

# **CBSE | DEPARTMENT OF SKILL EDUCATION**

## **CURRICULUM FOR SESSION 2020-2021**

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### **AIR CONDITIONING & REFRIGERATION (SUB.CODE – 827)**

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#### **JOB ROLE: SERVICE TECHNICIAN**

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#### **CLASS – XI**

#### **COURSE OVERVIEW**

For specific applications, efficiencies of both living and non-living beings depend to a great extent on the physical environment. The nature keeps conditions in the physical environment in the dynamic state ranging from one extreme to the other. Temperature, humidity, pressure and air motion are some of the important variables that at any location keep changing throughout the year. Adaptation to these many a times an unpredictable variation is not possible and thus working efficiently is not feasible either for the living beings or the non-living ones. Thus for any specific purpose, control of the environment is essential. Refrigeration and air-conditioning is the subject who deals with the techniques to control the environments of the living and non-living subjects and thus provide them comforts to enable them to perform better and have longer lives.

This course provides a simple understanding of Refrigeration and Air-conditioning fundamentals. This course is ideally suited for those with a little or no knowledge of the subject. The course consists of different refrigeration cycles and understanding of psychometric and psychometric processes used for the purpose of air-conditioning. Further, the comfort air-conditioning and indoor environment health are also addressed in this course.

#### **OBJECTIVES OF THE COURSE**

After successfully completing these two year of Senior Secondary course skill course students should be able to:-

- Understand the basic concept of refrigeration and air-conditioning and study the psychometric properties of air.
- Use efficiently the different refrigeration and air-conditioning tools and equipment's.

- Finally apply this knowledge for the design of refrigeration equipment's and air-conditioning equipment's.
- To meet the increasing demands of Refrigeration and air-conditioning technicians and engineers.
- Further pursue higher education and get admission in the 2<sup>nd</sup> year of Engg. Diploma course. After completing the diploma a student is eligible to get admission in the 2nd year of B.Tech course through lateral entry in an Engg. College.
- To get employment in the same field as well as able to start his own work in this sector (i.e. repairing servicing, maintenance, assembling of units and further counseling of people.

### **SALIENT FEATURES OF THE COURSE**

- Understanding and acquiring of adequate professional skills and competencies in the field of Air-Conditioning and Refrigeration field.
- Advancement in the modern technology of Air-Conditioning and refrigeration technology. Save energy and financial cost of equipment's.
- Healthy and professional attitude towards students.
- Practical based course
- Essential and modern approach
- Fulfilling the needs of modern society.
- Complete syllabus and study material is available on CBSE website.
- Previous years question papers and sample papers are available on CBSE website.
- Time to time guidance and updations from CBSE.

### **SCHEME OF UNITS**

This course is a planned sequence of instructions consisting of units meant for developing employability and vocational competencies of students of Class XI opting for skill subject along with other education subjects.

The unit-wise distribution of hours and marks is as given on the next page:

# CLASS – XI (SESSION 2020-2021)

Total Marks: 100 (Theory – 60+ Practical – 40)

<b>AIR CONDITIONING &amp; REFRIGERATION (SUBJECT CODE - 827)</b>				
<b>Class XI (Session 2020-2021)</b>				
	<b>UNITS</b>	<b>NO. OF HOURS for Theory and Practical</b>		<b>MAX. MARKS for Theory and Practical</b>
<b>Part A</b>	<b>Employability Skills</b>			
	Unit 1 : Communication Skills-III	10		10
	Unit 2 : Self-Management Skills-III	10		
	Unit 3 : ICT Skills-III	10		
	Unit 4 : Entrepreneurial Skills-III	15		
	Unit 5 : Green Skills-III	05		
	<b>Total</b>	<b>50</b>		<b>10</b>
<b>Part B</b>	<b>Subject Specific Skills</b>	<b>Theory</b>	<b>Practical</b>	<b>Marks</b>
	Unit 1: Meaning of Air Conditioning and Refrigeration etc.	35	10	07
	Unit 2: Vapour Compression Cycle, Working of a Domestic Refrigerators	30	10	10
	Unit 3: Meaning of Compressors, Compressor construction	27	08	10
	Unit 4: Meaning of Alternating Current etc., Wiring circuit diagrams	22	08	08
	Unit 5: Psychometrics– Composition of air, Human comfort etc.	24	06	08
	Unit 6: Applications of Air Conditioning, Measurement of air velocity and flow	22	08	07
		<b>Total</b>	<b>160</b>	<b>50</b>
<b>Part C</b>	<b>Practical Work</b>			
	Practical Examination			15
	Written Test			10
	Viva Voce			05
		<b>Total</b>		
<b>Part D</b>	<b>Project Work/Field Visit</b>			
	<b>Practical File/Student Portfolio</b>			10
		<b>Total</b>		
	<b>GRAND TOTAL</b>	<b>260</b>		<b>100</b>

