

Curriculum for HVACR Technician (6 Months)

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Overall Objective of course

This course is about the necessary needs of refrigeration and air conditioning in modern age.

There are some over all objectives of this course, as follows

- 1- Discuss the basic components of refrigeration to complete the basic compression cycle.
- 2- Explain the relationship among pressure, Temperature, Volume, when a refrigerant passes through refrigeration and air conditioning cycle.
- 3- Discuss the different types of commercial HVACR units according to specific need.
- 4- Include both the theory of HVACR and hands on laboratory work.
- 5- Contains all the most recent information and advance that are necessary to prepare the technician for today's world.

Competencies gained after completion of course

The learner will be able to install and repair units ranging in size from small window air conditioners up to large control systems, and also able to install motors, compressors and other components. At the end the learner connects ducts, refrigerant lines and piping, as well as makes power hookups. In the event of breakdown, they find the cause and make repair.

Job Opportunities

The pass outs of this course may find job/employment opportunities in the following sectors/areas:

- 1 Air conditioners manufacturing industry
- 2 Refrigerators manufacturing industry
- 3 Self-employment as HVACR Installation, Service & Troubleshooting Technician for residential, commercial & industrial units
- 4 HVACR sales / service / repair workshops

Curriculum Salient Points:

Course Title	:	HVACR Technician
Entry Level	:	Matric (Preferably Science)
Course Duration	:	6-months
Total Training Hours	:	800 Hours
Training Hours	:	34 Hours per week 6 hours / day (Friday 4 hours)
Training Methodology	:	Practical 80%
	:	Theory 20%
Medium of Instruction	:	Urdu / English

Overview about the Programme – HVACR Technician

Module	Learning Units	Duration (Hours)	Theory (Hours / week)	Practical Hours / week
<p>Module 1. Fundamentals of Refrigeration & Air-conditioning</p> <p>Aim: This module covers the basics of refrigeration & air conditioning including concepts of refrigeration, vapor compression cycle, modes of heat transfer, terms of temperature, basic components of HVACR system and Study & Use of Psychrometric Charts.</p>	<p>LU1: Fundamentals of Refrigeration LU2: Refrigeration Cycle Components LU3: Study & Use of Psychrometric Charts</p>	72	12	60
<p>Module 2. Safety At Work</p> <p>Aim: This module is about understanding the fire hazards at work place in HVACR industry. At the end of this module the learner will be able to understand safety related issues and adopt safety rules and precautions.</p>	<p>LU1: Safety Rules & Procedures for safe work environment LU2: Cause & Prevention from Fire Hazards</p>	34	6	28
<p>Module 3. Technical Mathematics</p> <p>Aim: This module is about the basic mathematical operations required for calculations of physical quantities as applied in HVACR field. He will be able to perform calculations such as load calculations, work, power and electrical load requirements in HVACR work.</p>	<p>LU1: Basic Mathematic Operations LU2: Calculation of Physical Quantities LU3: Energy, Power & Work Calculations LU4: Load Calculation</p>	30	30	0

<p align="center">Module 4. Technical Drawing</p> <p>Aim: This module is related to drawings / job orders used in HVACR field. At the end of this module the learner will be able to read & interpret HVACR symbols & drawings for execution of work.</p>	<p>LU1: Symbols used in HVACR / Electrical drawing (line drawing & wiring diagrams) LU2: Reading & interpretation of symbols / drawings</p>	74	14	60
<p align="center">Module 5. Basic Electrical Fundamentals & Motors.</p> <p>Aim: This module is related to fundamentals of electricity, basic electrical motor theory and controls as used in HVACR work.</p>	<p>LU1: Basic Electricity & Electronics LU2: Alternating Current Generation & Electrical Machines LU3: Basic Electrical Motor Theory LU4: Electrical Controls</p>	106	16	90
<p align="center">Module 6. Introduction to HVACR Tools & Gauges.</p> <p>Aim: This module covers HVACR tools & gauges and their uses for work purposes.</p>	<p>LU1: Common HVACR Hand & Power Tools LU2: Calibration, Use and Service of Pressure Gauges LU3: Measuring Instruments (Voltmeter, Ammeter, Multi-meter, Wattmeter, Air-Velocity Meter, Tong tester / Clipon Meter)</p>	82	12	70
<p align="center">Module 7. Installation, Service & Troubleshooting of Refrigeration Systems.</p> <p>Aim: This module is about installation, service & troubleshooting of refrigeration units of various types and categories used in domestic, commercial and industrial environments.</p>	<p>LU1: Types of Refrigeration Systems LU2: Installation, Service & Troubleshooting of Refrigeration Units</p>	175	30	145

