

**BOARD OF STUDIES MEETING
HELD ON 18.08.2021**

**SYLLABUS FOR
D.VOC IN REFRIGERATION & AIR CONDITIONING**



**DEPARTMENT OF LIFELONG LEARNING AND EXTENSION
GANDHIGRAM RURAL INSTITUTE - DEEMED TO BE UNIVERSITY**

*(Ministry of Education, Govt. of India)
Accredited by NAAC with 'A' Grade (3rd Cycle)*

**GANDHIGRAM-624 302, DINDIGUL DISTRICT
TAMIL NADU**

GANDHIGRAM RURAL INSTITUTE-DEEMED TO BE UNIVERSITY

Gandhigram – 624 302, Dindigul District, Tamil Nadu

[Funded by UGC, New Delhi]

Structure and Content of the

D.VOC IN REFRIGERATION & AIR CONDITIONING

(With effect from 2021)

1. Introduction:

The Gandhigram Rural Institute (GRI) - Deemed to be University, Gandhigram is one of the pioneering institutions working for rural development and preparing human resources for managing rural development during last six decades. In GRI -DU, the Department of Lifelong Learning and Extension has been mainly working for the Vocational Education and Training for skill development within the framework of University System. In the light of strengthening Teaching, Training and Research in the area of Lifelong Learning, attempts are being made to revisit and revise the existing curriculum of different academic courses and developing new curricula for offering courses at various levels. In this context, the Department focus on the “skills and knowledge” needed to work with people in various employment settings in the rural and semi-urban areas, particularly in the unorganized sector and also in the Non-Governmental organizations.

The Lifelong Learning has become a fundamental goal of recent educational policies as a way to achieve socio-economic development and as a tool for promoting knowledge based society. The Department of Lifelong Learning and Extension has been conducting more than 15 trades of Skill development training during two decades. Among the skill development training programmes, training in the domain of in Refrigeration & Air Conditioning servicing has been taken up to offer a **One - Year D.Voc in Refrigeration & Air Conditioning** from 2018 onwards. This programme enables the students to have **employable skills** that help to secure an employment in public, private sector and also to become an entrepreneur. The department has required physical and social infrastructure facilities including technical expertise to support this programme.

Justification:

In the present days, lot of educated unemployed individuals are seeking for suitable skill training courses which resulting in Self-employment or to promote entrepreneurs. The purpose of D. Voc in Refrigeration & Air Conditioning (*henceforth known as R&AC in this text*) is produce professional trained youth to meet the human resource needs of the industry.

Refrigeration & Air Conditioning has become part of everybody's life; right from top corporate business house, storage business, restaurants, individual homes etc. The R&AC industry is one of the most demanding industries in the modern world. In order to complete the servicing and maintenance work within the time frame, requires dedicated trained professionals. Therefore, the Diploma programme is structured to focus on the vital components of the skills sets required for the R&AC sector. Moreover, the syllabus is designed to include the theoretical as well as practical aspects of the cooling system of various scales.

Above all, the University Grants Commission (UGC) and the Ministry of Human Resource Development (MHRD), Government of India has been emphasizing on the importance of Diploma / Degree in the Vocational Domain as an integral part of higher education system. Therefore, it is proposed to offer a Diploma programme in Refrigeration & Air Conditioning.

2. Objectives:

- To enable the students to acquire appropriate and adequate technical knowledge with the professional skills and competencies in the field of Refrigeration and Air Conditioning.
- To train the students to upscale their skills for starting self-employment as well as to provide appropriate employment opportunities.

3. Methodology

The D.Voc in Refrigerator and Air Conditioning programme is of two-semester duration and follows the credit system. In the first semester, the students are introduced to the essential elements and appropriate practice in the form of practical training. The evaluation and Grading will be done as per the GRI pattern. Each course will be evaluated for a maximum of 100 marks – Combining both Theory and Practical components. Being a skill-based programme, the passing minimum marks will be 40%.

