

Course Curricula

for

**Short Term Courses based on
Modular Employable Skills (MES)**

in

Refrigeration & Air Conditioning Sector



**DIRECTORATE GENERAL OF EMPLOYMENT AND TRAINING
MINISTRY OF LABOUR & EMPLOYMENT
GOVERNMENT OF INDIA**

**Course Curricula for Short Term Courses based on
Modular Employable Skills (MES) in the Refrigeration & Air Conditioning
Sector**

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Skill Development based on Modular Employable Skills (MES)

Background

The need for giving emphasis on the Skill Development, especially for the less educated, poor and out of school youth has been highlighted in various forums. The skill level and educational attainment of the work force determines the productivity, income levels as well as the adaptability of the working class in changing environment. Large percentage of population in India is living below poverty line. One of the important causes is lower percentage of skilled persons in the workforce

The skill development at present is taking place mostly in the informal way, i.e. persons acquire skill at the work-place when they help their parents, relatives and employers etc. Such persons do not have a formal certificate and thus earn lower wages and are exploited by employers. They have come through informal system due to socio-economic circumstances of the family and the compulsions of earning a livelihood rather than attending a formal course. While their productivity is low, their contribution to the national GDP cannot be ignored. If the country can create a system of certification which not only recognizes their skills but also provides education and training in a mode that suits their economic compulsions, it will not only benefit the workforce to earn a decent living but also contribute to the national economy by better productivity of this workforce.

Another related problem to be tackled is large number of students drop outs (About 63% of the school students drop out at different stages before reaching Class-X).

Frame work for Skill Development based on 'Modular Employable Skills (MES)'

Very few opportunities for skill development are available for the above referred groups (out of school youth & existing workers especially in the informal sector). Most of the existing Skill Development programmes are long term in nature. Poor and less educated persons can not afford long term training programmes due to higher entry qualifications, opportunity cost etc. Therefore, a new frame work for Skill Development for the Informal Sector has been evolved by the DGET to address to the above mentioned problems. The **key features of the new frame work for skill development** are:

- ◆ Demand driven Short term training courses based on modular employable skills decided in consultation with Industry
- ◆ Flexible delivery mechanism (part time, weekends, full time)
- ◆ Different levels of programmes (Foundation level as well as skill upgradation) to meet demands of various target groups
- ◆ Central Government will facilitate and promote training while Vocational Training (VT) Providers under the Govt. and Private Sector will provide training
- ◆ Optimum utilisation of existing infrastructure to make training cost effective.
- ◆ Testing of skills of trainees by independent assessing bodies who would not be involved in conduct of the training programme, to ensure that it is done impartially.
- ◆ Testing & certification of prior learning (skills of persons acquired informally)

The Short Term courses would be based on 'Modular Employable Skills (MES)'.

The **concept for the MES** is :

- ❑ Identification of 'minimum skills set' which is sufficient to get an employment in the labour market.
- ❑ It allows skills upgradation, multiskilling, multi entry and exit, vertical mobility and life long learning opportunities in a flexible manner.
- ❑ It also allows recognition of prior learning (certification of skills acquired informally) effectively.
- ❑ The modules in a sector when grouped together could lead to a qualification equivalent to National Trade Certificate or higher.
- ❑ Courses could be available from level 1 to level 3 in different vocations depending upon the need of the employer organisations.
- ❑ MES would benefit different target groups like :
 - Workers seeking certification of their skills acquired informally
 - workers seeking skill upgradation
 - early school drop-outs and unemployed
 - previously child labour and their family

Age of participants

The minimum age limit for persons to take part in the scheme is 14 years but there is no upper age limit.

Curriculum Development Process

Following procedure is used for developing course curricula

- Identification of Employable Skills set in a sector based on division of work in the labour market.
- Development of training modules corresponding to skills set identified so as to provide training for specific & fit for purpose
- Organization of modules in to a Course Matrix indicating vertical and horizontal mobility. The course matrix depicts pictorially relation among various modules, pre requisites for higher level modules and how one can progress from one level to another.
- Development of detailed curriculum and vetting by a trade committee and by the NCVT

(Close involvement of Employers Organizations, State Governments, experts, vocational training providers and other stake holders is ensured at each stages).

Development of Core Competencies

Possession of proper attitudes is one of the most important attribute of a competent person. Without proper attitudes, the performance of a person gets adversely affected. Hence, systematic efforts will be made to develop attitudes during the training programme.