<p>Module 8. Installation, Service & Troubleshooting of Air-conditioning Systems.</p> <p>Aim: This module is about installation, service & troubleshooting of air conditioning units of various types and categories used in domestic, commercial and industrial environments.</p>	<p>LU1: Types of Air Conditioning Systems LU2: Categories of Air Conditioning LU3: Air Distribution Systems (Ducting) LU4: Installation, Service & Troubleshooting of Air Conditioning Units</p>	175	30	145
<p>Module 9. Introduction to HVACR Codes & Standards.</p> <p>Aim: This module covers the various international HVACR codes & references used by HVACR technicians in installation, service & troubleshooting work for safe installation of HVACR systems and their optimum performance.</p>	<p>LU1: Introduction to HVACR Codes for Technicians LU2: Introduction to HVACR Standards (ASHRAE, SMACNA etc)</p>	26	5	21
<p>Module 10. Work Ethics & Management Skills.</p> <p>Aim: This module covers the work ethics & management skills required for an HVACR Technician to help him perform professionally. It includes areas such as personal grooming, customer dealing, communication skills and organization skills required for success in his profession.</p>	<p>LU1: Personal Grooming & Professional Appearance LU2: Workplace Cleanliness (Equipment & Tools) LU3: Work Ethics LU4: Customer Care & Courtesy LU5: Communication Skills LU6: Introduction to Entrepreneurship (setting up of a small HVACR service/repair shop)</p>	26	5	21
	Total:	800	160	640

HVACR Technician Curriculum Contents (Teaching and Learning Guide)

Module 1: Fundamentals of Refrigeration & Air Conditioning

Objective of the Module: This module covers the basics of refrigeration & air conditioning including concepts of refrigeration, vapor compression cycle, modes of heat transfer, terms of temperature, basic components of HVACR system and Study & Use of Psychrometric Charts.

Duration: 72 hours **Theory:** 12 hours **Practice:** 60 hours

Learning Unit	Learning out come	Learning Elements	Duration	Materials Required	Learning Place
LU1. Understand the Fundamentals of Refrigeration	The learner will be able to understand the fundamentals of refrigeration	<ol style="list-style-type: none"> 1. Explain the fundamentals of Refrigeration & Air-conditioning and Vapor Compression Cycle. 2. Explain the terms of heat and modes of heat transfer. 3. Describe Sensible heat, Latent heat, Specific heat. 4. Study & Use of Psychrometric Charts (Dry bulb, wet bulb, dew point temperature and relative humidity) 5. Explain the Gas Laws, Dalton’s law and other related laws of thermodynamics and their importance in refrigeration. 6. Introduction to Temperature scales, instruments and measurements, Absolute and Absolute zero temperature, saturation temperature, conversion of temperatures (c° to F°) & (F° to c°) & (K° to R°) & (R° to K°) 7. Refrigerants and their types & properties. 	24 hr	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab.

<p>LU2 Describe the Basic components of refrigeration cycle and types of systems.</p>	<p>Assemble the basic parts in a refrigeration cycle to get the concept. Understand how refrigerant is used as heat carriers in HVACR cycle.</p>	<p>1. Explain basic components of refrigeration cycle. Also explain how refrigeration has made history and scope with the help of its several types /Basic refrigeration systems</p> <p>Basic components: Compressor, condenser, refrigerant control and evaporator.</p> <p>2. Typical refrigerating cycle systems:</p> <p>Compression system, compound refrigerating system, Multiple refrigerating system, cascade refrigerating system, Modulating refrigeration system and continuous cycle Absorption system. Explain how each component owing to its types is more suitable for various Refrigeration machines.</p> <p>Types of compressor and their parts Reciprocating compressor, Rotary compressor, centrifugal compressor, Scroll compressor, Screw compressor</p> <p>Condenser, Types of condenser: Air cooled condenser, water cool condenser, Evaporative condenser</p> <p>Evaporator Types of evaporator according to construction, temperature, flow and uses.</p> <p>Types of Refrigerants 7-Expain how types of refrigerant have a significant role to create a possible refrigerant effects.</p> <p>Types of refrigerants ;R-12, R-134a , R-502, R-22, R-407a</p> <p>3. Explain the recovery and recycling of CFC refrigerants.</p> <p>Types of refrigerant control:</p>	<p>24 hr</p>	<p>Models Wall Charts Multimedia White board Stationary Relevant data</p>	<p>Class Room/Lab</p>
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		Hand expansion valves, Automatic expansion valves, Thermostatic expansion valve, Capillary tubs, low pressure float control, High pressure float control			
LU3 Study & Use of Psychrometric Charts	Learner will be able to study & use psychrometric charts	Study & demonstration of the Psychrometric charts. dry bulb temperature wet bulb temperature. dew point temperature Relative Humidity. etc	24		