The teaching and training process includes the following:

- Classroom sessions, Demonstration
- Hands-on-Experience in the practical labs
- ICT enabled interactive sessions
- Industrial Placement
- Exposure Visit to Industry

4. Admission related matters:

- The minimum educational qualification for admission in the Diploma is +2 pass or equivalent including NIOS from any recognized board or university.
- The medium of instruction will be English and Tamil. The Question Paper will be in both English and Tamil.
- Provision is made to enroll students who will come up to this level following the National Vocation Education Qualifying Framework (NVEQF) / National Skill Qualifying Framework (NSQF).
- Reservation to SC, ST, OBC, and Differently - Abled and Service Personnel categories will be made as per the Government of India (GoI) Norms
- There shall be no age bar for admission to the programme.
- The selected students have to pay fees as per the GRI Norms. The maximum enrollment for the programme is 25.

5. Examination related matters:

- The Controller of Examination, GRI shall conduct the End Semester Examination [ESE] as is being practiced in the case of other Certificate / Diploma Programmes.
- The respective course teacher will be the examiner.
- The Industry Experts, if required, can be invited for conducting the practical Examinations.
- For theory papers, assessment is based on End Semester Examination only.
- A student will be declared to have passed in a course when she/he has scored a minimum of 40% both theory and practical.
- In the case of a student absent / failed in a subject in a semester examination, she/he has to write Theory / Practical examinations for that subject during the subsequent semesters.
- A student has to pass the course with a maximum of 5 attempts [1+4 times]

6. Industry collaboration:

- Networking with identified Refrigeration and Air Conditioning Service Centre's, Technical Institutions, Industries to provide Practical Training for hands-on experience.
- Signing of Memorandum of Understanding [MOU] by the Department of Lifelong Learning and Extension with identified Refrigeration and Air Conditioning Service Centres and Technical Institutions.
- Experts available in the Industrial Units / Technical Institutions will be invited as Guest Faculty
- During the second semester of the Practical Training, students are placed in the Service Centres / Industries for the In-plant training.

Scheme of Examination – I & II Semesters

	Course Code	Category	Title of Course	No. of credits	Duration of ESE Hours	Marks			
						CFA	ESE	TOTAL	
SEMESTER - I	21DRAV0101	GEC	Basics of Refrigeration and Air conditioning	4	3	40	60	100	
	21DRAV0102	SDC	Basics of Electrical & Electronics - <i>Practical</i>	6	3	60	40	100	
	21DRAV0103	SDC	Refrigeration service Techniques - <i>Practical</i>	8	3	60	40	100	
	21DRAV0104	SDC	Air conditioning Service Techniques - <i>Practical</i>	8	3	60	40	100	
	21DRAV0105	GEC	Customer Relationship Management	4	3	40	60	100	
	Sub Total (A)				30	-	260	240	500
SEMESTER - II	21DRAV0206	GEC	Refrigeration & Air Conditioning Applications	4	3	40	60	100	
	21DRAV0207	SDC	Engineering Drawing - <i>Practical</i>	6	2	60	40	100	
	21DRAV0208	SDC	Inplant Training	20	-	-	100	100	
	Sub Total (B)				30	-	100	200	300
	Total (A+B)				60	-	360	440	800

7. Content of the Programme

PAPER-I - BASICS OF REFRIGERATION AND AIR CONDITIONING

Course Code: 21DRAV0101

Theory - 4 Credits

Marks - 100

OBJECTIVES:

- To understand the basic knowledge of Principles and functions of Refrigeration.
- To understand the basic knowledge on the Principles and Functions of Air Conditioner.
- To know the working principles of the Compressor & Motors.

UNIT – I

Refrigeration introduction - its meaning and application - unit of refrigeration - various methods of refrigeration - science related to refrigeration – work, power, energy, force, Heat, and Temperature - Different temperature scales, Thermometers, Units of heat, sensible heat, latent heat, superheating and sub-cooling, saturation temperature, pressure, types, units.

UNIT - II

Types of Refrigeration systems - Ton of Refrigeration, Study the construction and working of the vapour compression cycle, low side & high side of vapour compression system - Applications of the vapour compression cycle.