The trainees deal with men, materials and machines. They handle sophisticated tools and instruments. Positive attitudes have to be developed in the trainees by properly guiding them and setting up examples of good attitudes by demonstrated behaviors and by the environment provided during training.

Some important core competencies to be developed are:

1. Safety consciousness and safe working practices
2. Care of equipment and tools
3. Punctuality, discipline and honesty
4. Concern for quality
5. Respect for rules and regulations
6. Concern for health and hygiene
7. Cordial relationship and Cooperation with co-workers and team Work
8. Positive attitude and behavior
9. Responsibility and accountability
10. Learn continuously
11. Communication Skills
12. Concern for environment and waste disposal

Following competencies should also be developed during level-II and higher courses:

1. Ability for planning, organizing and coordinating
2. Creative thinking, problem solving and decision making
3. Leadership
4. Ability to bear stress
5. Negotiation

Duration of the Programmes

Time taken to gain the qualification will vary according to the pathway taken and will be kept very flexible for persons with different backgrounds and experience. Duration has been prescribed in hours in the curriculum of individual module, which are based on the content and requirements of a MES Module. However, some persons may take more time than the prescribed time. They should be provided reasonable time to complete the course.

Pathways to acquire Qualification:

Access to the qualification could be through:

- An approved training programme; **Or**
- A combination of an approved training programme plus recognition of prior learning including credit transfer; **Or**
- The recognition of prior learning that provides evidence of the achievement of the competencies for the qualification.

Methodology

The training methods to be used should be appropriate to the development of competencies. The focus of the programme is on “performing” and not on “Knowing”. Lecturing will be restricted to the minimum necessary and emphasis to be given for ‘hands on training’.

The training methods will be individual centered to make each person a competent one. Opportunities for individual work will be provided. The learning process will be continuously monitored and feedback will be provided on individual basis.

Demonstrations using different models, audio visual aids and equipment will be used intensively.

Instructional Media Packages

In order to maintain quality of training uniformly all over the country, instructional media packages (IMPs) will be developed by the National Instructional Media Institute (NIMI), Chennai.

Assessment

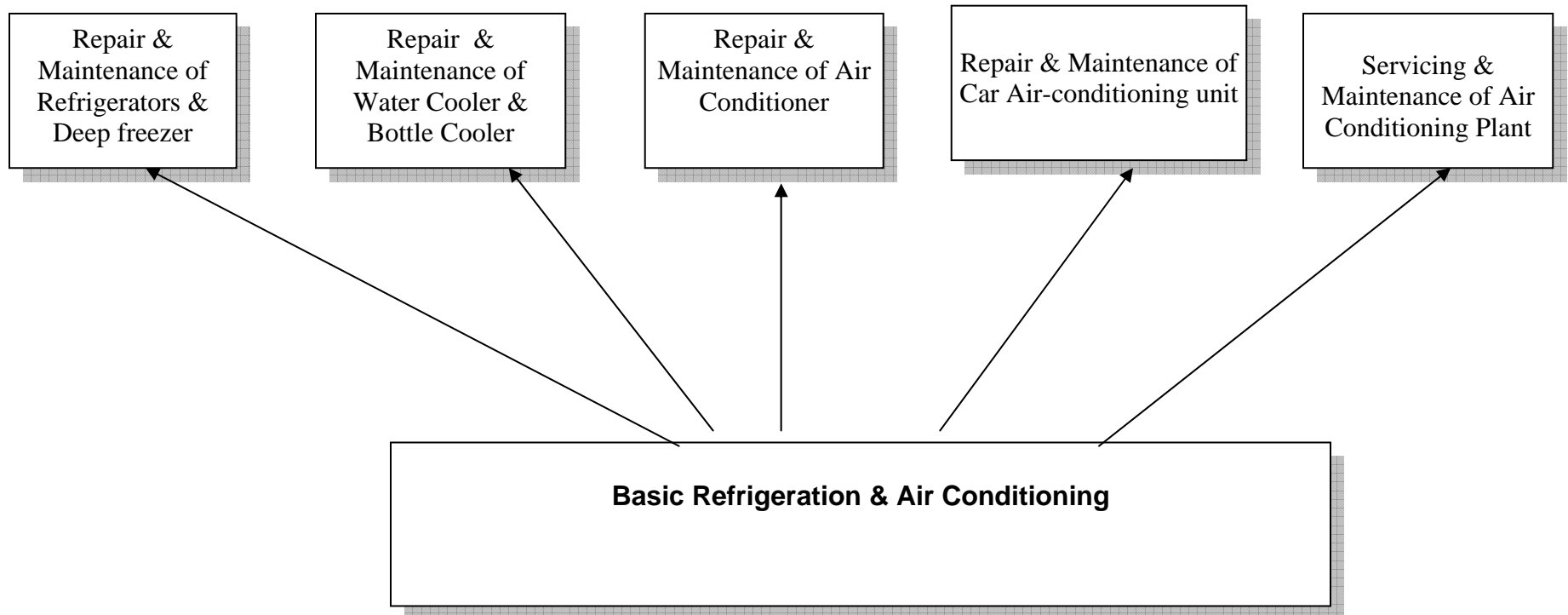
DGE&T will appoint assessing bodies to assess the competencies of the trained persons. The assessing body will be an independent agency, which will not be involved in conducting the training programmes. This, in turn, will ensure quality of training and credibility of the scheme. Keeping in view the target of providing training/testing of one million persons through out the country and to avoid monopoly, more than one assessing bodies will be appointed for a sector or an area.

