GOVERNMENT OF THE PUNJAB

TECHNICAL EDUCATION & VOCATIONAL TRAINING AUTHORITY

CURRICULUM FOR

HEATING VENTILATION AIR CONDITIONING & REFRIGERATION

(6 – Months Course)

Revised April 2016

APPROVED
Date: 7-4-16
Sign:

CURRICULUM SECTION

ACADEMICS DEPARTMENT

96-H, GULBERG-II, LAHORE

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TRAINING OBJECTIVES

This curriculum of six months duration is developed keeping in view the local job market demand by more focusing on practical training along with necessarily required theoretical knowledge.

There, the trained & skillful persons play a vital role in the modern era of the growth because of the increase of technological development all over the world.

This curriculum covers the major topics of work safety, fundamentals of electricity & refrigeration, measuring instruments used for electricity, pressure and Temperature. Installation, operation, troubleshooting, repairing & maintenance of domestic and small commercial refrigeration and air conditioning units along with work ethics in order to produce the honest and skillful workforce to meet the present & future demands of the market.

CURRICULUM SALIENT

Entry Level	:	Middle preferably Matric
Duration of course	:	06 - Months
Total Training Hours	:	800 Contact Hours
Training Methodology	:	Practical 80%
	:	Theory 20%
Medium of Instruction	:	Urdu / English

SKILL COMPETENCY DETAILS

On successful completion of the course, the trainee must be able to:

1. Apply work safety.
2. Select, use, clean, maintain and store the hand tools properly.
3. Adjust, use, read, clean and store the electricity, pressure and temperature measuring equipment accurately.
4. Adjust, use and maintain the gas welding equipment.
5. Carry out copper piping operation (cutting, reaming, bending, swaging, flaring, soldering, brazing etc.)
6. Carry out electrical wiring of refrigeration and air conditioning equipment.
7. Install, operate, troubleshoot, repair, service and maintain the domestic and small commercial refrigeration and air conditioning units especially as under.
   - Refrigerators (Direct Cool & Non Frost)
   - Electric Water Cooler & Deep Freezers
   - Domestic Air conditioners (window type)
   - Split Air conditioners
   - Split Air conditioners (DC Inverter)

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KNOWLEDGE PROFICIENCY DETAILS

On successful completion of this course, the trainee must be able to: -

1. Understand the work safety
2. Identify and describe the function of HVACR technician's tools and equipment as well as electricity, pressure and temperature measuring equipment
3. Express the fundamentals of electricity
4. Express the electrical circuits and their properties
5. Describe the capacitor (running, starting and fan capacitor)
6. Describe the transformers
7. Explain the fundamentals of refrigeration & refrigeration cycle
8. Explain the compressor
9. Define the condenser
10. Define the refrigerant controls
11. Define the evaporators
12. Define the fans & ducts
13. Describe the refrigerants (CFC / HCFC / HFC)
14. Describe the Basic theory, symbols, characteristics and working principles of:
    - Over loads
    - Relays
    - Thermostat
    - Capacitors
    - Selector switches
15. Describe laws of refrigeration
16. Define the air conditioning and working principle of air-conditioner
17. Express the basic working principles of split air-conditioner
18. Explain the fault-finding and troubleshooting techniques of refrigeration and air conditioning units

SCHEME OF STUDIES

Heating Ventilation Air-Conditioning & Refrigeration

(6 - Months Course)

S. No.	Main Topics	Theory Hours	Practical Hours	Total Hours
1.	Workshop Practice	10	70	80
2.	Measuring & Pipe Fitting	8	40	48
3.	Welding	10	40	50
4.	Basic electricity	11	45	56
5.	Electric Motor, transformer& capacitor	8	40	48
6.	Fundamental of Refrigeration	15	60	75
7.	Refrigeration Cycle	20	145	165
8.	Air Conditioning	18	120	138
9.	Technical Mathematics	10	-	10
10.	Technical Drawing	10	-	10
11.	I.T Fundamentals	8	32	40
12.	Functional English	16	64	80
Total		**144**	**656**	**800**

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DETAIL OF COURSE CONTENTS

Heat Ventilation Air-Conditioning & Refrigeration

(6- Months Course)

Sr. No.	Detail of Topics	Theory Hours	Practical Hours
1.	**Workshop Practice**	10	70
	1.1. Introduction (Workshop, Work Place, Tools)		
	1.1.1. Order of workplace		
	1.1.2. Introduction of general tools used in the metal workshop, their care and proper use		
	1.1.3. Safety precautions		
	1.2. Measuring (General Introduction)		
	1.2.1. Importance of measuring		
	1.2.2. Accuracy of measuring		
	1.2.3. Linear measuring (steel rules, micrometer, vernier calipers)		
	1.2.4. Types of Measuring Tools		
	1.2.5. Care & Maintenance of Measuring tools		
	1.3. Marking		
	1.3.1. Purpose of marking		
	1.3.2. Common marking tools (scriber, steel rule, & centre punch)		
	1.4. Filing		
	1.4.1. Process of filing		
	1.4.2. Types of files with regards to cut and shape		
	1.5. Sawing		
	1.5.1. Cutting principle (rake angle)		
	1.5.2. The saw blade (pitch of teeth, setting of teeth and tightening the blade)		