UNIT - III

Introduction Air Conditioning - meaning and general application – Psychrometry - Enthalpy of moist air - Sensible heating and cooling, Humidification and dehumidification and their methods. Thermal insulation – function – types - thermodynamic properties of heat insulation materials used in refrigeration and Air Conditioning systems classification of refrigerants and its properties.

UNIT - IV

Domestic AC - identifying various components - electrical circuits - testing components - fault detection - install gauge manifold in the system - leak testing - evacuation, gas charging, Installation - troubleshooting. Fundamentals of Central Air Conditioning - requirements of comfort A.C - Types of Central air conditioning.

UNIT – V

Compressor - Function, working like Reciprocating, rotary, scroll-type - centrifugal compressor. Condenser - Function of condenser, types. Evaporator - Function, types of evaporators used in various equipment. Drier - the function of drier, types, application, and its advantage - Expansion valve used in domestic Refrigeration and Air Conditioning systems.

References:

1. Arora C P (2008), Refrigeration and Air Conditioning, McGraw - Hill India Publishing Ltd
2. J.K. Gupta, R. S. Khurmi, (2006) Refrigeration and Air Conditioning, Pearson education, New Delhi
3. Ramesh Arora, Ramesh Chandra, (2012) Refrigeration and Air Conditioning, Prentice Hall of India Publisher
4. Roy J. Dossat (2001 Revised), Principles of Refrigeration, Pearson education, New Delhi
5. Sarao A, Gaurav Agarawal, (2014) Refrigeration and Air Conditioning, Pearson education, New Delhi

LEARNING OUTCOMES:

- Acquire the principles and functions of Refrigeration & Air conditioner.
- Obtain the capacity of servicing Refrigeration & Air conditioners.

PAPER II - BASICS OF ELECTRICAL & ELECTRONICS

Course Code: 21DRAV0102

Practical – 6 Credits

Marks - 100

OBJECTIVES:

- To acquire the basic knowledge of electrical and electronics.
- To understand the service of electrical and electronic devices.

PRACTICALS:

1. To get familiar with Voltage, Current, Resistance, continuity, and practice Electrical measuring instruments.
2. To get familiar with appropriate wires and fuses for household / domestic applications.
3. To practice Electrical Earthing and wire jointing.
4. To practice a Series / Parallel connection for Batteries & Lights.
5. To practice wiring connections and assemble the extension box.
6. To practice the wiring circuit of a single-phase meter.
7. To practice the wiring circuit of the Three-phase meter.
8. To practice household wiring circuits in a living room.
9. To get familiar with UPS and Generator provisions in household wiring.
10. To practice the measurement of a resistor using color code.
11. To get familiar with diode, rectifier, regulator, capacitors, IC, and Soldering & de-soldering.
12. To experiment with the circuits with relays.
13. To experiment the circuit in Air Conditioner.
14. To experiment the circuit in Refrigerator.
15. To experiment with the Star and Delta connection for Motors.

LEARNING OUTCOMES:

- Obtain the basic knowledge of electrical and electronics.
- Developing the capacity of servicing electrical and electronic devices

PAPER III - REFRIGERATION SERVICE TECHNIQUES

Course Code: 21DRAV0103

Practical – 8 Credits

Marks - 100

OBJECTIVES:

- To provide practical's in fault finding, rectification in the Refrigerator.
- To provide practical's in brazing technique, copper pipe swaged joint in Refrigerators.
- To understand the functions of commercial refrigeration units.

PRACTICALS:

1. To familiar with Refrigeration tools.
2. To identify the copper tube dia measurement.
3. To practice copper tube cutting.
4. To practice copper tube swaging.
5. To practice, copper tube flaring.
6. To practice copper tube brazing.
7. To practice copper tube de-brazing.
8. To Experiment with the thermometers.
9. To Experiment with the electrical components of the Refrigerator.
10. To practice and installation of manifold gauge.
11. To Experiment with the capillary replacing.
12. To Identify the leak testing method.
13. To Experiment with the flushing of Condenser.
14. To Experiment with the flushing of Evaporator.
15. To practice care and maintenance of Refrigerator.

LEARNING OUTCOMES :

- Acquired the basic knowledge of refrigerators.
- Perform the domestic Refrigeration service.