## DETAILED CURRICULUM/TOPICS FOR CLASS XI

### **PART-A: EMPLOYABILITY SKILLS**

<b>S. No.</b>	<b>Units</b>	<b>Duration in Hours</b>
1.	Unit 1: Communication Skills-III	10
2.	Unit 2: Self-management Skills-III	10
3.	Unit 3: Information and Communication Technology Skills-III	10
4.	Unit 4: Entrepreneurial Skills-III	15
5.	Unit 5: Green Skills-III	05
	<b>TOTAL DURATION</b>	<b>50</b>

**NOTE:** For Detailed Curriculum/ Topics to be covered under Part A: Employability Skills can be downloaded from CBSE website.

### **PART-B – SUBJECT SPECIFIC SKILLS**

- ❖ Unit 1: Meaning of Air Conditioning and Refrigeration etc.
- ❖ Unit 2: Vapour Compression Cycle, Working of a Domestic Refrigerators
- ❖ Unit 3: Meaning of Compressors, Compressor construction
- ❖ Unit 4: Meaning of Alternating Current etc. , Wiring circuit diagrams
- ❖ Unit 5: Psychometrics– Composition of air, Human comfort etc.
- ❖ Unit 6: Applications of Air Conditioning, Measurement of air velocity and flow

#### **1. INTRODUCTION:**

Thermodynamics and Its laws, meaning of Air Conditioning and Refrigeration, Brief history of Air Conditioning and Refrigeration, general safety, Application of Refrigeration, Concept of System, its boundary, and surroundings, Unit of Refrigeration, specification and uses of Refrigeration tools, Equipment, Instruments. Basic knowledge of heat energy. Comparison of heat engine, heat pump and refrigeration machine. Rating of Refrigeration Machines & Co-efficient of performance (C.O.P).

#### **2. REFRIGERATION CYCLE AND APPLICATIONS:**

- (i) Vapour Compression Cycle, Representation of Vapour Compression Cycle on temperature– entropy and pressure– enthalpy diagram, Effect of sub-cooling, Super heating, change in suction pressure and discharge pressure on coefficient of performance, Deviation of actual cycle from the theoretical cycle.

- (ii) Working of a Domestic Refrigerator, water cooler & Deep Freezer, Refrigeration tools and materials, tubing, cutting, bending, flaring, joining, swaging, instruments and gauges.

### **3. COMPRESSOR:**

- (i) Meaning of Compressors, Types of compressor-reciprocating (semi-hermetic, hermetic and open types), rotary, centrifugal and screwed type, working of compressor.
- (ii) Compressor construction, valves, piston, connecting rods, crankshafts, seals, oil circulation, hermetic and semi-hermetic units, cooling of windings, Mufflers.

### **4. BASIC ELECTRICITY:**

- (i) Meaning of Alternating current, D.C.Current and difference between them, Voltage, phase difference. Knowledge of Ohm's law and its representation on V-I graph, Resistance and its unit, measurement of current, voltage and power.
- (ii) Wiring circuit diagrams of Refrigerators and Air-Conditioners.