Module 2: Title. Safety at work

Objective of the Module: This module is about understanding the fire hazards at work place in HVACR industry. At the end of this module the learner will be able to understand safety related issues and adopt safety rules and precautions.

Duration: 34 hours **Theory:** 6 hours **Practice:** 28 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1 Understand safety rules and procedures for safe working environment LU2: Understand the causes & prevention of fire from use of material, (hazardous chemicals) at HVACR work place.	To promote safe working environment to avoid incidents.	1. State of the general hazards at work place especially with reference to HVACR industry. Also explain responsibilities of employers and employees for creating and maintaining a safe working environment. 2. List various types of safety equipment for use at workplace (personal protective equipment etc)	34	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab
		3. Explain the causes & prevention of fire with reference to hazardous chemicals used in HVACR work. causes of Fire: Heat, Fuel, Oxygen. Types of sources: Wood, Paper, hazardous / flammable chemicals used in HVACR, Oil/spirit, electrical. 4. Identify the appropriate basic first aid treatment in case of accident such as Treatment of Shock, Electrical Shock, Bleeding, Breaks to Bones, Miner Burns, Resuscitation, poisoning, eye Injuries.		Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab
		5. State the essential contents of a first aid box. Contents: bandages. Plasters, eye baht. Anti-septic. Sling. Simulations: wood/paper. Oil/spirit, electrical tweezers, scissors.		Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab

	To demonstrate how to keep away from the victims from dangerous place.	<p>1. Identify the types of fire-fighting equipment and there uses.</p> <p>Equipment: fire extinguishers (water. co. Foam .Powder). sand / water, bucket, blanket, fire hose uses. Wood/paper. Oil/spirit, electrical.</p>		<p>Models Wall Charts Multimedia White board Stationary Relevant data</p>	Class Room/Lab
		<p>2. Identify types of fire evacuation</p> <p>Means of escape assembly points.</p>		<p>Models Wall Charts Multimedia White board Stationary Relevant data</p>	Class Room/Lab Work shop
		<p>3. Describe emergency procedures.</p> <p>Procedures: Rising. Alarms. Alarms types. Safe/efficient evacuation. Means of escape assembly points.</p> <p>Emergencies: fire drill. Bomb warning</p>		<p>Models Wall Charts Multimedia White board Stationary Relevant data</p>	Class Room/Lab

Module 3: Title: Technical Mathematics

Objective of the Module: This module is about the basic mathematical operations required for calculations of physical quantities as applied in HVACR field. He will be able to perform calculations such as load calculations, work, power and electrical load requirements in HVACR work.

Duration: 30 hours **Theory:** 30 hours **Practice:** 0 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Basic mathematic operations	To understand basic mathematical terms for use in HVACR calculations	Introduction to basic mathematical operations, Whole Numbers, fractions, decimal fractions.	5hr	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab
LU 2: Calculation of Physical quantities & measurement units	To understand the measurement of various physical quantities	<ol style="list-style-type: none"> 1. Measurement of length, area, volume, weight, angles, pressure, temperature etc. 2. Definition of polygon, circumference, diameter formulae for calculating circumference, diameter of circle, circle area and cylinders 3. Introduction to various systems of units used in HVACR 	10hr	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab
LU3: Calculation of Energy, Work & Power	To understand Work, Power and Energy calculations	<ol style="list-style-type: none"> 1. Definition of work & power 2. Horse power 3. Electrical power 4. Electrical horsepower efficiency 5. Solution of problems on the above related to HVACR (area & volume calculation) 	5hr		

LU 4: Basic Heating / Cooling Load calculations	To understand basic heating / cooling load calculations	<ol style="list-style-type: none"> 1. Cooling load calculations 2. Heating load calculations 3. Factors affecting heating / cooling load calculations in a given environment. 	10hr	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab
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Module 4: Title: Technical drawing

Objective of the Module: This module is related to drawings / job orders used in HVACR field. At the end of this module the learner will be able to read & interpret HVACR symbols & drawings for execution of work.