Certificate

Successful persons will be awarded certificates issued by National Council for Vocational Training (NCVT).

Course Matrix in RAC Trades

Proposed Course Outline/ Pathway



MODULES

Basic Refrigeration & Air Conditioning

1. NAME : Basic Refrigeration & Air Conditioning

2. SECTOR : Refrigeration & Air Conditioning

3. CODE :

4. Entry Qualification : Minimum V standard & 14 years of age

5. DURATION : 120 Hrs

6. TERMINAL COMPETENCY

After the completion of the course, the participants would be able to :

- Handle the basic Tools & equipments in the workshop with safety
- Upkeep the workshop Tools & equipment
- Identify the main mechanical components & electric motors used in RAC trade
- Maintain the inventory
- Install of refrigerator and room air conditioner
- Service of refrigerator and room air conditioner

8. CONTENT

| Practical Competencies | Underpinning Knowledge (Theory) |
|---|---|
| <p>Familiarization of Safety Procedures Identify tools & equipments Care and Maintenance</p> <p>Identify different type of :</p> <ul style="list-style-type: none"> • Compressor (open type, Semi sealed , Sealed) • Condenser (air cooled/ Water cooled) • Evaporator • Expansion device • Use of thermometer • Gauges(Compound & Pressure) <p>Use of measuring instruments such as</p> <ul style="list-style-type: none"> • Volt meter • Ammeter • Ohmmeter • Multi meter • Series and Parallel Connection <p>Test of open & Short Circuit</p> <ul style="list-style-type: none"> • Identify of various electric motors <p>Service & installation of Refrigerator & Air Conditioner, Bottle Cooler, Water Cooler</p> | <p>Importance of safety General precaution</p> <p>General refrigeration & Air Conditioning Tools & Equipments used</p> <p>Heat , Temperature, Pressure Unit of heat, temperature & Pressure Use of pressure gauge, thermometer</p> <p>Refrigeration System Compressor Condenser Evaporator Expansion Devise Different types of all components as stated above</p> <p>Basic Electricity Current, Potential difference, Resistance & its unit.</p> <p>Series Circuit Parallel Circuit.</p> <p>Use of Voltmeter, ammeter, Multi meter.</p> <p>Different types of Electric motor used.</p> |

9. List of Tools & equipment by which experiments are to be conducted

| | |
|---|--|
| 1) Screw driver | 2) Line tester |
| 3) File | 4) Hammer |
| 5) Drilling Machine | 6) Pliers, |
| 7) Crimping Tool | 8) Solder Iron |
| 9) ampere meter | 10) volt meter |
| 11) Megger | 12) Multi meter |
| 13) Dry bulb & wet bulb thermometer | 14) Tube cutter |
| 15) Hacksaw | 16) Pipe Wrench |
| 17) Torque Wrench | 18) Screw Wrench |
| 19) Vice | 20) Snip |
| 21) DE Spanner Set | 22) Ring Spanner Set |
| 23) Swaging tool | 24) Oxy Acetylene gas cylinder/Oxy LPG gas cylinder |
| 25) Blow torch | 26) Compressor |
| 27) E& C Unit | 28) Recovery Machine |
| 29) Gas Mani fold | 30) Compound Gauges, |
| 31) Pressure Gauge | 32) Empty Cylinder for Refrigerant |
| 33) Nitrogen Cylinder with two stage regulator | 34) Halide Torch, 35) Flaring tool set |
| 36) Compressor | Condenser |
| 37) Evaporator | 38) Expansion device/capillary |
| 39) Different types of Electric Motors | |