	1.6. Drilling 1.6.1. Drilling of holes (effect of movements of the drill, cutting process) 1.6.2. Main parts of drill (their name and function) 1.6.3. Clamping and removing of twist drills 1.6.4. Drilling faults **1.7. Reaming** 1.7.1. Purpose and process of reaming 1.7.2. Types of reamers **1.8. Counter Sinking and Counter boring** 1.8.1. Counter sinking tools, purpose and procedure 1.8.2. Size / No. of Counter bore **1.9. Filing Exercise – I** 1.9.1. Filing of Channel **1.10. Marking Exercise** 1.10.1. Flat Filing 1.10.2. Marking 1.10.3. Centre Punching **1.11. Filing Exercise – II** 1.11.1. Flat Filing 1.11.2. Square Filing **1.12. Sawing Exercise** 1.12.1. Sawing and Square Filing within size **1.13. Sheet Metal Box – I** 1.13.1. Filing 1.13.2. Marking 1.13.3. Shearing **1.14. Drilling Exercise** 1.14.1. Marking 1.14.2. Center Punching 1.14.3. Drilling		

	1.14.4. De burring		
2.	**Measuring, Pipe Fitting**		
	2.1. Purpose of measuring	8	40
	2.2. Measuring by steel rule, vernier calipers		
	2.3. Use of micrometer, standard wire gauge		
	2.4. Units of length and angle		
	2.5. Marking		
	2.5.1. Marking Tools		
	2.5.2. Method of marking		
	2.6. Cutting		
	2.6.1. Cutting Principles		
	2.6.2. Types of chisels and hand shears and their use		
	2.7. Pipe Fitting		
	2.7.1. Types of Pipes and material		
	2.7.2. Pipe wrenches and dies		
	2.7.3. Types of pipe fitting, cutting and threading		
	2.8. Use of hand tools and safety precautions		
	2.9. Purpose of measuring		
	2.10. Accuracy of measuring		
	2.11. Measuring with steel rule, standard wire gauge and micrometer		
	2.12. Use of marking tools		
	2.13. Methods of marking		
	2.14. Use of chisels and hand shears		
	2.15. Types of files		
	2.16. Use of File (Cuts and shapes)		
	2.17. Cutting and notches of pipe		
	2.18. Types of pipe and materials		
	2.19. Use of pipes wrenches and dies		
	2.19.1. Making of pipe fitting, cutting and threading		

3.	**Welding** 3.1. Introduction of welding 3.2. Welding Tools and Equipments 3.3. Types of welding (Arc and gas welding) 3.4. Introduction of gases used in gas welding 3.5. Types of flames 3.6. Preparation of flames 3.7. Joining of copper tubes of equal and unequal sizes with gas welding	10	40
4.	**Basic Electricity & Electronics** **4.1 Basic Electricity** 4.1.1 Introduction of Electricity 4.1.2 Structure of Atom and their particles 4.1.3 Definition of Electric Current, 4.1.4 Types of Current 4.1.5 Conductors, Semi conductors and insulators 4.1.6 First aid and treatment for electric shock 4.1.7 Circuits 4.1.8 Introduction of current, volt and resistance and their units 4.1.9 Ohm's law 4.1.10 Resistance depends on, material, length, cross section area and temperature 4.1.11 Series circuit, parallel circuit 4.1.12 Series and parallel circuit 4.1.13 Power and Energy 4.2 **Basic Electronics** 4.2.1 Introduction of Electronics. 4.2.2 Carbon Resistance. 4.2.3 Color Coding of Resistance 4.2.4 Diode.	11	45

	4.2.5 Bridge Rectifier 4.2.6 Light Emitting Diode **4.3 Semi Conductor** 4.3.1 N-Type semi conductor. 4.3.2 P-Type semi conductor. **4.4 Transistor** 4.4.1 P-N-P Transistor 4.4.2 N-P-N Transistor 4.5 Use of Ampere meter 4.6 Use of voltmeter 4.7 Use of multimeter 4.8 Use of watt meter 4.9 Measuring of power by different method 4.10 Use of clamp on ammeter 4.11 Making series connection, parallel and series, parallel connection. 4.12 Checking of Carbon Resistance 4.13 Checking of Diode 4.14 Checking of Semi Conductor 4.15 Checking of Transistor 4.16 Checking of Capacitor		
5.	**Electric Motor, Transformer and Capacitor** **5.1 Electric Motor** 5.1.1 Definition 5.1.2 Types of AC / DC Motor 5.1.3 Construction of AC Motor 5.1.4 Single Phase Motor (AC) 5.1.5 Kinds of single phase motor 5.1.6 Split phase induction motor 5.1.7 Capacitor start motor 5.1.8 Capacitor start and run motor 5.1.9 Shaded pole motor 5.1.10 Introduction of three phase motor	8	40

	5.1.11 Opening and assembling of AC single phase motor 5.1.12 Complete the wiring diagram of split phase induction motor 5.1.13 Making connection of capacitor start motor 5.1.14 Making connection of capacitor start capacitor run motor 5.1.15 Connection of shaded pole motor 5.1.16 Use of shop down, step up and Auto Transformer **5.2 Transformer** 5.2.1 Construction of transformer 5.2.2 Types of transformer 5.2.3 Measuring of transformer output 5.2.4 Methods of capacitors checking **5.3 Capacitor** 5.3.1 Electric Field 5.3.2 Die Electric 5.3.3 Capacitance 5.3.4 Types of capacitor 5.3.5 Capacitors connection in series and parallel 5.3.6 Checking of capacitor with multimeter 5.3.7 Checking of capacitor with series test board 5.3.8 Use of capacitor analyzer		
6.	6 **Fundamentals of Refrigeration** 6.1 Introduction of refrigeration 6.2 Definition of refrigeration 6.3 Scope of refrigeration 6.4 Types of refrigeration 6.5 Mechanical refrigeration	15	60