Duration: 74 hours **Theory:** 14 hours **Practice:** 60 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Understand symbols used in HVACR and Electrical drawing (line drawing & wiring diagrams)	The learner will be able to understand & draw the HVACR drawings and circuits using the appropriate symbols	<p>Refrigeration & Electrical symbols:</p> <p>Compressor, Condenser, Refrigerant Control, Valves and Evaporators etc. Refrigeration Cycle Line Diagram, Electrical / Mechanical Accessories & line diagrams.</p> <p>Series circuit, Parallel circuit, Series parallel To demonstrate various circuits on test Board.</p>	50hrs	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab
LU2: Study & Interpret HVACR Drawings	The learner will be able to read and interpret HVACR drawings	<p>Electrical Wiring diagram practice for:</p> <p>Direct cool refrigerator, Non frost refrigerator, Water cooler, Window A/C, Split A/C unit etc.</p>	24hrs	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab

Module 5: Title: Applied Electricity & Motors Fundamentals

Objective of the Module: This module is related to fundamentals of electricity, basic electrical motor theory and controls as used in HVACR work.

Duration: 106 hours **Theory:** 16 hours **Practice:** 90 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: To understand fundamentals of electricity & electronics.	The learner will be able to understand terms of electricity.	<ol style="list-style-type: none"> 1. Basic Electrical Theory & Electronics 2. Ohm's Law 3. resistor, Inductor & Capacitor 4. Circuit schematic and symbols 5. Series & Parallel circuit use in HVACR 6. Conducting & Insulating Materials 	106 hr	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab.
LU2: Alternating current generation & Electrical Machines	To understand Alternating Current production & Application specially to the devices utilized in HVACR systems	<ol style="list-style-type: none"> 1. Magnetism & AC generation 2. Resistive, Inductive & capacitive loads 3. Impedance & Power distribution 4. Transformers 		Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab.
LU3: Basic Electrical Motor Theory	Understand basic electrical motor theory	<ol style="list-style-type: none"> 1. Basic Electrical motor theory 2. Different t types of electric motors used in HVACR (Open, Hermetic, Capacitive, Three-phase) 3. Applications of Electric Motors 4. Diagnosis and replacing the electrical motors 		Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab.
LU4: Electrical controls in HVACR	Will be able to understand electrical control equipment	<ol style="list-style-type: none"> 1. Control Methods (Temperature & Pressure) 2. Heating & Cooling Thermostats 3. Relays 4. Contractors / Starters with protection 5. Power wiring 6. Electrical circuit diagrams 			

Module 6: Title. HVACR Tools and Gauges

Objective of the Module: This module covers HVACR tools & gauges and their uses for work purposes.

Duration: 82 hours **Theory:** 12 hours **Practice:** 70 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Introduction to various hand tools HVACR	The learner will be able to understand the various types of HVACR hand & power tools	<ol style="list-style-type: none"> 1. Introduction and use of hand tools in HVACR 2. Introduction & use of power tools in HVACR 	30hr	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab
LU2: Introduction to Pressure Gauges used in HVACR	Understand the use & calibration of various types of Pressure Gauges in HVACR	<ol style="list-style-type: none"> 1. Explain how to use different gauges to maintain the pressure level of refrigerant in various units 2. Introduction to calibration of pressure gauges <p>Types of Pressure Gauges, Gauge manifold, high pressure gauges, low pressure gauges, compound gauges</p>	30hrs	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab
LU3: Introduction to HVACR measuring instruments	Learner will be able to use various types of measuring instruments	Types & uses of measuring instruments in HVACR such as Voltmeter, Ammeter, Multimeter etc.	22hrs		

Module 7: Installation, Service & Troubleshooting of Refrigeration Systems

Objective of the Module: This module is about installation, service & troubleshooting of refrigeration units of various types and categories used in domestic, commercial and industrial environments.