Repair & Maintenance of Refrigerators & Deep freezer

- 1. NAME** : Repair & Maintenance of Refrigerators & Deep freezer
- 2. SECTOR** : **Refrigeration & Air Conditioning**
- 3. CODE** :
- 4. Entry Qualification** : Minimum V standard & 14 years of age
MES Module on Basic Refrigeration & Air Conditioning
- 5. DURATION** :- 120 Hrs
- 6. TERMINAL COMPETENCY**

After the completion of the course, the participants would be able to:

- Handle the basic Tools & equipments in the workshop with safety
- Upkeep the workshop Tools & equipment
- Service the Refrigerator & deep freezer
- Maintain the inventory
- Do Pre Delivery Inspection

8. CONTENT

| Practical Competencies | Underpinning Knowledge (Theory) |
|--|--|
| <p>Practical Competencies Familiarization of Safety Procedures Identify of tools & equipments</p> <p>Cut, Flare, Swag, Braze</p> <ul style="list-style-type: none"> • Prepare joints before brazing • Flare & Swag copper pipes • Braze <p>Practice measuring, Voltage, Current, Resistance</p> <ul style="list-style-type: none"> • Measure current, Potential difference, Resistance • Check series of the compressor with the help of test lamp and Multi meter <p>Check resistance, Diode, Relay, thermostat, OLP etc.</p> <ul style="list-style-type: none"> • Refrigerator & deep freezer wiring practices • Refrigeration wiring • Deep freezer wiring <p>Service of Refrigerator & deep freezer</p> <ul style="list-style-type: none"> • Replacement of Components • Flush, Vaccumise & Gas Charging <p>Performance testing</p> <p>Trouble Shooting & Performance of Refrigerator & Deep freezer</p> <ul style="list-style-type: none"> • Fault finding in refrigerator • Fault finding in Deep freezer. | <p>Theory</p> <p>Importance of safety General precaution</p> <p>General refrigeration & Air Conditioning Tools & Equipments used</p> <p>Refrigeration cycle</p> <ul style="list-style-type: none"> • Various factors in a Refrigeration cycle, • unit of Refrigeration • Gas transforms from one state to another in a refrigeration cycle • De frosting system <p>Handling of Gases & Gauges</p> <ul style="list-style-type: none"> • Pressure Gauge , Compound Gauge • Handling of different gases in workshop <p>Identification of components used in Air conditioning</p> <ul style="list-style-type: none"> • Electrical components used in Window Ac unit • Electrical Components used in Split Ac unit • Electrical components used in Remote window Ac • Electrical Components used in Remote split Ac • Type of Fan/ Blower Motors used in Window & split ac units <p>Knowledge about checking & Measuring resistance, Current, Potential difference, using instruments such as Multi meter, Clamp Meter, Ampere meter, Volt meter.</p> <p>The units of current, Potential difference , resistance</p> <p>Different Electrical & electronic components used in Refrigerator & deep freezer such as Relay, overload protector, thermostat etc.</p> <p>Different Wiring circuits</p> <ul style="list-style-type: none"> • General Electrical wiring • Refrigerator wiring • Deep freezer wiring <p>Good Service procedure using CFC & Non CFC Refrigerants</p> <ul style="list-style-type: none"> • Recovery of Gases • Various Good service Procedure used in R&Ac |

9. List of Tools & equipment by which experiments are to be conducted

| | |
|---|--|
| 1) Screw driver | 2) Line tester |
| 3) File | 4) Hammer |
| 5) Drilling Machine | 6) Pliers |
| 7) Crimping Tool | 8) Solder Iron |
| 9) ampere meter | 10) volt meter |
| 11) Megger | 12) Multi meter |
| 13) Dry bulb & wet bulb thermometer | 14) Tube cutter |
| 15) Hacksaw | 16) Pipe Wrench |
| 17) Torque Wrench | 18) Screw Wrench |
| 19) Vice | 20) Snip |
| 21) DE Spanner Set | 22) Ring Spanner Set |
| 23) Swaging tool | 24) Oxy Acetylene gas cylinder/Oxy LPG gas cylinder |
| 25) Blow torch | 26) Compressor |
| 27) E& C Unit | 28) Recovery Machine |
| 29) Gas Mani fold | 30) Compound Gauges |
| 31) Pressure Gauge | 32) Empty Cylinder for Refrigerant |
| 33) Nitrogen Cylinder with two stage regulator | 34) Halide Torch |
| 36) Refrigerator 165 lt. | 35) Flaring tool set |
| | 37) Deep freezer |

