மனோன்மணியம் சுந்தரனார் பல்கலைக்கழகம்

MANONMANIAM SUNDARANAR UNIVERSITY

SYLLABUS FOR DIPLOMA IN REFRIGERATION AND AIR CONDITIONING PROGRAM OFFERED THROUGH DIRECTORATE OF VOCATIONAL EDUCATION (COMMUNITY COLLEGES AND VOCATIONAL SKILL DEVELOPMENT CENTRES) FROM 2019 – 2020

கல்விசார் நிலைக்குழுக் கூட்டம்

MEETING OF THE STANDING COMMITTEE ON ACADEMIC AFFAIRS HELD ON FRIDAY THE 28th JUNE 2019

Program Code:5273

DIPLOMA IN REFRIGERATION AND AIR CONDITIONING

குளிர்பதனம் மற்றும் தட்ப வெப்பநிலை கட்டுபடுத்துதல் பட்டயம்

SCHEME OF EXAMINATION

Subject code	Title of Course	Credit	Hours	Passing Minimum
Semester I				
C19RA11/E19RA01	Basic Engineering & Air Refrigeration	6	90	40/100
C19RA12/E19RA02	Vapour Compression Refrigeration	6	90	40/100
C19RA13/E19RA03	Vapour Absorption Refrigeration	6	90	40/100
C19CE10/E19CE10	Communicative English	6	90	40/100
C19RAP1/E19RAP1	Practical I – Refrigeration	4	120	40/100
Semester II				
C19RA21/E19RA04	Air Conditioning System	6	90	40/100
C19RA22/E19RA05	Cooling Load Estimation & Application of Refrigeration & Air Conditioner	6	90	40/100
C19LS23/E19LS05	Life Skill	6	90	40/100
C19RAP2/E19RAP2	Practical II – Air Conditioning	4	120	40/100
C19RAPW/E19RAPW	Project/Internship	10	150	40/100

Eligibility for admission: Pass in 12th Std. Examination Conducted by the Govt. of Tamil Nadu Board of Secondary Education, Government of Tamilnadu (or) Any Other Equivalent Examination

Examination: Passing minimum for each Course is 40%.classification will be done on the basis percentage Marks of the total marks obtained in all of the Courses and given as below:

40% but less than 50% - Third Class
50%but less than 60% - Second Class
60% and above - First Class

Theory Paper

Internal Marks-25
External Marks-75

SYLLABUS

Semester I

Course I : Basic Engineering & Air Refrigeration
Course II : Vapour Compression Refrigeration
Course III : Vapour Absorption Refrigeration
Course IV : Communicative English
Course V : Practical I – Refrigeration

Semester II

Course VI : Air Conditioning System
Course VII : Cooling Load Estimation & Application of Refrigeration & Air Conditioner
Course VIII : Life skill
Course IX : Practical II - Air Conditioning
Course X : Project/Internship

***(Semester Pattern for Community College Only)**

Program Objectives

- Study about basic tools and equipments and measuring instruments in workshop.
- Describe the working and construction of condensers and evaporator for refrigeration and Air conditioning System
- Learn and understand the gap between the technical knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.

Semester I
Course I

(C19RA11/E19RA01)**Basic Engineering & Air Refrigeration**

Objectives

- Study about basic tools and equipments and measuring instruments in workshop.
- Explain the basics of air refrigeration and Carnot cycle.
- Explain the working of open and closed air system of refrigeration

Unit I **18 Hrs**

Engineering Materials and Properties

Engineering Materials

Types of Engineering materials – Ferrous materials- Pig Iron – Cast Iron – Steel – Alloy steel – Non-Ferrous materials – Copper – Aluminium – Brass – Bronze – Zinc – Tin. Non-metallic materials – Plastics – Types of Plastics – Fibre material.

Mechanical Properties

Elasticity – Plasticity – Ductility – Strength – Hardness – Brittleness – Machine ability – Cast ability – Weld ability-Creep.

Unit II **18 Hrs**

Fitting and Sheet Metal Works

Fitting Works

Fitting tools – Uses – Functions – Applications – Measuring instruments – Steel rule – Vernier Caliber – Vernier height gauge.

Sheet Metal Works

Sheet metal tools – Uses – Functions – Applications – Measuring Tools- Gauges - Types of sheet metal joints – Uses - Specification of sheet metals.