### **5. PSYCHROMETRY AND HUMAN COMFORT:**

- (i) Psychrometry, composition of air, moist air, vapours and gases, specific humidity, absolute humidity, degree of saturation, relative humidity, Dry Bulb Temperature, Wet bulb Temperature, wet bulb depression, Dew point temperature, dew point depression.
- (ii) Human comfort, concept of effective temperature, comfort zone.

### **6. APPLICATION OF AIR CONDITIONING, MEASUREMENT OF AIR VELOCITY AND FLOW:**

- (i) Applications of Air Conditioning, comfort, industrial and process Air Conditioning, study of window type air conditioners, package units, Central Air conditioning plants.
- (ii) Measurement of air velocity and flow.

## PRACTICALS

**Time: 3 Hours**

**Marks: 40**

1. To learn proper techniques of cutting, fitting, reaming, bending, flaring of soft and hard copper Tubing, swaging etc.
2. To learn brazing of copper tubing.
3. To understand the construction and functions of reciprocating compressors, condensers and evaporators.
4. To study a hermetic unit and it's testing.
5. Study of various types of compressors, dismantling and assembling of compressors.
6. Testing of reciprocating compressors.
7. To study Domestic Refrigerator and water cooler.
8. Study of window, split and package type air-conditioner.
9. Charging and testing of Air-Conditioner.
10. Measurement of voltage, current, power etc.
11. Making electric circuit diagrams for refrigerators and Air-conditioner.
12. Study of tools and materials, instruments and gauges.
13. To study the safety measures to be taken in a workshop

## LIST OF EQUIPMENT AND MATERIALS

### List of Equipment used in Air-Conditioning & Refrigeration work-shop:

1. Window type Air-Conditioner
2. Split type Air-Conditioner
3. Refrigerator
4. Water-cooler
5. Deep-freezer
6. Refrigerant charging machine
7. Vacuum-pump
8. Pressure gauge
9. Compound gauge
10. Charging line
11. Shut-off valves

12. Service valves
13. Gauge-manifolds
14. Refrigerant-Cylinders
15. Condensing unit
16. Cut-model of hermetically sealed compressor

**Tools:**

1. Plier
2. Nose-plier
3. Screw Driver
4. Punching-tool
5. Flaring Tool
6. Swaging tool
7. Tube-cutter
8. Tube-bender
9. Wrench set
10. Feeler-gauge
11. Brazing-tool kit.
12. Different sizes of flaring nuts.
13. Allen key set.
14. Thimbles
15. Wire-cutter
16. Spanner-Set
17. Tommy set
18. Bench-Vice
19. Files (Triangular and flat files etc.)
20. Round file
21. Hand Hack-Saw
22. Portable Drill-machine

**Raw-Materials for Air-Conditioning & Refrigeration work-shop:**

1. Different sizes of copper tube (1/4", 3/8", 5/8", 1/2" etc.)
2. Compressor oil.
3. Brazing rods
4. Flux

5. Filler-materials
6. Emery paper
7. Hake-Saw blade
8. Different sizes drills (2mm, 4mm etc.)
9. Refrigerants.

## **CAREER OPPORTUNITIES**

After completing this two year A.C.& Ref. skill course of CBSE at +2 level a student has the following career opportunities:-

1. Student shall be gainfully employed in Domestic, Ice-factory, cold storage plant, specialized A/C units and Refrigerator and A/C manufacturing plants.
2. 'Easy to employ in different government, semi-government and private sector such as:- Public Health, Railways, Hospitality, Health-department, Air-lines and many other engineering departments.
3. They can start their own enterprise by setting up manufacturing or servicing work-shops etc.
4. They can get franchisee of different renowned companies like: - Voltas, Godrej, Samsung, whirlpool etc.
5. More employment opportunities at International level.

## **VERTICAL MOBILITY**

1. Great opportunities for higher study in National &International level.
2. A student can get admitted in 2ndyear of 3 year Engineering Diploma course in the respective field like- Mech. Engg, Electrical Engg. etc. and further in 2ndyear of 4 year B. tech course through lateral entry.
3. A student can get admission in Bachelor of Vocational (B.Voc.) course of 3 year duration in various universities.
4. Also eligible to continue in degree course of academics from various universities.