Repair & Maintenance of Water Cooler & Bottle Cooler

- 1. NAME** : Repair & Maintenance of Water Cooler & Bottle Cooler
- 2. SECTOR** : **Refrigeration & Air Conditioning**
- 3. CODE** : GRM/RAC/002
- 4. Entry Qualification** : Minimum V standard & 14 years of age
MES Module on Basic Refrigeration & Air Conditioning
- 5. DURATION** :- 120 Hrs
- 6. TERMINAL COMPETENCY**

After the completion of the course, the participants would be able to :

- Handle the basic Tools & equipments in the workshop with safety
- Service & Maintenance of the Water Cooler & Bottle Cooler with proper equipments & eco friendly refrigerants
- Identify the refrigerants using Gauges
- Check the performance

8. Content

| | |
|---|--|
| <p>Practical Competencies</p> <p>Familiarization of Safety Procedures</p> <p>Identification of tools & equipments</p> <p>Cut, Flare, Swag, Braze</p> <ul style="list-style-type: none">• Prepare joints before brazing• Flare & Swage copper pipes• Braze <p>Practice measuring, Voltage, Current, Resistance</p> <ul style="list-style-type: none">• Measure current, Potential difference, Resistance• Check series of the compressor with the help of test lamp and Multi meter <p>Service/Repair of Water Cooler</p> <ul style="list-style-type: none">• The Appliance Assessing• Components replacing• Unit repairing• Gas charging (steps Involved)• Performance testing <p>Bottle Coolers & Water Cooler wiring</p> <p>Service/Repair of Bottle Cooler</p> <ul style="list-style-type: none">• Repair of Bottle cooler• Replacement of Components• Gas charging• Performance testing <p>Service /Repair of Water Cooler</p> <ul style="list-style-type: none">• Water cooler Repairing• Replacement of Components• Gas Charging• Performance Test <p>Trouble Shooting</p> <ul style="list-style-type: none">• Fault finding of electrical parts• Fault finding of Water Cooler• Fault finding of the Bottle Cooler• Fault finding in performance of unit | <p>Underpinning Knowledge (Theory)</p> <p>Importance of safety General precaution</p> <p>General refrigeration & Air Conditioning & Tools & Equipments used</p> <p>Refrigeration cycle</p> <ul style="list-style-type: none">• Various factors in a Refrigeration cycle,• Unit of Refrigeration• Gas transforms from one state to another in a refrigeration cycle <p>Handling of Gases & Gauges</p> <ul style="list-style-type: none">• Pressure Gauge , Compound Gauge• Handling of different gases in workshop <p>Identification of components used in Water Cooler & Bottle Cooler</p> <ul style="list-style-type: none">• Electrical components used in Water Cooler• Electrical Components used in Bottle Cooler• Fan Motors <p>Knowledge about checking & Measuring resistance, Current, Potential difference, using instruments such as Multimeter, Clamp Meter, Ampere meter, Volt meter.</p> <p>The units of current, Potential difference , resistance</p> <p>Various Good service Procedure used in Repairing Refrigeration units</p> <ul style="list-style-type: none">• Recovery of gases• Cleaning• Flushing• Repairing• Leak testing• Vacuuming• Gas charging• Pinching• Performance testing |
|---|--|

9. List of Tools & equipment by which experiments are to be conducted

| | |
|--|--|
| 1) Screw driver | 2) Line tester |
| 3) File | 4) Hammer |
| 5) Drilling Machine | 6) Pliers |
| 7) Crimping Tool | 8) Solder Iron |
| 9) ampere meter | 10) volt meter |
| 11) Megger | 12) Multi meter |
| 13) Dry bulb & wet bulb thermometer | 14) Tube cutter |
| 15) Hacksaw | 16) Pipe Wrench |
| 17) Torque Wrench | 18) Screw Wrench |
| 19) Vice | 20) Snip |
| 21) DE Spanner Set | 22) Ring Spanner Set |
| 23) Swaging tool | 24) Oxy Acetylene gas cylinder/Oxy LPG gas cylinder |
| 25) Blow torch | 26) Compressor |
| 27) E& C Unit | 28) Recovery Machine |
| 29) Gas Manifold | 30) Compound Gauges |
| 31) Pressure Gauge | 32) Empty Cylinder for Refrigerant |
| 33) Nitrogen Cylinder with two stage regulator. | 34) Halide Torch 35) Flaring tool set |
| 36) Water Cooler | 37) Bottle Cooler |