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	6.6 Heat 6.6.1 Definition of heat 6.6.2 Sensible heat 6.6.3 Latent heat 6.6.4 Units of heat 6.6.5 Heat transfer methods **6.7 Temperature** 6.7.1 Definition and measurement of temperature 6.7.2 Absolute zero temperature 6.7.3 Temperature scales and its measurement. **6.8 Pressure** 6.8.1 Definition and measurement devices 6.8.2 Atmospheric, gauge and absolute pressure 6.8.3 Vacuum , temperature 6.8.4 Dalton law of partial pressure 6.8.5 Pascal's law 6.8.6 Boyle's law 6.8.7 Charles law 6.8.8 Gas Law 6.9 Introduction of Brass Fitting 6.10 Introduction of Copper Fitting and Copper Pipe sizing. 6.11 Flaring of copper Tube 6.12 Use of Flaring and swaging Tools. 6.13 Swaging of Copper Tube. 6.14 Use of Bending Tools (Spring Type and lever Type Bender). 6.15 Bending of Tube. 6.16 Cutting of Capillary Tube and sizing.		
7.	**7 Refrigeration Cycle**		

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	7.1 **Principles of refrigeration.** 7.1.1 Laws of thermodynamics. 7.1.2 Laws of refrigeration. 7.1.3 Basic mechanical refrigeration cycle. **7.2 Compressor** 7.2.1 Definition of compressor. 7.2.2 Types of compressor. 7.2.3 Reciprocating compressor and its parts 7.2.4 Rotary compressor and its parts. 7.2.5 Centrifugal comp and screw type comp 7.2.6 Opening of sealed type compressor 7.2.7 Identification of compressor parts (reciprocating type, rotary type and screw type compressor) 7.2.8 Overhauling and assembling of reciprocating compressor 7.2.9 Overhauling and assembling of rotary type compressor 7.2.10 Overhauling and assembling of screw type compressor 7.2.11 Introduction and identification of centrifugal compressor 7.2.12 Making of gas kit / head plate and valve plate 7.2.13 Air gap adjustment / Rotor and stator 7.2.14 Checking of terminals (compressors and motor) **7.3 Condenser** 7.3.1 Definition 7.3.2 Types of condenser 7.3.3 Servicing of air and water cooled condenser. 7.3.4 Servicing of evaporative air and water	20	145

	cooled condenser and their installation **7.4 Refrigerant control** 7.4.1 Definition 7.4.2 Types of refrigerant control 7.4.3 Automatic Expansion Value (AEV), Thermostatic Expansion Valve (TEV) 7.4.4 Capillary tube, 7.4.5 Low side Float Valve and High Side Float Valve **7.5 Evaporator** 7.5.1 Definition 7.5.2 Types of Evaporators according to construction 7.5.3 Types of evaporators according to temp. 7.5.4 Servicing and installation of electric water cooler & air cooled evaporator 7.5.5 Installation of electric water cooler **7.6 Relays** 7.6.1 Identification of current relay and its checking. 7.6.2 Checking of electronic relay. 7.6.3 Checking of hot wire relay 7.6.4 Checking of potential relay 7.6.5 Identification, Definition and checking of over load. **7.7 Thermostat.** 7.7.1 Purpose of thermostat and its checking **7.8 Pressure switches** 7.8.1 Description, identification and checking of pressure switches **7.9 Water cooler**		

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	7.9.1 Function of water cooler and its electric wiring. **7.10 Refrigerator & Deep Freezer** 7.10.1 Electric wiring of direct cool refrigerator, Non frost refrigerator 7.10.2 Electric wiring of deep freezer and water cooler. **7.11 Gauges** 7.11.1 Use of gauge manifold 7.11.2 Gas charging 7.11.3 Leak testing, vacuuming of refrigerator 7.11.4 Gas charging of refrigerator 7.11.5 Gas charging of deep freezer **7.12 Lubricants** 7.12.1 Lubricants and its types. 7.12.2 Oil charging 7.13 Troubleshooting of refrigerator 7.14 Troubleshooting of deep freezer 7.15 Troubleshooting of non frost refrigeration 7.16 Checking of compressor efficiency 7.17 Introduction and making of star delta connection (3 phase motor) 7.18 Checking & installation of defrost timer 7.19 Pump down the refrigeration 7.20 Use of thermometer		
8.	**8 Air Conditioning** 8.1 Fundamental of Air Conditioning 8.1.1 Definition 8.1.2 Types of Air conditioning 8.1.3 Scope of Air conditioning 8.1.4 Psychometric properties of Air	18	120

	8.1.5 Wet Bulb Temp, Dry Bulb Temp, Dew Point Temp, Absolute / Relative Humidity		
	8.1.6 Electric Wiring of window type AC		
	8.1.7 Electric Wiring of Split AC		
	8.1.8 Installation of Window AC		
	8.1.9 Installation of Split AC		
	8.1.10 Gas charging of Window AC		
	8.1.11 Gas charging of split AC		
	8.1.12 Recovery of Refrigerant from a Unit		
	8.1.13 Reclaiming of Refrigerant		
	8.1.14 Recycling of Refrigerant		
	8.1.15 Retrofitting		
	8.1.16 Introduction of ducts		
	8.1.17 Introduction and installation of Air Filter		
	8.1.18 Troubleshooting of Window AC		
	8.1.19 Troubleshooting of Split AC		
	8.1.20 Introduction of Auto Mobile Air Conditioning		
	8.1.21 Introduction of valves		
	8.1.22 Solenoid Valve		
	8.1.23 Hand Expansion valve		
	8.1.24 Service Valve		
	8.1.25 Introduction of refrigeration Accessories		
	8.1.25.1 Muffler		
	8.1.25.2 Moisture Indicator		
	8.1.25.3 Heat Exchanger		
	8.1.25.4 Oil separator		
	8.1.25.5 Accumulator		
	8.1.25.6 Sight glass		
	8.1.25.7 Vibration Absorber		
	8.1.25.8 King valve		