PAPER IV - AIR CONDITIONING SERVICE TECHNIQUES

Course Code: 21DRAV0104

Practical – 8 Credits

Marks - 100

OBJECTIVES:

- To provide the knowledge of the Principles and Functions of Air Conditioner.
- To understand the types & Electrical components in the Air Conditioner.
- To Perform fault finding, rectifications of Compressor & Motors.

PRACTICALS:

1. To perform the pressure Gauge Installation.
2. To practice the Humidification Methods.
3. To practice the dehumidification method.
4. To Identify the Insulation materials.
5. To Identify the Mechanical Components for Domestic Air Conditioner.
6. To practice the evacuation method for Air conditioner system.
7. To practice the Gas charging method for Air conditioner system.
8. To perform fault detection and troubleshooting.
9. To perform the R&AC Compressor Replacement.
10. To practice the Gasket preparing & lubrication methods.
11. Performance of three-phase Induction motor.
12. Perform the Drier replacement.
13. To identify the Refrigerants cylinder code.
14. To practice the split Air conditioner installation.
15. To practice the starting relay, capacitor checking method.

LEARNING OUTCOMES :

- Understand the working principles of the Air Conditioner.
- Acquired the capacity of servicing Domestic and Commercial Air Conditioning systems.

PAPER – V - CUSTOMER RELATIONSHIP MANAGEMENT

Course Code: 21DRAV0105

Theory – 4 Credits

Marks - 100

OBJECTIVES:

- To enable the students with basic skills required for maintaining a good relationship with customers in Refrigeration & Air Conditioning industry.

UNIT - I

Concept of Customer Relationship Management (CRM) : Meaning, Definition, Scope, Importance of Customers in Service Sector - Types of Customers - their needs in the Service Sector.

UNIT - II

Process and Implementation of Customer Relationship Management: Customers Development process - Need for Customer Relation - Customer Satisfaction - Strategies for Attracting and Retaining Customers

UNIT - III

Understanding Customers: Customer Information database in Media Analyzing customers Profile; Customers perception, expectations and behavior - Focus Profitable Customers.

UNIT IV :

Customer Relationship Skills: Leadership Skills in Marketing R& AC Services and Products - Importance of Team Work in Media, Public Speaking, Talents for Negotiation, Maintaining good Interpersonal Relationship - Effective Communication in delivering Services

UNIT V :

Practical Exercise: Role Playing - Public speaking- Interview - Work in a Team - Group Discussion - use of Mobile - SMS and Whatsapp - Discussion on Case Studies from Refrigeration and Air Conditioning Sector.

REFERENCE

1. *Management (Eleventh Edition)*, Stephen P. Robbins and Mary Coulter, Pearson Education, New Jersey, 2012
2. *Customer Relationship Management*, Kaushik Mukerjee, PHI Learning Private Limited, New Delhi, 2007
3. *The essence of Customer Relationship Management*, Balasubramaniyan. K, GIGO Publishing, 2005
4. *Service Marketing and Management*, Balaji, S.Chand Publishing, 2002
5. *Customer Relationship Management - A Step-By-Step Approach*, A. Sagadevan and H. Peru Mohamed, Vikas Publishing, New Delhi, 2002

LEARNING OUTCOMES:

- Students acquire the skills of maintaining good relations with the customer
- Students learn leadership skills and self-confidence.

SECOND SEMESTER

PAPER VI - REFRIGERATION & AIR CONDITIONING APPLICATIONS

Course Code: 21DRAV0206

Theory – 4 Credits

Marks - 100

OBJECTIVES:

- To provide the basic knowledge of R & AC application in the current situation
- Explore the students to the variety of R & AC machines for commercial purposes.
- To make them understand, the students have an industrial visit.

UNIT - I

Food Preservation - factors contributing to food spoilage, methods of food preservation, freezing method of food preservation, preservation of food with direct contact of liquid N₂, freeze-drying, preservation of different products, cold storage, and commercial cabinets.