Repair & Maintenance of Air Conditioner

- 1. NAME :- Repair & Maintenance of Air Conditioner**
- 2. SECTOR : Refrigeration & Air Conditioning**
- 3. CODE :**
- 4. Entry Qualification :** Minimum V standard & 14 years of age
MES Module on Basic Refrigeration & Air Conditioning
- 5. DURATION :- 120 Hrs**
- 6. TERMINAL Competency**

After the completion the course, the participants would able to :

- Handle the basic Tools & equipments used in the workshop with safety
- Repair & Maintenance of the Window & split type Ac units
- Identify the refrigerants using Gauges
- Air Conditioner (Split & Window Type) wiring
- Check the performance of Air Conditioner

8. CONTENT

| | |
|--|---|
| <p>Practical Competencies</p> <p>Familiarization of Safety Procedures</p> <p>Identification of tools & equipments</p> <p>Cut, Flare, Swag, Braze</p> <ul style="list-style-type: none">• Prepare joints before brazing• Flare & Swag copper pipes• Braze <p>Practice measuring, Voltage, Current, Resistance</p> <ul style="list-style-type: none">• Measure current, Potential difference, Resistance• Check series of the compressor with the help of test lamp and Multi meter <p>Test electrical components used in Air Conditioner</p> <ul style="list-style-type: none">• Relay testing, Thermostat, timer, starting capacitor, running capacitor, over load protector, Fan capacitor, Fan / blower motor.• Checking up of Compressor winding <p>All the A/c. unit wiring</p> <ul style="list-style-type: none">• PSC, CSC, Split Ac With remote & without Remote wiring <p>Service of Window type air conditioner</p> <ul style="list-style-type: none">• Fan/ Blower motor service• Dismantling & assembling the unit• Replacing of components• Gas charging system• Performance Testing <p>Service of split type air conditioner</p> <ul style="list-style-type: none">• Fan/ Blower motor service• Appliance Assessing• Unit Dismantling & assembling• Replacing of components• Gas charging system• Performance Testing <p>Trouble Shooting & performance of Air conditioner units</p> <ul style="list-style-type: none">• Fault finding in Window Ac• Fault finding in Split Ac• Fault finding in Remote window Ac• Fault finding in Remote split Ac• Air filter unit | <p>Underpinning Knowledge (Theory)</p> <p>Importance of safety General precaution</p> <p>General refrigeration & Air Conditioning & Tools & Equipments used</p> <p>Refrigeration cycle</p> <ul style="list-style-type: none">• Various factors in a Refrigeration cycle,• Ton of Refrigeration• Gas transforms from one state to another in a refrigeration cycle <p>Handling of Gases & Gauges</p> <ul style="list-style-type: none">• Pressure Gauge , Compound Gauge• Handling of different gases in workshop <p>Identification of components used in Air conditioning</p> <ul style="list-style-type: none">• Electrical components used in Window Ac unit• Electrical Components used in Split Ac unit• Electrical components used in Remote window Ac• Electrical Components used in Remote split Ac• Type of Fan/ Blower Motors used in Window & split ac units <p>Knowledge about checking & Measuring resistance, Current, Potential difference, using instruments such as Multi meter, Clamp Meter, Ampere meter, Volt meter.</p> <p>The units of current, Potential difference , resistance</p> <p>Different Wiring circuits in Ac units</p> <ul style="list-style-type: none">• General Electrical wiring• Window type air conditioner• Split type air conditioner• Remote window Ac wiring• Remote Split Ac wiring <p>Good Servicing procedure</p> <ul style="list-style-type: none">• Recovery of gases• Cleaning• Flushing• Repairing• Leak testing• Vacuuming• Gas charging• Pinching• Performance testing <p>A/C Service procedure & performance testing.</p> <ul style="list-style-type: none">• Cleaning procedure• Fan motor performance• Air flow problem• Condensation problem• Temperatures Testing• Performance Testing |
|--|---|