	8.1.25.9 Relief valve 8.1.25.10 Water regulating valve (pressure type) 8.1.25.11 Oil pressure control switch 8.1.25.12 Liquid Receiver 8.1.26 Introduction and use of insulating materials 8.1.27 Principle and working of package type unit **8.2 DC Inverter Air Conditioner** 8.2.1 Introduction 8.2.2 Principle and working of DC Invertor Type Air Conditioner 8.2.3 Accessories 8.2.4 Service and Installation of DC Invertor AC		
9.	**TECHNICAL MATHEMATICS** **9.1. Introduction** **Whole numbers** 9.1.1. Addition and subtraction 9.1.2. Multiplication and division **9.2. Decimal Fractions** 9.2.1. Addition, subtraction 9.2.2. Multiplication, division **9.3. Conversion of Inch to Metric System** 9.3.1. Equivalent of one inch in mm 9.3.2. Conversion of dimensions **9.4. Percentages** 9.4.1. Meaning of percentage 9.4.2. Changing numbers to percents 9.4.3. Changing percents to decimal and	10	

common fractions

9.5. Fractions

9.5.1. Addition, subtraction of common fractions

9.5.2. Proper fractions, improper fractions and mixed numbers

9.5.3. Multiplication and division of fractions

9.6. Decimal System of Measurement

9.6.1. Meter, gram, liter

9.6.2. Multiples and parts of units

9.7. Transposition of Equations

9.7.1. Exchangeable sides of a scale

9.7.2. Addition, Subtraction

9.8. Transposition of Formula

9.8.1. Exercise with simple already known formula

9.8.2. Multiplication and division

9.9. Magnitudes of Current and Voltage

9.9.1. Units and subunits of current, resistance and voltage

MA kA A mA μA

MΩ KΩ Ω mΩ μΩ

MV KV V mV μV

9.10. Ohm's Law

Calculation of current, voltage and resistance

$$I = \frac{V}{R} \quad , \quad V = I \times R$$

$$R = \frac{V}{I}$$

9.11. Resistance of a Wire

9.11.1. Calculation of R, I, A by applying formula:

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	$R = \frac{\rho X l}{A}$ **9.12. Series Connection** 9.12.1. $I_T = I_1 = I_2 = I_3 = \ldots\ldots I_n$ 9.12.2. $V_T = V_1 + V_2 + V_3 + \ldots\ldots V_n$ 9.12.3. $R_T = R_1 + R_2 + R_3 + \ldots\ldots R_n$ **9.13. Parallel Connection** 9.13.1. $V = V_1 = V_2 = V_3 = \ldots\ldots V_n$ 9.13.2. $I = I_1 + I_2 + I_3 + \ldots\ldots I_n$ $1/R = 1/R_1 + 1/R_2 + 1/R_3 \ldots\ldots + 1/R_n$		
10.	**Technical Drawing** **10.1. Introduction to Technical Drawing** 10.1.1. Kinds of lines 10.1.2. Drawing instruments 10.1.3. Lettering exercises **10.2. Symbols** 10.2.1. Electrical Symbol 10.2.2. Refrigeration symbol **10.3. Circuit** 10.3.1. Single Pole Switch Circuit 10.3.2. Two-Way Switch Circuit 10.3.3. Tube light circuit **10.4. Combination of Different Circuits**	10	
	TOTAL	**120**	**560**

LIST OF PRACTICALS

1. Use of hand tools & Safety precautions
2. Use of cutting tools, chisels, hand share, fillers, Drills
3. Process of filling (Cuts and shape)
4. Cutting and Nocher of Pipe
5. Procedure of Drilling
6. Bending Tools
7. Use of bending Machine and rolling machine
8. Use of Hammers and Mallets
9. Pipe Fitting cutting and threading
10. Use of tube cutter, pipe cutter and wire cutters
11. Use of Flaring tools, swaging tools and bending tools
12. Arc & gas welding
13. Joining of Copper Tubes of Equals & unequal sizes with gas welding
14. Basic Electricity
15. Connection of single pole switch with one lamp
16. Series Circuit
17. Parallel Circuit
18. Series and Parallel Circuit
19. Series and Parallel Test Board Circuit
20. Tube Light Connection
21. Use of Volt, Amp and Watt Metter
22. Use of Multi meter
23. Use of Clump on meter
24. Transformer and Capacitor
25. Use of Transformer and measuring of output
26. Checking of capacitor
27. Checking of Carbon Resistance
28. Checking of Diode
29. Checking of Semi Conductor
30. Checking of Transistor
31. Checking of DC Supply
32. Introduction of Brass Fitting