Unit III **18 Hrs**

Electrical and Welding Works

Electrical Works

Conductors – Insulators – Capacitor – Resistance – Materials used as Conductors, Insulators and Capacitors. Voltage – Current – Ohm's law – Series and Parallel circuits. Measuring Instruments – Voltmeter – Ammeter – Wattmeter – Energy meter – Multimeter – Earthing – Earth Resistance – Importance of Earthing.

Welding Works

Definition – Types of welding – Gas welding – Gas welding equipments – Types of flames – Filler rods – Flux – Use of Flux – Gas cutting – Soldering – Brazing.

Unit IV **18 Hrs**

Heat and Modes of Heat Transfer

Heat

Definition – Specific heat – Specific heat capacity at constant volume – Specific heat capacity at constant pressure – Ratio specific heat – Gas constant – Sensible heat – Latent heat – Simple Problems.

Modes of Heat Transfer

Conduction – Convection – Radiation – Laws of heat transfer – Newton's law of cooling – Fourier's law of heat conduction.

Unit V **18 Hrs**

Air Refrigeration System

Refrigeration – History of Refrigeration – Types of refrigeration – Ice refrigeration – Air refrigeration – Open cycle – Closed cycle – Reversed Carnot cycle – C.O.P of refrigeration – Unit of refrigeration – Tones of Refrigeration – Work done on the compressor – Simple Problems.

Reference Books

- Refrigeration and Air-conditioning, R.S.Khurmi, Eurasia Publishing House Pvt. Ltd.
- Refrigeration and Air-conditioning, J.K.Gupta, Eurasia Publishing House Pvt. Ltd.
- A course in refrigeration and air conditioning , Domkundwar,
- Principles of refrigeration, Dossat
- Home refrigeration and air conditioning, Audels, Theo.Audel& Co. publisher, 199 Edn.49, West 23rd Street, New York. - 1998
- Refrigeration and air conditioning, C.P Arora

Course II

(C19RA12/E19RA02)**Vapour Compression Refrigeration**

Objectives

- Explain the vapor compression Refrigeration system.
- Describe the working and construction of the compressors used for refrigeration
- Describe the working and construction of condensers and evaporator for refrigeration and Air conditioning System

Unit I **18 Hrs**

Vapour Compression Refrigeration

Gas – Vapour – Laws of Perfect gas – Boyle's law – Charles law. Vapour compression refrigeration system – Construction – Working principle – Sub cooling – Superheating – Effect of sub cooling and superheating – Simple Problems.

Unit II **18 Hrs**

Refrigerant Compressors

Compressor –Types of compressors – Reciprocating Compressor – Hermetic Sealed compressor – Semi hermetic Sealed compressor – Rotary Compressor. Reciprocating compressor – Function – Construction – Working Principle – Applications.

Unit III **18 Hrs**

Condenser

Condenser – Types of condenser – Air cooled condenser – Water cooled condenser – Comparison of air cooled and water cooled condensers – Evaporative condenser.
Air and Water cooled condenser – Function – Construction – Working Principle – Applications.

Unit IV **18 Hrs**

Expansion Devices

Expansion devices – Types of expansion devices – Capillary tube – Hand operated expansion valve – Automatic expansion valve – Thermostatic expansion valve _ Electronic Expansion Valve – Function – Construction – Working principle – Applications.

Unit V **18 Hrs**

Evaporator

Evaporator – Capacity of evaporator – Types of evaporator – Shell and tube evaporator – Shell and coil evaporator – Natural convection evaporator – Forced convection evaporator – Function – Construction – Working principle – Applications.

Reference Books

- Refrigeration and Air-conditioning, R.S.Khurmi, Eurasia Publishing House Pvt. Ltd.
- Refrigeration and Air-conditioning, J.K.Gupta, Eurasia Publishing House Pvt. Ltd.
- A course in refrigeration and air conditioning , Domkundwar,
- Principles of refrigeration, Dossat Home refrigeration and air conditioning, Audels, Theo.Audel& Co. publisher, 199 Edn.49, West 23rd Street, New York. - 1998
- Refrigeration and air conditioning, C.P Arora

Course III

(C19RA13/E19RA03)**Vapour Absorption Refrigeration**

Objectives

- Explain the Vapour Absorption Refrigeration system
- Compare the properties of Various Refrigerants
- Compare the various applications of various refrigerants
- Explain the Lithium Bromide and Solar Absorption Refrigeration

Unit I **18 Hrs**

Vapour Absorption Refrigeration

Simple Vapour Absorption Refrigeration system –
Construction – Working Principle – Applications – Advantages – Disadvantages – Comparison of Vapour compression and Vapour absorption refrigeration system.