9. List of Tools & equipment by which experiments are to be conducted

| | |
|---|--|
| 1) Screw driver | 2) Line tester |
| 3) File | 4) Hammer |
| 5) Drilling Machine | 6) Pliers |
| 7) Crimping Tool | 8) Solder Iron |
| 9) ampere meter | 10) volt meter |
| 11) Megger | 12) Multi meter |
| 13) Dry bulb & wet bulb thermometer | 14) Tube cutter |
| 15) Hacksaw | 16) Pipe Wrench |
| 17) Torque Wrench | 18) Screw Wrench |
| 19) Vice | 20) Snip |
| 21) DE Spanner Set | 22) Ring Spanner Set |
| 23) Swaging tool | 24) Oxy Acetylene gas cylinder/Oxy LPG gas cylinder |
| 25) Blow torch | 26) Compressor |
| 27) E& C Unit | 28) Recovery Machine |
| 29) Gas Mani fold | 30) Compound Gauges |
| 31) Pressure Gauge | 32) Empty Cylinder for Refrigerant |
| 33) Nitrogen Cylinder with two stage regulator | 34) Halide Torch 35) Flaring tool set |
| 36) Window type Air Conditioner | 37) split type Air Conditioner |
| 38) Window type Air conditioner with remote control, | 39) Split type air Conditioner with remote control |

Repair & Maintenance of Car Air-conditioning unit

1.NAME : Repair & Maintenance of Car – Air conditioning Unit

2.SECTOR : Refrigeration & Air Conditioning

3.CODE : GRM/RAC/004

**4. Entry Qualification: Minimum V standard & 14 years of age
MES Module on Basic Refrigeration & Air Conditioning**

5. DURATION :- 120 Hrs

6 .TERMINAL COMPETENCY

After the completion the course the participants will able to

- Handle the basic Tools & equipments used in the workshop with safety
- Servicing & Maintenance of the Car Air conditioning unit.
- Identify the refrigerants using Gauges
- Checking of wiring of the Car Air conditioning unit.
- Checking of the performance

8. Content

| | |
|--|---|
| <p>Practical Competencies</p> <p>Familiarization of Safety Procedures</p> <p>Identify of tools & equipments</p> <ul style="list-style-type: none">• Tool require for which service <p>Cut, flare, Swag, Braze</p> <ul style="list-style-type: none">• Prepare joints before brazing• Swage copper pipes• Braze <p>Practice measuring, Voltage, Current, resistance</p> <ul style="list-style-type: none">• Measure current & Potential differences• Check series of the compressor <p>Service of evaporation unit</p> <ul style="list-style-type: none">• Blower checking• Check fan motor, Oil charge of the compressor• Check oil level• Oil charging in different car a/c units <p>Service of Car Air conditioner</p> <ul style="list-style-type: none">• Condenser cleaning• Cooling coil cleaning <p>Service & Maintenance of Car Air conditioner using CFC's & Non CFC</p> <ul style="list-style-type: none">• Assessing the Appliance• Replacing of Components• Repairing of unit• Leak Testing• Vaccumising• Gas charging(steps Involved)• Performance testing <p>Car Air conditioner retrofitting</p> <ul style="list-style-type: none">• Recovery of refrigerants• Changing of components• Gas charging• Performance testing <p>Trouble shooting</p> <ul style="list-style-type: none">• General faults• Cabin temperature faults• Fault finding with compressor | <p>Underpinning Knowledge (Theory)</p> <p>Importance of Safety General precaution</p> <p>General Refrigeration & Air conditioning tools& equipments used</p> <p>Refrigeration cycle</p> <ul style="list-style-type: none">• Various factors in a Refrigeration cycle• Unit of refrigeration• Gas transforms from one state to another in a refrigeration cycle <p>Handling of Gases & Gauges</p> <ul style="list-style-type: none">• Pressure Gauge & Compound Gauge• Handling of different gases in workshop <p>Identification of Car Air conditioner components</p> <ul style="list-style-type: none">• Compressor identification• Dual switch• Wiring• Condenser• Evaporator <p>Knowledge about checking & Measuring resistance, ampere, Voltage, using instruments such as Multimeter, Clamp Meter, Ampere meter, Volt Meter The units of current, potential difference resistance</p> <p>Different Wiring circuits in Car air Conditioning units</p> <ul style="list-style-type: none">• Automobile wiring concerned with Air Conditioner <p>Dismantle the Car Air conditioner Cleaning, Assembling, evacuation, charging, performance testing</p> <p>Good Servicing procedure</p> <ul style="list-style-type: none">• Recovery• Vacuumising• Gas charging• Performance testing |
|--|---|