33. Introduction of Copper Fitting and Copper Pipe Sizing
34. Flaring of Tube
35. Swaging of Tube
36. Bending of Tube
37. Cutting of Capillary Tube and Sizing
38. Compressor
39. Opening of Sealed Type Compressor
40. Identification of Compressor Parts (All Types)
41. Overhauling and Assembling of Reciprocating Compressors (Sealed, Open Type, Semi Sealed)
42. Over hauling and assembling of Rotary compressor
43. Over hauling and assembling of screw type compressor
44. Introduction of centrifugal compressor
45. Air Gap adjustment / Rotor and stator
46. Checking of terminals (compressor & motors)
47. Relays
48. Identification of current relay and its checking
49. Checking of Electronic relay
50. Checking of Hot wire relay
51. Checking of Potential relay
52. Overload
53. Identification of Overload and its checking
54. Checking of thermostat
55. Pressure switches
56. Identification of pressure switches and it's checking
57. Electric wiring of single and double door refrigerator
58. Servicing of Air cooled condenser and water cooled condenser
59. Servicing of Evaporator
60. Installation of Air cooled condenser
61. Installation of Evaporator
62. Electric Wiring of Water Cooler
63. Electric Wiring of Deep Freezer
64. Electric Wiring of Non Frost Refrigerator
65. Electric Wiring of Window AC

66. Electric Wiring of Split AC
67. Installation of Window AC
68. Installation of Split AC
69. Lubricants and its types
70. Oil Charging
71. Use of Single compound gauge and gauge manifold
72. Vacuuming of all types of units
73. Leak Testing of refrigerator
74. Leak Testing of Window AC
75. Gas charging of Refrigerator
76. Gas charging of Deep Freezer
77. Gas charging of window AC
78. Gas charging of split AC
79. Recovery of Refrigerant from a Unit
80. Reclaiming of Refrigerant
81. Recycling of Refrigerant
82. Retrofitting
83. Introduction of ducts and its installation
84. Installation and introduction air filters
85. Troubleshooting of Refrigerator
86. Troubleshooting of Window AC
87. Troubleshooting of Split AC
88. Introduction of DC Invertor AC
89. Principle and working of DC Invertor Type Air Conditioner
90. Service and Installation of DC Invertor AC
91. Troubleshooting of Non Frost Refrigerator
92. Troubleshooting of Deep Freezer
93. Introduction of sling Psychrometer
94. Use of Sling Psychrometer
95. Introduction of heat load
96. Pump Down the system
97. Compressor Efficiency
98. Identification and use of defrosting timer
99. Use of tachometer

100. Introduction of valves, Solenoid valve, HEV, service valve
101. Introduction of refrigeration accessories
102. Mufflers
103. Moisture Indicator
104. Heat Exchanger
105. Oil Separator
106. Accumulator
107. Sight Glass
108. Vibration Absorber
109. King Valve
110. Relief Valve
111. Oil Pressure Control
112. Liquid Receiver
113. Introduction & Use of insulating material
114. Introduction and use of heating method
115. Filling of daily log, monthly, annual log sheets
116. Maintenance
117. Types of maintenance
118. Proactive
119. Periodic
120. Breakdown
121. Trouble shooting of split Air Conditioner (DC inverter)
122. Gas charging of split Air Conditioner (DC inverter)

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SCHEME OF STUDIES

I.T. Fundamentals

S.No	Main Topics	Theory Hours	Practical Hours	Total Hours
1.	Introduction to Computers	2	6	8
2.	Typing - Microsoft Word	4	14	18
3.	Internet & Electronic Mail	2	12	14
Total		**8**	**32**	**40**

DETAIL OF COURSE CONTENTS

I.T Fundamentals

S. No	Detail of Topics	Theory Hours	Practical Hours
1	**Introduction to Computers** 1.1 What is a computer- Definition, functions and general features? 1.2 What is Hardware – 1.2.1 Computer parts and units 1.2.1.1 Input Unit - Keyboard, Mouse etc. 1.2.1.2 Central Processing Unit 1.2.1.3 Output Unit 1.3 What is Software – 1.3.1 Electronic Parts of a Pc it is 1.3.1.1 Software and Its types 1.3.1.2 System Software, Application software and its functions 1.4 Working with windows Operating System 1.4.1 How does windows desktops work? 1.4.2 Setting desktop, background and wall papers etc. 1.4.3 Viewing directories – List of files and folders different styles. 1.5 What are the Icons, Shortcuts and other graphic, 1.5.1 How to see computer contents on different drives etc. 1.5.2	2	6
2	**Typing and Word processing (MS Word)** 2.1 Proper way of typing correct and speedy - getting familiar with the keys 2.2 Where to type in computer? How to save a file? How to get it back? Where to find your saved work? 2.3 Formatting in MS Word Bold, Italic, page setup, setting shades and colors. 2.4 Working with saved work, opening and moving files. 2.5 How to get it printed?	4	14

3	**Emailing and Internet Surfing** 3.1 How to go to Internet, what is required for an internet connection etc. 3.2 How to use email? How to search on web? Etc 3.3 How to make new email account, login and logout an email account etc.? 3.4 Downloading and uploading attachments etc.	**2**	**12**
	Total	**8**	**32**

LIST OF PRACTICALS

I.T Fundamentals

S. No.	Name of Practical
1.	Turn On/Off and setting of power supply
2.	Accessing The Desktop
3.	Using of Icons and Shortcuts
4.	Setting / customizing the desktop
5.	Viewing the contents of computer – Directory
6.	Setting the view of a folder
7.	Copying, Deleting and Moving Files in a folder
8.	Working with different Applications
9.	Opening MS Word for typing
10.	First lesson of Typing A S D F
11.	Second Lesson of typing J K L ;
12.	Third Lesson U I O P
13.	Fourth Lesson R E W Q
14.	Fifth Lesson N M , .
15.	Sixth Lesson V C X Z
16.	Seventh Lesson All letter using R index Finger
17.	Eighth Lesson All letter using L index Finger
18.	Formatting in MS Word Bold, Italic etc.
19.	Page Setting/ Page Layout
20.	Using Internet
21.	Opening Email, making new account
22.	Sending Receiving Emails
23.	Downloading and uploading attachments etc.