Unit II **18 Hrs**

Refrigerants and Lubricants

Refrigerant – Classification of refrigerant – Primary and Secondary refrigerants – Inorganic – Organic – Fluorinated hydro carbons – Halo Carbon Refrigerant .
Properties of Ideal refrigerant – Physical properties – Chemical Properties – Thermodynamic Properties.
Lubricant – Use of Lubricant in refrigeration – Types – Application

Unit III **18 Hrs**

Domestic Electrolux Refrigeration

Domestic Electrolux Refrigeration system –
Construction – Working Principle – Applications – Advantages – Disadvantages.

Unit IV

Lithium Bromide Absorption Refrigeration **18 Hrs**

Lithium Bromide Absorption Refrigeration system –
Construction – Working Principle – Applications – Advantages – Disadvantages.

Unit V **18 Hrs**

Solar Absorption Refrigeration

Solar Absorption Refrigeration system – Magnetic Refrigeration System – Giffered McMohan Refrigerator
Construction – Working Principle – Applications – Advantages – Disadvantages.

Reference Books

- Refrigeration and Air-conditioning, R.S.Khurmi, Eurasia Publishing House Pvt. Ltd.
- Refrigeration and Air-conditioning, J.K.Gupta, Eurasia Publishing House Pvt. Ltd.
- Refrigeration and Air-conditioning, R.S.Khurmi, Eurasia Publishing House Pvt. Ltd.
- Refrigeration and Air-conditioning, J.K.Gupta, Eurasia Publishing House Pvt. Ltd.
- A course in refrigeration and air conditioning , Domkundwar,
- Principles of refrigeration, Dossat
- Home refrigeration and air conditioning, Audels, Theo.Audel& Co. publisher, 199 Edn.49, West 23rd Street, New York. - 1998
- Refrigeration and air conditioning, C.P Arora

Course IV

(C19CE10/E19CE10)**Communicative English**

1. **Basic Grammar**:
   a. Review of grammar
   b. Remedial study of grammar
   c. Simple sentence
   d. Word passive voice etc.

2. **Bubbling Vocabulary**:
   a. Synonyms
   b. Antonyms
   c. One – work Institution

3. **Reading and Understanding English**
   a. Comprehension passage
   b. Précis – writing
   c. Developing a story from hints.

4. **Writing English**
   a. Writing Business letters.
   b. Paragraph writing
   c. Essay writing
   d. Dialogue writing

5. **Speaking English**
   a. Expressions used under different circumstances
   b. Phonetics

Reference

1. V.H.Baskaran – "English Made Easy"

2. V.H.Baskaran – "English Composition Made Easy"

(Shakespeare Institute of English Studies, Chennai)

3. N.Krishnaswamy – "Teaching English Grammar"

(T.R.Publication, Chennai)

4. "Life Skill" – P.Ravi, S.Prabakar and T.Tamzil Chelvam,

M.S.University, Tirunelveli.

Course V
Practical I
(C19RAP1/E19RAP1)**Refrigeration**

Objectives

- Identify the various Tools and Equipments used in Refrigeration Lab
- Determine the COP and Compressor Capacity of Refrigerator
- Describe the wiring of refrigerator and coolers
- Perform Servicing on Refrigerator and cooler

PART – A

1. **BASIC REFRIGERATION WORKSHOP OPERATION**

a) Copper and Steel tubing
   - To study the various sizes of copper and steel tubing.
   - To study the various tools used for operations.
   - Various operations on Copper and steel tubing – Cutting – Bending – Flaring – Swaging.

b) Soldering and Brazing methods used in refrigeration

2. **PROPER METHODS OF SETTING AND ADJUSTING OF**
   a) Thermostats
   b) Low pressure and High pressure cut-outs.
   c) Thermostatic expansion valve
   d) Automatic expansion valve

PART – B

I. TEST PROCEDURES

1. To determine the C.O.P, Refrigerating effect and Compressor Capacity of a open type system with
   a) Thermostatic expansion valve
   b) Capillary tube
   c) Automatic
2. To determine the C.O.P of sealed type system using electrical measurements.
3. Wiring of Refrigerator
4. Wiring of water cooler

II. SERVICE PROCEDURES

1. To change refrigerant into service cylinder from storage cylinder.
2. To evaluate the entire system.
3. To locate the leaks in the system.
4. To pump down the system.
5. To purge air from the system.
6. To charge the system.
7. To check the oil level in the compressor.
8. To tracing common faults in refrigeration system and the remedies.

