



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

**CURRICULUM**

| Course Name                  | REFRIGERATION & AC MECHANIC   |
|------------------------------|---|
| Course Code                  | ME/2020/001   |
| Course Duration              | 120 Hours   |
| Minimum Eligibility Criteria | ITI/10th/+2/Diploma/Graduates   |
| Pre-requisites (if any)      | -   |
| Course Objectives            | <p>Training module has been designed for the participants to</p> <ul style="list-style-type: none"> <li>• Learn the fundamental principles and different methods of Refrigeration and Air Conditioning.</li> <li>• Study the various refrigeration cycles and evaluate the performance using Mollier charts and refrigerant tables.</li> <li>• Study the different refrigerants with respect to properties, applications and environmental concern.</li> <li>• Understand the basic air conditioning processes on psychometric charts, cooling load calculations for human comfort, its applications and industrial air conditioning.</li> <li>• Study the various equipment-operating principles and safety controls employed in refrigeration and air conditioning system.</li> </ul> |
| Course Outcomes              | <p>At the end of training, the participants will be able to</p> <ul style="list-style-type: none"> <li>• Explain the concept of air refrigeration system and the components of refrigeration equipment's.</li> <li>• Illustrate the working of VCR, VAR and cryogenic refrigeration system with problems on VCR systems.</li> <li>• Outline the refrigeration flow controls, refrigerants, lubricants and applications of refrigeration system.</li> <li>• Explain the properties of humid air with the help of psychometric chart and comfort air-conditioning.</li> <li>• Diagnose and carry out the fault and service of domestic Refrigerator and Air Conditioner</li> </ul>  |
| Expected Job Roles           | Domestic Refrigerator and Air Conditioner Technician  |

**TEACHING AND SCHEME OF EXAMINATION**

| Course Code | Course Name                            | Hours     |     | Assessment Marks |     | Duration of the Examination |
|-------------|--|-----------|-----|------------------|-----|-----------------------------|
|             |  |           |     | Min              | Max |                             |
| ME/2020/001 | <b>REFRIGERATION &amp; AC MECHANIC</b> | Theory    | 50  | 10               | 20  | 3 Hours                     |
|             |  | Practical | 70  | 40               | 80  |                             |
|             |  | Total     | 120 | 50               | 100 |                             |

**ME/2020/001 - REFRIGERATION & AC MECHANIC**  
**DETAILED SYLLABUS**

| Unit No.   | Modules   | No. of Hours    |           |
|------------|---|-----------------|-----------|
|            |   | Theory          | Practical |
| <b>I</b>   | <b>Unit System and Introduction to Electricity:</b>   | <b>12 Hours</b> |           |
| 1.1        | FPS, CGS, MKS – SI-General description of basic terms – Pressure, Temperature – Heat, work done – Power, Energy   | 08              |           |
| 1.2        | Units for the above measuring instruments and devices – Heat transfer modes.  |                 |           |
| 1.3        | Definition and until of current – voltage – power – energy – resistance.  |                 |           |
| 1.4        | Series and parallel circuits – ammeter – voltmeter – wattmeter – energy meter – merger.   |                 |           |
| 1.5        | Functions of capacitors – fuse – trippers – cutout-tools – materials. Rules – safety precautions – symbols. Understanding – purpose   |                 |           |
| 1.6        | <b>Practical:</b> <ul style="list-style-type: none"> <li>➤ Safety Practices and Demonstration of Refrigeration and Air Conditioning equipments</li> <li>➤ 5S and Maintenance Procedures of R &amp; AC Equipments</li> </ul> |                 | 04        |
| <b>II</b>  | <b>Types of Refrigeration Systems and Refrigeration Tools:</b>  | <b>18 Hours</b> |           |
| 2.1        | General terms – Clausius statement – Heat engine, Heat pump, Refrigerating Effect, Tonnes of Refrigeration – COP - Basic applications   | 08              |           |
| 2.2        | Types of refrigeration Ice refrigeration – Evaporative refrigeration – Air expansion refrigeration – Throttling refrigeration   |                 |           |
| 2.3        | Vapour compression refrigeration system parts and their functions – Introduction of cryogenic refrigeration system  |                 |           |
| 2.4        | General purpose tools – measuring instrument working with such tools. Understanding R & AC tools, pipes and equipments.   |                 |           |
| 2.5        | <b>Practical:</b> <ul style="list-style-type: none"> <li>➤ Exercise on tube cutting, Swaging, flaring and bending</li> </ul>  |                 | 10        |
| <b>III</b> | <b>Refrigerants and Expansion Devices:</b>  | <b>18 Hours</b> |           |
| 3.1        | Purpose – Primary and secondary refrigerants – Types of refrigerants – Applications – CFCs and ozone problem – ECO – friendly refrigerants  | 10              |           |
| 3.2        | Insulating material Vapour absorption system of refrigeration – Electrolux refrigeration – Advantages – Disadvantages   |                 |           |
| 3.3        | Functions – capillary tube – automatic – thermostatic valves – purposes of thermostatic functions – Drier – Strainer – Accumulator  |                 |           |
| 3.4        | Liquid receiver – Defrosting purpose and methods- Commercial refrigerating units  |                 |           |
| 3.5        | Bottle Cooler – Deep freeze – Water cooler – Safety ice cream unit- Plate ice unit – Ice candy unit – Combination Cooler  |                 |           |