SCHEME OF STUDIES
Functional English

S.No	Main Topics	Theory Hours	Practical Hours	Total Hours
1.	Use of past indefinite tense	2	6	8
2.	Use of 'was' 'were' ' questions and negatives	3	6	8
3.	Explaining a situations/ analysis	2	6	8
4.	Communication in writing	2	6	8
5.	Comprehension	1	6	7
6.	Application/ C.V.	1	6	7
7.	Dialogues	1	9	10
8.	Understand vocabulary	1	3	4
9.	Writing complaints/ answers to complaints	1	9	10
10.	Interviews	2	7	10
Total		**16**	**64**	**80**

DETAIL OF COURSE CONTENTS
Functional English

S. No	Detail of Topics	Theory Hours	Practical Hours
1	**Use of past indefinite tense** 1.1 Describing past events	2	6
2	**Use of 'was' 'were' ' questions and negatives**	2	6
3	**Explaining a situations/ analysis** 3.1 Making a plan 3.2 Visiting factory area 3.3 Giving justifications	2	6
4	**Communication in writing** 4.1 Asking for list of stationery items 4.2 Submitting report of performance of team of technicians 4.3 Submitting joining report	2	6
5	**Comprehension: practice sets**	2	6
6	**Job application/C.V.**	1	6
7	**Dialogues**	1	9
8	**Understand vocabulary**	1	3
9	**Writing complaints/ answers to complaints**	1	9
10	**Interviews**	2	7
	Total	**16**	**64**

LIST OF PRACTICALS
Functional English

S. No.	Practical
1.	Group discussion
2.	Interviews
3.	Role play

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LIST OF LABS

HVACR

- Basic Lab / Workshop
- Electric Lab / Workshop
- HVACR Lab / Workshop

I.T Fundamentals

- Computer Lab

LIST OF TOOLS & EQUIPMENT'S

(For a Class of 25 Students)

Name of Trade	**HVACR**
Duration of Course	**6 – Months Course**

S. No.	Name of Tools & Equipment	Quantity
1	Absolute Vacuum Pump (2 cfm)	01 No.
2	Absorption Refrigeration Trainer	01 No.
3	Adjustable Wrench 8", 12"	10 Each
4	Air Conditioner Split 01 TR	01 No.
5	Air Conditioner Split 02 TR (Heating & Cooling)	01 No.
6	DC Invertor Air Conditioner Split Type 02 TR	01 No.
7	Air Conditioners Fan Motor (Window)	05 Nos.
8	Air Velocity Meters	02 Nos.
9	Air-Conditioner (Window Type) 1.5 TR	02 Nos.
10	Allen Key Set (mm & Standard Size)	05 Each
11	Arc Welding Plant with Equipment	01 No.
12	Automatic Expansion Valve	05 Nos.
13	Automobile Air Conditioning Trainer	01 No.
14	Bench Vice	25 Nos.
15	Capacitor Analyzer With Tester	01 No.
16	Capillary Tube Cleaner	01 No.
17	Center Punch	5 Nos.
18	Chisels	05 Nos.
19	Clamp On Ammeter	05 Nos.
20	Combination Plier 8"	25 Nos.

21	Compression Refrigeration System Trainer/Domestic Refrigeration Trainer	01 No.
22	Compression System Trainer for Air Conditioning	01 No.
23	Compressor 1 TR Reciprocating & Rotary	02 Each
24	Compressor Test Cord	05 Nos.
25	Condenser ¼ HP for Refrigerators	05 Nos.
26	Cylinder Of Nitrogen Gas with Pressure regulator	02 Nos.
27	Deep Freezer 10 Cubic ft.	01 No.
28	Digital Thermometers	05 Nos.
29	Dividers	05 Nos.
30	Drill Bit Set (Masonry)	10 Sets
31	Drill Machine (Hammering Type)	02 Nos.
32	Drills Bits (Set) (Metal)	10 Sets
33	Electric Dust Blower	02 Nos.
34	Electric Hand Drill Machine	02 Nos.
35	Evaporator ¼ HP for Refrigerators	05 Nos.
36	Fan motor split AC indoor	05 Nos.
37	Fan motor split AC outdoor	05 Nos.
38	Files (Flat)	30 Nos.
39	Files (Half Round , Round, Tri-Angle & Square)	05 Each
40	Filler Gauge 10 Blades	5 Nos.
41	Filler Gauge 13 Blades	5 Nos.
42	Fins Straightening Comb	05 Nos.
43	Fire Fighting System	01 No.
44	Flaring Tools Set	10 Nos.
45	Flat Screw Driver 6", 8", 10"	25 Each.