Semester II

Course VI(C19RA21/E19RA04)**Air Conditioning System**

Objectives

- Define the Parameters used in Psychrometry
- Use of Psychrometry Chart, Describe the equipments used for Air Conditioning
- Explain window air conditioning system

Unit I **18 Hrs**

Psychrometric Properties

Psychrometry – Uses – Properties – Dry air – Moist air – Saturated air – Dry bulb temperature – Wet bulb temperature – Dew point temperature – Specific Humidity – Absolute humidity – Relative humidity – Degree of saturation – Wet bulb depression.

Unit II **18 Hrs**

Psychrometric processes

Psychrometric chart – Uses – Psychromtric processes – Sensible heat process – Sensible heating – Sensible cooling – Latent heat process – Humidification – Dehumdification – Sensible heat factor – By-pass factor of heating and cooling coil – Combined process – Sensible heating and humidification – Sensible heating and dehumidification – Sensible cooling and humidification – Sensible cooling and dehumidification – Simple problems used in psychrometric chart.

Unit III **18 Hrs**

Comfort Air Conditioning

Human comfort – Factors affecting human comfort – Effective temperature – Governing optimum effective temperature – Comfort chart – Design Consideration

Unit IV **18 Hrs**

Equipments Used in Air Conditioning System

Circulation fan – Types – Centrifugal fan – Axial flow fan – Air conditioning Unit – Supply duct – Supply outlet – Return outlet – Filters – Types of filters – Wet filters – Dry filters – Electronic filters – Register – Insulator –Properties of Ideal Insulating Materials – Insulating Material – Function – Types of Insulating Materials.

Unit V **18 Hrs**

Window and Split Air Conditioning System

Air conditioning – Classification of air conditioning – Window Air conditioning system – Construction – Working principle – Applications – Split Air conditioning system – Construction – Working principle – Advantages – Applications.

Reference Books

- Refrigeration and Air-conditioning, R.S.Khurmi, Eurasia Publishing House Pvt. Ltd.
- Refrigeration and Air-conditioning, J.K.Gupta, Eurasia Publishing House Pvt. Ltd.
- A course in refrigeration and air conditioning , Domkundwar,
- Principles of refrigeration, Dossat
- Home refrigeration and air conditioning, Audels, Theo.Audel & Co. publisher, 199 Edn.49, West 23rd Street, New York. - 1998
- Refrigeration and air conditioning, C.P Arora, Cryogenic systems RandellFd Barron.

Course VII

(C19RA22/E19RA05)**Cooling Load Estimation & Application of Refrigeration & Air Conditioner**

Objectives

- Explain the working of Central Air Conditioning System
- Estimate the Cooling Load for the given Recruitment
- Explain the Application of Refrigeration
- Explain the Industrial Application of Air Conditioning

Unit I **18 Hrs**

Central Air Conditioning System

Central Air conditioning – Types of Central Air Conditioning(Direct and Indirect System) - Components – Construction – Working Principle – Faults- Care - Maintenance – Advantages – Applications – Comparison of Window and Central Air Conditioning.

Unit II **18 Hrs**

Cooling Load Estimation

Different Heat Sources – Conduction of Heat Load – Radiation Load Due to sun – Occupants Load – Equipment Load – Infiltration Air Load – Miscellaneous Heat Sources - Fresh Air Load– Heat gain from duct – Simple Problems.

Unit III **18 Hrs**

DUCT

Duct – Classification of ducts – Duct materials – Duct Designing – Shape – Duct supply systems – Loop perimeter system – Radial perimeter system – Extended perimeter system – Duct Insulation.

Unit IV **18 Hrs**

Applications of Refrigeration

Dairy refrigeration – Ice manufacturing – Ice cream cabinets – Ice making – Frost free refrigeration – Freezer – Water cooler – Milk Cooler.