Duration: 175 hours **Theory:** 30 hours **Practice:** 145 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1.Types of Refrigeration units	Learner will be able to understand various types of refrigeration units	1. Types of refrigeration units in domestic, commercial and industrial environment (Cabinet, deep-freezers, refrigerators etc.)	75hrs	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab
LU2 Installation, service & troubleshooting of Refrigeration units	Understand the installation, service & troubleshooting procedures of different types of refrigerating units	1. Installation procedure of different types of refrigeration units including tubing & fitting etc. 2. Service procedure of different types of units / components 3. Troubleshooting of refrigeration units (domestic, commercial and industrial units)	100hrs	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab

Module 8: Installation, Service & Troubleshooting of Air conditioning Systems

Objective of the Module: This module is about installation, service & troubleshooting of air conditioning units of various types and categories used in domestic, commercial and industrial environments.

Duration: 175 hours **Theory:** 30 hours **Practice:** 145 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Types of Air Conditioning units	Learner will be able to understand various types of refrigeration units	1. Types of refrigeration units in domestic, commercial and industrial environment (Cabinet, deep-freezers, refrigerators etc.)	50hrs	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab
LU2: Classification & categories of Air conditioning Systems	Learner will be able to understand different types of Air Conditioning units and systems	1. Absorption system of Air conditioning 2. All Air Systems 3. All water system 4. Air-water system 5. Window A/c 6. Split A/c 7. Ductable Split A/c 8. Variable Refrigerant Volume (VRV) and Variable refrigerant Flow (VRF) 9. Ductable Package A/c 10. Central Plant Chiller systems	50hrs		
LU3: Air Distribution Systems (Ducting)	Learner will be able to understand ducting system for air distribution	1. Duct definition & terminology 2. Finding duct size for given application 3. Basic Sheet metal working for ducting 4. Duct Materials & Insulation materials used in HVACR	20 hrs		

LU4. Installation, service & troubleshooting of Refrigeration units	Understand the installation, service & troubleshooting procedures of different types of refrigerating units	<ol style="list-style-type: none"> 1. Installation procedure of different types of air conditioning units Including tubing & fitting etc. 2. Service procedure of different types of units / components 3. Troubleshooting of Air conditioning units (domestic, commercial and industrial units) 	55hrs	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab
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Module 9: Title. Use of HVACR Codes & Standards

Objective of the Module: This module covers the various international HVACR codes & references used by HVACR technicians in installation, service & troubleshooting work for safe installation of HVACR systems and their optimum performance.

Duration: 26 hours **Theory:** 5 hours **Practice:** 21 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Introduction & use of International HVACR codes reference for HVACR Technician	Learner will be able to use international HVACR codes reference for HVACR technicians used worldwide in installation, service and troubleshooting work. Demonstrate the abilities learned in this module through presentations.	<ol style="list-style-type: none"> 1. Introduction to HVACR codes (building codes, mechanical, electrical and plumbing codes etc.) 2. Use of HVACR codes for technician work 	10 hrs	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab
LU2: Introduction to HVACR Standards	Learner will be introduced to HVACR standards for use in technician work. Demonstrate the abilities learned in this module through presentations.	Introduction & use of HVACR standards for HVACR technicians (such as ASHRAE, SMACNA etc.)	16 hrs	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab

Module 10: Title. Work Ethics & Management Skills

Objective of the Module: This module covers the work ethics & management skills required for an HVACR Technician to help him perform professionally. It includes areas such as personal grooming, customer dealing, communication skills and organization skills required for success in his profession.

Duration: 26 hours **Theory:** 5 hours **Practice:** 21 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Personal Grooming & Professional Appearance	Learner will be able to adopt procedures for personal grooming & professional appearance required for success in the profession	<ol style="list-style-type: none"> 1. Basics of personal grooming 2. Basics & Importance of professional appearance 	3hrs	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab
LU2: Workplace cleanliness (equipment & tools)	Learner will be able to adopt procedures for ensuring cleanliness of equipment & tools	<ol style="list-style-type: none"> 1. Procedures for cleanliness of equipment & tools 2. Procedures for cleanliness of workplace. 	3hrs	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab
LU3: Work Ethics	Learner will be able to apply basics of work ethics	Basics of work ethics, use and importance in workplace, and organizational skills.	5hrs	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab
LU4: Customer Care	Learner will be able to maintain fruitful customer relationship for success in the profession. Demonstrate the abilities learned in this module through presentations.	<ol style="list-style-type: none"> 1. Introduction to customer service 2. Types of customers 3. Handling customer complaints 	5hrs	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab

LU5: Communication Skills	Learner will be able to communicate effectively in his professional & personal life. Demonstrate the abilities learned in this module through presentations.	<ol style="list-style-type: none"> 1. Basics & importance of communication skills 2. Types of communication skills 3. Use of different type of communication in workplace for taking work orders, customer complaints etc. 	5hrs	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab
LU6: Introduction to Entrepreneurship with reference to setting up a small HVACR service / repair workshop	Learner will be able to grasp the basic concept of entrepreneurship and setting up a small business related to his field. Demonstrate the abilities learned in this module through presentations.	<ol style="list-style-type: none"> 1. Basics of entrepreneurship 2. Basic requirements of setting up a small HVACR service/repair workshop 	5hrs	Models Wall Charts Multimedia White board Stationary Relevant data	Class Room/Lab

List of Tools, Machinery / Equipment

(Recommended for a class of 25 students)

Name of Course	HVACR Technician
Duration	6-month Course

Sr. No.	Name of Items	Quantity
1.	Tube cutter	1 No.
2.	Pinch off tools	2 Nos.
3.	Hack saw	5 Nos.
4.	Chisels	5 Nos.
5.	Pliers	5 Nos.
6.	Snipers	2 Nos.
7.	Calipers	5 Nos.
8.	Measuring taps	5 Nos.
9.	Packing gland wrench	1 No.
10.	Electric hand drills	1 No.
11.	Multimeters	2 Nos.
12.	Absolute vacuum pump (2 cfm)	1 No.
13.	Pulley pullers	1 No.
14.	Taps, dies and reamer	1 No.
15.	Tachometer	1 No.
16.	Clamp on meter	1 No.
17.	Lab with work tables	1 No.

18.	Flaring tools	5 Nos.
19.	Tube benders (Pulley & Spring type)	5 Nos.
20.	Files sets (Flat, Half round , Round, tri-angle & square)	5 Nos.
21.	Hollow punch set	5 Nos.
22.	Spanners set, Double end type (mm & Inches type)	5 Nos.
23.	Pipe wrench 12"	5 Nos.
24.	Scissors	5 Nos.
25.	Wire brushers	5 Nos.
26.	Ratchet spanners(wrench)	5 Nos.
27.	Soldering Iron (75 Watt)	1 No.
28.	Thermometers(Fahrenheit & Celsius)	5 Nos.
29.	Amp meters	5 Nos.
30.	1000 volt magger (insulation tester)	1 No.
31.	Pressure gauges (High pressure & compound gauge)	5 Nos.
32.	Pipe cutter	5 Nos.
33.	Leak detectors I. Electronic II. Halide torch	1each
33 A	Humidistat (digital + ordinary)	1 No.
34.	Gas charging station	1 No.
35.	Air conditioners (user) (windows type)	1 No.
36.	Air velocity meters	2 Nos.
37.	Swaging tools (Hammering types)	5 Nos.
38.	Reamers	5 Nos.
39.	Hammers (500 Gms.)	5 Nos.

40.	Screw drivers kit	5 Nos.
41.	Socket Spanner set (mm & inches size)	5 Nos.
42.	Allen key set (mm & Standard size)	5 Nos.
43.	Dividers	5 Nos.
44.	Scroll & Screw type Compressor	1 Each
45.	Prototype Absorption Chiller VAV Control	1 No.
46.	Different Types of Air filter For AHU	1 No.
47.	Insulation tester/mugger	5 Nos.
48.	Leak testing apparatus(Electronic leak detector)	2 Nos.
49.	Gauge Manifold & charging station for HFC	1 No.
50.	Absorption Refrigerator	1 No.
51.	Package Type AC Unit (5 ton)	1 No.
52.	Techo-meter	5 Nos.
53.	Sling Psycho meter (Hygrometer)	1 No.
54.	Capillary tube cleaner	5 Nos.
55.	Manometer for Air Velocity	5 Nos.
56.	Oil pressure switch	5 Nos.
57.	Fins straightening comb.	2 Nos.
58.	Sprit level	2 Nos.
59.	Capacitor Analyzer	1 No.

Reference Books

1. **Modern Refrigeration & Air Conditioning** By Athous Tranquest And Good Heart
2. **Principles of Refrigeration** By R.J Dossat
3. **Refrigeration & Air Conditioning Practice** By Billy C. Langelly
4. **Trane Air Conditioning Manual** By Trane Company USA
5. **Air-conditioning Manual** by Carrier Company
6. **ASHRAE Handbook**
7. **DEWALT HVACR Code Reference Book**

NAME OF CURRICULUM DEVELOPER

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