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46	Gas Charging Adopter	05 Nos.
47	Gas Charging Station	01 Nos.
48	Gauge Manifold	05 Nos.
49	Electric Grinder (Hand)	02 Nos.
50	Electric Grinder (Pedestal)	1 No.
51	Hack Saw Frame	05 Nos.
52	Hammer (Cross Peen, Straight Peen, Ball Peen)	02 Each
53	Hammers (500 Grams)	10 Nos.
54	Hermetic Compressor Opener	01 No.
55	Hollow Punch Set	05 Nos.
56	Humidistat (Digital)	01 No.
57	Leak Detectors; Electronic, Halide Torch	02 Each
58	Electric Line Tester (0-500 V)	25 Nos.
59	Liquid Receiver (Horizontal, Vertical)	01Each
60	Long Nose Plier 6"	25 Nos.
61	Magger (Insulation Tester)	01 No.
62	Mallet (Wooden, Rubber)	5 Each
63	Measuring Tapes (5 m)	05 Nos.
64	Micrometer	5 Nos.
65	Micron Pressure Gauges	01 No.
66	Multi Meter	05 No's
67	Number Punch (10 mm, 6 mm)	2 Sets
68	Oil Separator	01 No.
69	Oxy-Acetylene Cylinder	02 Nos.
70	Panel Mounted Amp Meters And Volt Meter (0 - 500 V) (0 - 30 Amp)	05 Each

71	Phillips Screw Driver 6", 8", 10"	25 Each
72	Piercing Valve	05 Nos.
73	Pinch Off Tool (Plier)	02 Nos.
74	Pipe Cutters (G.I Pipe Cutter)	05 Nos.
75	Pipe Vice	02 Nos.
76	Adjustable Pipe Wrench 10", 12", 18"	02 Each
77	Pressure Gauge (High & Compound)	05 Each
78	Pulley Pullers	02 Nos.
79	Ratchet Wrench	05 Nos.
80	Reamers (For Copper Tubing)	10 Nos.
81	Reciprocating Compressor ¼ HP, 1/5 HP for Refrigeration	02 Each
82	Refrigerant Recovery Unit	01 No.
83	Refrigerators Direct Cool, No Frost, 12 Cubic ft.	01 Each
84	Ring Spanner Set (mm & Inches)	05 Each
85	Riveting Gun	02 Nos.
86	Scissors 6"	05 Nos.
87	Screw & Scroll Type Compressor	01 Each
88	Screw Drivers (Set)	25 Nos.
89	Screw Extractors	02 Set
90	Scriber	5 Nos.
91	Side Cutting Plier 6"	25 Nos.
92	Sight Glass	02 Nos.
93	Sling Psychrometer	02 Nos.
94	Snipers	05 Nos.
95	Socket Spanner Set (mm & Inches)	05 Each

96	Soldering Iron 100 W	05 Nos.
97	Solenoid Valve (2 way & 4 way)	05 Each
98	Spanners Set Double End Type (mm & Inches Type)	05 Each
99	Sprit Level	06 Nos.
100	Steel Rule (12")	25 Nos.
101	Swaging Tools Set (Hammering Type)	10 Sets
102	Taps, Dies And Reamers Set	03 Each
103	Tachometer	02 Nos.
104	Thermostatic Expansion Valve	5 Nos.
105	Three Phase Induction Motor	01 No.
106	Try Square (8")	25 Nos.
107	Tube Benders (Pulley Type & Spring Type)	05 Each.
108	Tube Cutter (Miniature & Large)	10 Each
109	Vernier Calipers	05 Nos.
110	Water Cooler 60 Gallon	01 No.
111	Water Dispenser	01 No.
112	Welding Set Equipment (with Regulator, Pipes, Nozzles & Back Fire Arrester)	01 Set
113	Wire Brushes	05 Nos.

LIST OF FURNITURE

S.No	Name of Articles	Quantity
1.	Working bench	20 No's
2.	Stool	20 No's
3.	Tabulate chairs	20 No's
4.	Instructor Table	01 No.
5.	Instructor Chair Arm Legs	02 Nos.
6.	Office Chain with Arms	02 Nos.
7.	Office Table	1 No.
8.	Steel / Wooden Almirah (Cupboard)	3 Nos.

COMPUTER LAB

S. No.	Tools / Equipment	Quantity
1.	**Desktop computer (Specifications as per notification issued by MIS Section, TEVTA)**	26 (1 for each student & 1 for the teacher)
2.	Printer (Laser)	01
3.	Scanner	01
4.	Internet Connection (At least 1 MB speed)	01
5.	UPS 10 KVA	01
6.	Air Conditioner 1 ½ Ton	02
7.	Multimedia Projector	01

CONSUMABLE MATERIALS

HVACR

S.No	Name of item	For 1 trainee	For 25 trainees
1.	MS flate 1/4 inch	4 inch	8.33 ft
2.	Soft copper tube ¼ inch	8 inch	16.66 ft
3.	Soft copper tube 3/8 inch	6 inch	12.5 ft
4.	Capillary tube 0.036 inch	4 inch	8.33 ft
5.	Oxygen gas		2 cylinder refill
6.	Accitileen gas		1 cylinder refill
7.	Nitrogen gas		1cylinder refill
8.	Soldering rod		250 gram
9.	Brazing rod		250 gram
10.	Welding flux		250 gram
11.	PVC wire 3/29		1 coil
12.	PVC tap		6 no
13.	Fuse 6 Amp		12 no
14.	Single pole switch		12 no
15.	Two pin socket		12 no
16.	Lamp Holder		12 no
17.	Electric board 8x6		12 no
18.	Tube Rod 40 w		5
19.	Choke 40w		5
20.	Starter		5
21.	Connector		10
22.	Voltmeter		5
23.	Ampmeter		5
24.	Watt meter		5
25.	Flexible wire 40/76		1 coil
26.	Bulb 60 w		12
27.	Bulb refrigerator		12
28.	Bulb deep freezer		12
29.	Indication light (red,green)		12
30.	Refrigerator bulb holder		5
31.	Deep freezer bulb holder		5
32.	Door switch		5
33.	Double door switch		5
34.	Female thembols		12 dozen
35.	Current relay(non capacitor)		5
36.	Current relay(capacitor type)		5
37.	Potentional relay		5
38.	PTC relay(electronics)		5
39.	Overload		5
40.	Thermostat (refrigerator)		5
41.	Thermostat(AC)		5
42.	Selector switch(AC)		2
43.	Defrost timer		5
44.	Defrost heater		2