UNIT - II

Commercial Applications - Air-conditioning of houses, offices, hotels, and restaurants, air-conditioning of departmental stores - air conditioning of theatres and auditoriums- hospitals, and medical applications.

UNIT - III

Ice-Manufacturing - principles of ice production, different methods of ice manufacturing, treatment of water for making ice – brines - freezing tanks - ice cans and quality of ice.

UNIT - IV

Industrial Applications - The importance of RH in different industries, ice-cream manufacturing, refrigeration for breweries, selection of refrigerant for breweries, use of liquid N₂ for fabric, quality, air conditioning in textile and photographic industries.

UNIT - V

Transport Air Conditioning - automobile air conditioning, railway air-conditioning, marine air conditioning - aircraft air conditioning - Planning for Preventive maintenance and scheduling of maintenance activities in large AC and Refrigeration plants.

Exposure Visit:

To visit the R & AC application units available in the campus and outside the campus its working nature and assembling models, units, and environment.

References:

1. Arora C.P (2017), Refrigeration and Air Conditioning, McGraw Hill Education (India) (P) Limited, New Delhi
2. Arora S.C and Domkundwar S, Dhanpatrai and sons (1999) 5th Edition, Course in Refrigeration and Air Conditioning, Delhi
3. Manohar Prasad (2014), Refrigeration and Air Conditioning, New age international (P) Limited, New Delhi

LEARNING OUTCOMES:

- Understand the variety of R & AC machines for commercial purposes.
- Acquired Installation and functions of R & AC commercial units.

PAPER VII – ENGINEERING DRAWING

Course Code: 21DRAV0207

Practical - 6 Credits

Marks - 100

OBJECTIVES:

- To provide knowledge in Engineering Drawing and Instrument.
- To provide knowledge about dimensions and trade-related drawings.
- To impart knowledge of reading blueprints and working cycle.

PRACTICALS:

1. To practice the usage of Drawing instruments.
2. To practice the Sheet layout, Line types, symbols for drawing, Alphabet, and numbers.
3. To practice the Engineering Scales & Dimensions
4. To perform the Projections of Point & Straight Lines.
5. To perform the orthographic views of simple objects 1st angle projection.
6. To perform the Simple orthographic views for 3rd angle projection.
7. To draw the 2D diagram for Air Conditioner Duct pathway.
8. To draw the Freehand sketch diagram for Refrigerator & its components.
9. To draw the Freehand sketch diagram for Air conditioner & its components.
10. To draw the Freehand sketch diagram for R & AC tools.
11. To practice Blueprint Reading
12. To make a 2D wiring circuit diagram for Refrigerator.
13. To make a 2D wiring circuit diagram for Air conditioner.
14. To Practice a 2D sketch diagram for the R & AC working cycle.
15. To Marking the wall mount points for Air conditioner.

LEARNING OUTCOMES :

- Acquired the knowledge of Engineering Drawing and Instrument
- Practiced trade-related drawings, reading blueprints, and working cycles.

PAPER VIII - 21DRAV0208 - INPLANT TRAINING

(20 Credits)

OBJECTIVE:

- To learn skills for specific job roles from relevant Service Agencies / Companies

Students have to undergo four weeks of training in any **Refrigeration and Air Conditioning Service Agencies / Companies** to acquire relevant skills. The in-plant training may be organized continuously for four weeks or more than one spell within a semester as per the convenience of the Service Agencies / Companies. During their stay in the Agency, they have to maintain a diary on daily basis to record the work assigned, the outcome of the work and it has to be countersigned by the student's in-charge. In addition, he/she has to submit a weekly report to the department. During the in-plant training period, the Service Agencies / Companies will evaluate their performance for 60 marks and the concerned course teacher for 40 marks as given below.

INDUSTRY/ AGENCY

1.	Attitude	10 marks
2.	Punctuality	
3.	Behavior	
4.	Involvement	10 marks
5.	Performance (completion of assigned work)	20 marks
6.	Contribution to the industry	20 marks
	Total	60 Marks

COURSE TEACHER

1.	Diary /Record	10 marks
2.	Weekly report	10 marks
3.	Viva –voce	20 marks
	Total	40 marks
