - Practical Guidelines and Case Studies for Equipment Conversion, Retrofit and Replacement, UNEP
5. R &AC -Manohar Prasad

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year -I Sem. M. Tech (HV & AC)

COLD STORAGE TECHNOLOGY & SYSTEMS (Professional Elective-II)

UNIT-I:

Theories and Method of Chilling: Freezing and free de-humidification, Preparation for freezing, Freezing methods. Commercial freezing methods, Sharp, quick and air blast freezing, Freezing drying - Methods of pre-cooling fruits and vegetables, Hydro cooling, Forced air cooling and Vacuum cooling.

UNIT-II:

Processing of Meat Products: Refrigeration systems for carcass chilling and holding, Chilled brine spray, Sprayed coil, Dry coil systems. Chilling and freezing variety meats, overnight chilling, quick chilling. Effect of freezing temperature on quality of meat products.

Fishery Products: Icing of fish. Saltwater icing. Freezing methods, Slow freezing Blast freezing, Plate Freezing and Immersion freezing offish.

UNIT-III:

Dairy Products: Milk processing, Handling, Diary plant procedure. Standardizing, Pasteurization, Homogenizing, and Container filling.

Fruit Juice Concentrations: Processing and quality control selection, Grading and handling of fresh fruit, Washing, Juice extraction, Heat Treatment, Flavour fortification, Packing storage and distribution, Convection methods, freezing and mechanical separation. Low temperature vacuum evaporation, Direct refrigerant contact method. Indirect refrigerant contact methods, High temperature short time evaporations.

UNIT-IV:

Refrigerated Warehouse: Factors affecting warehouse design, Building location, Design reduction. Shipping and receiving plant forms. Utility space, Controlled atmospheric storage rooms. Jacketed storages. Automated warehouse insulation, Cold storage doors.

UNIT-V:

Refrigerated Trucks, Trailers & Containers: Temperature control methods, Body Design & construction, Auxiliary equipment, Types of refrigeration systems. Railway refrigeration cars.

REFERENCES:

1. Refrigeration and Air-Conditioning / C. P. Arora/ Dhanpat Rai & Co.
2. Food Processing Technology: Principles and Practice / Peter Fellows / Woodhead Publishing / 3rd Edition / 2009
3. Guide and Data Book / ASHRAE.
4. Hand Book of Air-Conditioning system design/Carrier.
5. Basic Refrigeration & Air Conditioning – P.N. Ananathanarayanan – McGraw Hill
6. Principles of Refrigeration/ Dossat-Pearson

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

I Year - I Sem. M. Tech (HV & AC)

REFRIGERATION & AIR CONDITIONING LAB

1. Study and Performance of Vapor Compression Refrigeration Cycle
2. To find Performance of refrigeration test rig by using different expansion devices
3. To find performance Parameters of cooling Towers
4. To find performance parameters of an Ice Plant
5. To find performance parameters of Vapor Absorption Refrigeration system
6. Performance analysis of Vortex tube Apparatus
7. Performance analysis of Mechanical heat pump
8. Performance analysis of air conditioning law limit
9. Study of pull down characteristics of domestic refrigerator
10. Study of performance parameters using ventilation trainer