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45.	Defrost termination switch + fuse		2
46.	Defrost fan motor		1
47.	Fan capacitor 5 micro farad		2
48.	Running capacitor 50 micro farad		5
49.	Starting capacitor 80-110 micro farad		54 liter
50.	Compressor oil		18.75 kg
51.	Refrigerator R 134 A	750 gram	75 kg
52.	Refrigerator R 22	3 kg	100 no
53.	Filter drier	4	1
54.	Drill bit set		5
55.	PCB kit remote type (split AC)		5
56.	Gas kit sheet	6 inch	12.5 foot
57.	Door gas kit refrigerator type	6 inch	12.5 foot
58.	Deep freezer		5

Functional English

S. No.	Item	Quantity
1.	Stationary	As per requirement
2.	Board Markers	As per requirement

I.T Fundamentals

S. No.	Item	Quantity
1.	Printing Paper	As per requirement
2.	Printer Toner	As per requirement

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EMPLOYABILITY OF THE PASS-OUTS

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

1 Manufacturing Industry of Refrigeration and Air conditioning equipment.

2 Service providing companies for the installation, operation, repairing and maintenance of Refrigeration and Air Conditioning systems.

3 Sale centers of Refrigeration & Air Conditioning Equipment/Parts

4 Private business

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. TTP – 91 By Development Cell
6. TTP – 92 By Development Cell
7. TTP – 93 By Development Cell
8. TTP – 94 By Development Cell
9. TTP – 95 By Development Cell

Functional English

1. High School English Grammar By Wren & Martin
2. Oxford English Grammar

I.T Fundamentals

1. Introduction to Computer by Peter Norton
2. 2007 Microsoft® Office System Step by Step by Joyce Cox, Steve Lambert and Curtis Frye
3. Internet and E-mail with Windows 7 by Studio Visual Steps

MINIMUM QUALIFICATION OF INSTRUCTOR

HVACR

- DAE in Refrigeration & Air Conditioning Technology with two years experience in the relevant field

OR

- Two Years certificate of HVACR (G-II Level) with six years experience in the relevant field.

Functional English

- M.A (English)

I.T Fundamentals

- DAE CIT/ BCS from HEC recognized university

LIST OF TRADE RELATED JARGON

Ambient Temperature	کسی بھی مشین کے اردگرد کا درجہ حرارت	Ventilation	ہوا کی آمد و رُفت کا اِنتظام
Duct	ہوا کے گزارنے کا الہ	Calibration	تَعیُن کا طَریقہ کار
Scriber	نشان لگانے والا اوزار	Caliper	پیمانش کا آلہ
Knurling	کھردرا پن	Prick punch	چھوٹا سوراخ کرنے کا آلہ
Sledge	ایک قسم کا بڑا ہتھوڑا	Thermal	حرارت سے متعلق
Fusion	پگھلاہٹ کا عمل	Vapor	بُخارات
Conduction	ایصالیت	Emit	خارج کرنا
Compression	دباو	Sensible heat	حرارت حسی
Latent heat	مَخفی حَرارَت	Specific heat	حرارَت نُوعی
Sublimation	ٹھوس کا مائع میں تبدیل ہووے بغیر بخارات میں تبدیل ہو جانا	BTU	حرارت کی اکائی برٹش تھرمل یونٹ
CHU	حرارت کی اکائی سینٹی گریڈ ہیٹ یونٹ	AHU	ایئر ہینڈلنگ یونٹ
Convection	مائع اور گیسوں میں حرارَت کا اِنتقال	Radiation	اشعاع حرارت
Ton of refrigeration	ٹھنڈک کی اکائی	Lubrication	چکنائی
Condensation	عمل تَکثیف	Evaporation	بخارات بنانے کا عمل
Expansion	پھیلانا- سپرے کرنا	Thermostat	درجہ حرارت کو کنٹرول کرنے والا الہ
Frosting	سَردی سے جَمنے والا	Split	حصّے کَرنا
Psychrometer	ہوا کی خصوصیات معلوم کرنے والا الہ	Enthalpy	ہوا میں حرارت کی کُل مقدار
Absorption	ملانے کا عمل	Refrigerant	ٹھنڈک پیدا کرنے والا محلول
Thermal	حرارت سے متعلق	Axial	محوَری
Muffler	آواز روکنے والا الہ	Capillary Tube	باریک قطر والی تانبے کی نالی
Dehydrater	نمی کو خشک کرنے والا آلہ	Brine	پانی اور نمک کا محلول
VRF	ویری ایبل ریفریجرنٹ فلو	Boiler	پانی کو بھاپ میں تبدیل کرنے کی مشین

Vibration	تھرتھراہٹ	Viscosity	گاڑھاپن
Vacuum/ evacuation	ہوا کو خارج کرنے کا عمل	choke	بند ہونا
FCU	فین کوائل یونٹ	Energy	توانائی

Curriculum Revision Committee

1.	**Muhammad Farooq,** Sr. Instructor, GSPCT	**Convener**
2.	**Muhammad Haroon,** Sr. Instructor, GCT Railway Road, Lahore	**Member**