



GOVERNMENT OF TAMILNADU
DIRECTORATE OF TECHNICAL EDUCATION, CHENNAI
STATE PROJECT COORDINATION UNIT
(Established under Canada India Institutional Cooperation Project)
CURRICULUM

Course Name	HEATING VENTILATION AND AIR CONDITIONING
Course Code	ME/2020/003
Course Duration	60 Hours
Minimum Eligibility Criteria	ITI/10th/+2/Diploma/Graduates
Pre-requisites (if any)	Basic knowledge in R & AC
Course Objectives	<p>Training module has been designed to provide the participants to</p> <ul style="list-style-type: none"> • Learn the basic concepts and principles of air conditioning and refrigeration. • Learn the fundamental analysis methodology of air conditioning and refrigeration. • Apply the course knowledge to do a design project of HVAC system. • Identify the routine preventive maintenance tasks to be performed on HVAC units. • Describe the common problems and their causes for HVAC units.
Course Outcomes	<p>At the end of training, the participants will be able to</p> <ul style="list-style-type: none"> • Gain the knowledge of installing air conditioning system • Demonstrate how to read temperature/pressure charts and diagnose problems within the system • Identify and recognize standard symbols and abbreviations • Gain knowledge of the air conditioning system to repair problems • Demonstrate a proper Load Calculation of a structure. • Estimate the cooling load, duct size and energy conservation techniques of air-conditioner • Perform preventive maintenance on various equipment in lab.
Expected Job Roles	Air-conditioner and HVAC service technician

TEACHING AND SCHEME OF EXAMINATIONS						
Course Code	Course Name	Hours		Assessment Marks		Duration of the Examination
ME/2020/003	HEATING VENTILATION AND AIR CONDITIONING	Theory	28	10	20	3 Hours
		Practical	32	40	80	
		Total	60	50	100	

ME/2020/003 - HEATING VENTILATION AND AIR CONDITIONING
DETAILED SYLLABUS

Unit No.	Modules	No. of. Hours	
		Theory	Practical
I	Refrigeration Systems and Refrigeration Equipments	7 Hours	
1.1	Thermodynamic state of a pure substance -Modes of heat transfer- laws of heat transfer	3	
1.2	Mechanisms of Production of cold -Unit of Refrigeration -Types of Refrigeration		
1.3	Reversed Carnot cycle -C.O.P of Heat Engine- Heat pump and Refrigerating Machine		
1.4	Compressor -Condensers-Cooling towers		
1.5	Expansion valve and Evaporators		
1.6	Vapour Compression Refrigeration systems and Vapour Absorption Refrigeration systems		
1.7	Practical: ➤ Dismantle, Identification of various parts and Assembly of Refrigeration Equipments		4
II	Psychrometrics	8 Hours	
2.1	Psychrometry Properties	4	
2.2	Adiabatic saturation of air by evaporation of water-Psychrometric Chart and its uses		
2.3	Sensible heating and cooling-Humidifying and Heating-Dehumidifying and Cooling-Adiabatic Cooling with Humidification		
2.4	Total heating or cooling processes-Sensible heat factor-Bypass factor- Adiabatic mixing- Evaporative cooling		
2.5	Problems on Psychrometric Charts		
2.6	Practical: ➤ Study and analysis of different psychrometric process and its uses.		4
III	Air Conditioning	15 Hours	
3.1	Air-conditioning -Factors controlled in Air-Conditioning	7	
3.2	Types: Window type AC-Split AC system and Package AC system		
3.3	Refrigerants and Brine		
3.4	Centralized AC plant -Direct Expansion System and Water-Cooled System		
3.5	Centralized AC plant -Air handling units- Overload protector -Relay types, high pressure and low pressure cut out		
3.6	Centralized AC plant-Lubrication Oil-Properties and types -Oil charging, leak testing methods and gas charging procedure		
3.7	Maintenance procedure and general troubles in AC System		

3.8	Practical: <ul style="list-style-type: none"> ➤ Identification of various parts controls used in Air-conditioning system. ➤ Maintenance and Repair of various Air-conditioning equipment's 		8
IV	HVAC	15 Hours	
4.1	Introduction to HVAC -Introduction to Codes & Standards	7	
4.2	Heating Ventilation and Air-Conditioning: Codes and standards (ASHRAE, ISHRAE and IMC)		
4.3	Ducts and its types -Duct fittings -Flexible ducts		
4.4	Duct elbows selections -Vanes -dampers and their importance		
4.5	Duct designing methods (manual calculations) using Equal friction/Velocity reduction method		
4.6	Pipe sizing methods-Chilled water pipe sizing- Pump size		
4.7	Introduction to Software's: MACQUAY-HAP-Trane Trace 700		
4.8	Practical: <ul style="list-style-type: none"> ➤ Design of air conditioning ducts using Equal Friction and Velocity Reduction method ➤ Design of Air-conditioner system using HVAC software 		8
V	Heat Load Calculations	15 Hours	
5.1	Heat Load Calculations- Equipment Selection	7	
5.2	Air Distribution System		
5.3	Ventilation & Exhaust Systems		
5.4	Piping-Static Pressure Calculations and Pump Head Calculation		
5.5	Air Conditioning Concepts-Drawing Practices		
5.6	Duct system-distribution system		
5.7	Adding and modifying fittings		
5.8	Practical: <ul style="list-style-type: none"> ➤ Experimental Investigation and Analysis on heating load for design of Air-conditioner. ➤ Experimental Investigation of Piping system, Ventilation & Exhaust system. 		8
Total Theory and Practical hours		28	32
Total hours		60	