Unit V **18 Hrs**

Applications of Air Conditioning

Industrial application of Air conditioning – Car air conditioning – Bus Air Conditioning – Train Air conditioning – Marine Air conditioning.

Reference Books

- Refrigeration and Air-conditioning, R.S.Khurmi, Eurasia Publishing House Pvt. Ltd.
- Refrigeration and Air-conditioning, J.K.Gupta, Eurasia Publishing House Pvt. Ltd.
- Refrigeration and Air-conditioning, R.K.Rajput, S.Chand Publications.
- A course in refrigeration and air conditioning , Domkundwar,
- Principles of refrigeration, Dossat
- Home refrigeration and air conditioning, Audels, Theo.Audel& Co. publisher, 199 Edn.49, West 23rd Street, New York. - 1998
- Refrigeration and air conditioning, C.P Arora
- Cryogenic systems RandellFd Barron.

Course VIII

(C19LS23/E19LS05)**Life Skill**

I Life Coping or adjustment

(a) External and internal influence in one's life
(b) Process of coping or adjustment
(c) Coping with physical change and sexuality
(d) Coping with stress, shyness, fear, anger far live and criticism.

II Attitude

(a) Attitude
(b) Self acceptance, self – esteem and self actualization
(c) Positive thinking

III Problem Solving

(a) Goal Setting
(b) Decision Making
(c) Time Management and stress Management.

IV Computers

(a) Introduction to Computers
(b) M.S.Office
(c) Power Point

V Internet

(a) Introduction to internet
(b) E – mail
(c) Browsing

References

1) Life Skill Programme course I & II by Dr. Xavier Alphona MCRDCE Publications. R.K.Mutt Road, Chennai – 28
2) ஆளுமை பண்பு வளர்த்தல் மற்றும் தகவல் தொடர்பு by M.Selvaraj Community College,Palayamkottai
3) "Life Skill" –P.Ravi, S.Prabahar & T.Tamil Chelvam, M.S. University, Tirunelveli

Course IX

(C19RAP2/E19RAP2)**Practical II – Air Conditioning**

Objectives

- Identify the various tools and equipments used in Air Conditioning Lab Practical
- Determine the COP of Air Conditioner
- Set the Parameters for Comfortable operation of an Air Conditioner
- Determine the capacity of Window and Split AC.
- Perform the Servicing on Air Conditioner.

PART – A

1. USE OF PSYCHROMETER AND PSYCHROMETRIC CHART

a) To find the psychrometric properties by using sling psychrometer.

b) To find the psychrometric properties by using Psychrometric chart.

2. To Measuring the Air flow using

a) Anemometers

b) Pitot Tube

3. Identify the Various Mechanical Components Used in Car A/C.
4. Identify the Various Electrical Components Used in Car A/C.
5. Identify the Various Components Used in Train A/C.

PART – B

III. TEST PROCEDURES

1. To determine the Capacity of window air conditioning.
2. To determine the Capacity of Split air conditioning.
3. To determine the efficiency of cooling towers.
4. Wiring of Room air conditioning.
5. Wiring of Packaged air conditioner.
6. Wiring of Car Air conditioning.

IV. SERVICE PROCEDURES

1. Service of Fan and blower used in air conditioning.
2. Service of different types of filters used in air conditioning.
3. Repair and maintenance of car A/C system.
4. Repair and maintenance of Bus A/C system.
5. To charge the system.
6. To check the oil level in the compressor.
7. To tracing common faults in air conditioning system and the remedies.

Course X

(C19RAPW/E19RAPW)**Project/Internship**

Objectives

- Learn and understand the gap between the technical knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out co operative learning through the synchronous guided discussion with in the class key days, Asynchronous document sharing and discussion, as well as to prepare colloprative edition of the final project.

Project Work

1. Assemble a Window Air conditioning / Split Air conditioning.
2. Assemble a Car A/C cycle.
3. Make a Duct for Central Air conditioning system.
4. Survey a Heat load of commercial / Industrial building.
5. Making a piping circuit of cooling tower.
6. Prepare a model of frost free refrigerator

Internship

1. Milk storage plant.
2. Ice making plant.
3. Central A/C plant in hospitals.
4. Central A/C plant in Restaurants and Theatre.