|   |  |                 |           |
|---|--|-----------------|-----------|
| 3.6                                     | <b>Practical:</b> <ul style="list-style-type: none"> <li>➤ Identify the fault and service the expands devices</li> <li>➤ Dismantle, identify the components, service and assemble the Water Cooler / Bottle Cooler</li> </ul>  |                 | 08        |
| <b>IV</b>                               | <b>Refrigerator and Types of Evaporator</b>  | <b>40 Hours</b> |           |
| 4.1                                     | Descriptions of Domestic Refrigerator, Compressor functions – Air cooled – Water cooled – tube – in tube – shell and tube – shell and coil condensers  | 12              |           |
| 4.2                                     | Cooling towers – Natural draft – Mechanical draft – Evaporators – functions types – Flooded type and dry type – Tube in tube – Tank type – shell and tube – Shell and coil evaporators.  |                 |           |
| 4.3                                     | <b>Practical:</b> <ul style="list-style-type: none"> <li>➤ Dismantle, identify the components, service and assemble of the following               <ol style="list-style-type: none"> <li>Hermetically Sealed Compressor</li> <li>Domestic Refrigerator</li> </ol> </li> <li>➤ Trace the fault and remedies of Hermetically Sealed Compressor, Evaporator and Domestic Refrigerator</li> </ul> |                 | 28        |
| <b>V</b>                                | <b>Air Conditioning:</b>   | <b>32 Hours</b> |           |
| 5.1                                     | Air condition – factors controlled in air-conditioning types – window type AC – Split AC system – package AC system – maintenance procedure – heat load calculation.   | 12              |           |
| 5.2                                     | Centralized AC plant – direct expansion system – water cooled system – Air handling units – air ducts – installation and maintenance, procedure.   |                 |           |
| 5.3                                     | Electrical parts – relay, running capacitors – overload protector – relay types – high pressure and low pressure cut out – Lubrication oil – properties and types  |                 |           |
| 5.4                                     | Oil charging – leak testing methods gas charging procedure general troubles in R & AC System.  |                 |           |
| 5.5                                     | <b>Practical:</b> <ul style="list-style-type: none"> <li>➤ Dismantle, identify the components, service and assemble the following               <ol style="list-style-type: none"> <li>Window Type Air Conditioner</li> <li>Spilt Type Air Conditioner</li> </ol> </li> <li>➤ Trace the fault and remedies of Window Type Air Conditioner and Spilt Type Air Conditioner</li> </ul>            |                 | 20        |
| <b>Total Theory and Practical hours</b> |  | <b>50</b>       | <b>70</b> |
| <b>Total hours</b>                      |  | <b>120</b>      |           |