HARDWARE REQUIREMENTS

S. No.	List of Tools and Equipments
1	Vapour Compression Refrigeration system experimental setup
2	Vapour Absorption Refrigeration system experimental setup
3	Air conditioner test rig
4	Mixed-air plenum and outdoor air control, Air filter, Supply fan, Exhaust or relief fans and an air outlet, Outdoor air intake, Ducts, Terminal devices, Return air system, Heating and cooling coils, Self-contained heating or cooling unit, Cooling tower, Boiler, Control, Water chiller, Humidification and dehumidification equipment
5	Hand Tools: Hammer, Screwdrivers, Pliers, Measuring Tape, Wire Strippers, Pipe Wrench, Tubing Cutter, Tin Snips, Hand Seamers, Crimpers, Awl, Staple Gun and Step Ladder
6	Multimeter, Dual Temperature Meter, Cordless Drill, Sawzall and Manifold Gauge

SOFTWARE REQUIREMENTS

S. No.	Software
1	HVAC Software

REFERENCE BOOKS

S. No.	Name of the Book	Author	Publisher
1	Refrigeration and Air conditioning	P.L.Ballaney	Khanna Publishers, New Delhi
2	Refrigeration and Air conditioning	V.K.Jain	S.Chand & Co., New Delhi.
3	A Course in Refrigeration and Air conditioning	Domkundwar	Dhanpat Raj &Co., New Delhi
4	Principles of Refrigeration	Dossat	Pearson Education, New Delhi
5	Heating, Ventilating and Air Conditioning Analysis and Design	Spitler, Mcquiston, Parker	Wiley India Pvt. Ltd., New Delhi.
6	Audel Refrigeration Home and Commercial	Rex Miller, Mark Richard Miller and Edwin Panderson	John Wiley & Sons

ASSESSMENT AND CERTIFICATION

S. No.	Criteria for Assessment
1.	A trainee will be assessed based on the performance in End Examination for Theory and Practical conducted internally in the Project Polytechnic College for a duration of 3 hours
2.	A trainee must have 75% of attendance to appear for End examination in Theory and Practical.
3.	The assessment for theory part will be based on the marks scored in the end examination on the knowledge bank of questions (1 word/objective type questions)
4.	The assessment for practical part will be based on the marks scored in the end examination conducted by the Project Polytechnic and assessed by the Examiners approved by Strategic Plan Implementation Committee (SPIC) of the project polytechnic.
5.	The passing criteria for successful completion of training is every trainee should score 50% of marks in theory and practical examination.
6.	On successful completion of training , Certificate will be issued to the participants by the Directorate of Technical Education through the Project Polytechnics.

END EXAMINATION

ALLOCATION OF MARKS

S.NO	Description	Max.Marks
1.	Theory Examination	20
2.	Practical Examination	
	a)Aim and Procedure	20
	b)Demonstration / Execution	25
	c) Result & Viva Voce	15
	d)Record	20
Total Marks		100

THEORY MODEL QUESTION PAPER

ME/2020/003-HEATING VENTILATION AND AIR CONDITIONING

(Maximum Marks: 20)

(N.B: Answer any **Twenty** questions)

20x1= 20 Marks

1. What is refrigeration?
2. What is refrigerant?
3. What is pure substance?
4. What are the modes of heat Transfer?
5. What is meant by Conduction?
6. Write any two type of refrigeration
7. Define Radiation
8. Write any two application of refrigeration
9. Write any two parts in the reciprocating compressor
10. Name any two main parts in the vapor compression cycle
11. Write any two main parts in the vapor absorption system.
12. What is meant by dry air?
13. What is meant by Humidity?
14. Write the application of Psychrometric chart
15. What is sensible cooling?
16. Name any two parts in the window air conditioning System
17. Write any two advantage of vapor compression cycle
18. What is called refrigeration effect?
19. Write any two properties of good lubricant
20. Name two types of oil
21. Write the any two types of ducts
22. What is the function of vanes?
23. Write the any two equipment for heat load calculation
24. Define total pressure in the duct
25. Write the duct system classification