## HARDWARE REQUIREMENT

| S.NO | LIST OF TOOLS /EQUIPMENTS   |
|------|---|
| 1.   | Working models of the following with Arrangements for conducting tests <ul style="list-style-type: none"><li>• Vapour Compression Refrigerator test rig</li><li>• Domestic Refrigerator</li><li>• Water cooler</li><li>• Window Air Conditioner</li><li>• Split Air Conditioner</li><li>• Cooling tower</li></ul>   |
| 2.   | Working model of the following to conduct Experiments <ul style="list-style-type: none"><li>• Thermostat units</li><li>• Cut off units</li><li>• Thermostatic expansion valve unit</li><li>• Automatic expansion valve unit</li><li>• Sealed compressor with experimental setup</li></ul>   |
| 3.   | Tools: <ul style="list-style-type: none"><li>• Mechanics tool set</li><li>• Tube cutter</li><li>• Tube bender type</li><li>• Tube bender spring</li><li>• Swaging tool</li><li>• Flaring block</li><li>• Flaring nut</li><li>• Pinching tool</li><li>• Capillary tube testing gauge</li><li>• Blow Lamp</li><li>• Copper Tube</li></ul>                                 |
| 4.   | SERVICE TOOLS: <ul style="list-style-type: none"><li>• Gas cylinder with receiver valve and key</li><li>• Charging System</li><li>• Blow lamp</li><li>• Stem key</li><li>• Spring remover</li><li>• Service valve</li><li>• 't' connector</li><li>• High pressure gauge</li><li>• Compound gauge</li><li>• Leak detector</li><li>• Soldering and Brazing kit.</li></ul> |

### REFERENCE BOOKS

| S. NO. | NAME OF THE BOOK                               | AUTHOR                            | PUBLISHER  |
|--------|--|-----------------------------------|--|
| 01     | Refrigeration and Air Conditioning             | P.L.Ballaney                      | Khanna Publishers, New Delhi., 15 <sup>th</sup> Edition, 2009.         |
| 02     | Refrigeration and Air Conditioning             | V.K.Jain                          | S.Chand & Co, New Delhi. 6 <sup>th</sup> Edition 2009.                 |
| 03     | A Course in Refrigeration and Air Conditioning | Domkundwar                        | Dhanpat Raj & Co Publishers, New Delhi. 8 <sup>th</sup> Edition, 2009. |
| 04     | Principles of refrigeration                    | Dossat                            | Pearson Education, New Delhi, 2002.                                    |
| 05     | Home Refrigeration and Air Conditioning        | Audel                             | Theo. Audel & Co., Publishers, New York, 1998.                         |
| 06     | Refrigeration and Air Conditioning             | C.P Arora                         | Dhanpat Rai & Co, New Delhi  |
| 07     | Industrial Refrigeration Hand Book             | Wilbert F.Steocker                | McGraw-Hill Companies, Inc.  |
| 08     | Practical Refrigeration and Air Conditioning   | Dr.M.Adhithiyan<br>Dr.S.C.Laroiya | New Age International Pvt.Ltd, Chennai                                 |

### 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/2020/001 - REFRIGERATION & AC MECHANIC

(Maximum Marks: 20)

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

**20x1= 20 Marks**

1. Define – Heat and Work done.
2. What are the modes of heat transfer?
3. Define – current and voltage.
4. Write the use of merger in electrical systems.
5. What are the functions of capacitors?
6. Define - Tonnes of Refrigeration.
7. What are the types of refrigeration?
8. Write the main components of vapour compression refrigeration system.
9. Define - Refrigeration Effect.
10. Give an example of R & AC tools.
11. Write the types of refrigerants?
12. Write the applications of vapour absorption refrigeration system.
13. What are the advantages of Capillary tube?
14. Write short notes on water cooler.
15. Write the use of accumulator.
16. What is the location of a condenser in a refrigeration system?
17. Give the comparison of natural draft and forced draft cooling towers.
18. What is the function of an evaporator?
19. What are the types of compressors used in the refrigeration?
20. What is the use of condensers?
21. Define – air conditioning system.
22. State Dalton's law of partial pressure.
23. List out the components of Air Handling Unit.
24. Write the properties of good lubricant.
25. Write any two types of duct systems.