9. List of Tools & equipment by which experiments are to be conducted

| | |
|---|--|
| 1) Screw driver | 2) Line tester |
| 3) File | 4) Hammer |
| 5) Drilling Machine | 6) Pliers |
| 7) Crimping Tool | 8) Solder Iron |
| 9) ampere meter | 10) volt meter |
| 11) Megger | 12) Multi meter |
| 13) Dry bulb & wet bulb thermometer | 14) Tube cutter |
| 15) Hacksaw | 16) Pipe Wrench |
| 17) Torque Wrench | 18) Screw Wrench |
| 19) Vice | 20) Snip |
| 21) DE Spanner Set | 22) Ring Spanner Set |
| 23) Swaging tool | 24) Oxy Acetylene gas cylinder/Oxy LPG gas cylinder |
| 25) Blow torch | 26) Compressor |
| 27) E& C Unit | 28) Recovery Machine |
| 29) Gas Mani fold | 30) Compound Gauges |
| 31) Pressure Gauge | 32) Empty Cylinder for Refrigerant |
| 33) Nitrogen Cylinder with two stage regulator | 34) Halide Torch |
| | 35) Flaring tool set |
| 36) Car Air Conditioning units (HFC unit) | 37) Car Air Conditioning units (HC unit) |

Servicing & Maintenance of Air Conditioning Plant

1. NAME : Servicing & Maintenance of Air Conditioning Plant

2.SECTOR : Refrigeration & Air Conditioning

3.CODE :

4. Entry Qualification ; Minimum VIII standard & 14 years of age
MES Module on Basic Refrigeration & Air Conditioning

5. DURATION : 150 Hrs

6. TERMINAL COMPETENCY

After the completion of the course, the participants would be able to :

- .Handle the basic Tools & equipments in the workshop with safety
- .Operation of Central Air Conditioning Plant
- Minor Maintenance of Central Air Conditioning Plant .
- .To Identify the refrigerants using Gauges
- To Check wiring of the A/C Plant
- .To check the performance of A/c plant.

8. CONTENT

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| <p>Practical Competencies Familiarization of Safety Procedures Identify of tools & equipments</p> <p>Cut, Flare, Swag, Braze</p> <ul style="list-style-type: none"> • Prepare joints before brazing • Flare & Swag copper pipes • Braze <p>Practice measuring, Voltage, Current, Resistance</p> <ul style="list-style-type: none"> • Measure current, Potential difference, Resistance • Check series of the compressor with the help of test lamp and Multimeter <p>Resistance Checking</p> <ul style="list-style-type: none"> • Check compressor winding <p>Wiring of Ac Plant</p> <ul style="list-style-type: none"> • Single phase wiring • 3 phase wiring • Cable wiring • Checking of Starter, switch, electrical motors, inter locking system/ automation system of plant. <p>Service of evaporation unit & condensing unit</p> <ul style="list-style-type: none"> • Service of compressor, condenser, evaporator • Clean of Cooling tower • De scale of A/c unit • Service of plant with charging • Gas pump down procedure • Gas Charging procedures <p>Trouble Shooting</p> <ul style="list-style-type: none"> • Check water pump • Problem arises due to high pressure / low pressure of gas • Problem arises due to variation in electric supply on the electrical components. • PH value of water • Visit Air conditioning plant | <p>Underpinning Knowledge (Theory) Importance of Safety General precaution General Refrigeration & Air conditioning tools& equipments used</p> <p>Refrigeration cycle</p> <ul style="list-style-type: none"> • Various factors in a Refrigeration cycle • Unit of refrigeration • Gas transforms from one state to another in a refrigeration cycle <p>Handling of Gases & Gauges</p> <ul style="list-style-type: none"> • Pressure Gauge & Compound Gauge • Handling of different gases in workshop <p>Knowledge about Checking and measuring Potential difference, Current, resistance, using instruments such as Multimeter, Clamp Meter, Ampere meter, Volt Meter</p> <ul style="list-style-type: none"> • Units of Potential difference, Current, resistance • Conductor, Insulator <p>Identification of Plant A/C components, Plant A/C system</p> <ul style="list-style-type: none"> • Electrical components such as capacitor, motor, switch,starter,LP /HP cut out, Solenaid valve etc. in Ac plant • Components such as compressor, condensers, Evaporator, expansion device, Air handling unit, chiller system, heat exchanger, cooling tower <p>Different Wiring circuits in Ac plants</p> <ul style="list-style-type: none"> • Types of wiring • single phase wiring • 3 phase wiring <p>Plant Servicing, Condenser, Evaporator Cleaning, Assembling, evacuation, charging</p> <p>Good Servicing procedure</p> <ul style="list-style-type: none"> • Gas pump down procedure • Servicing of the Ac plant • Cooling tower maintenance • Condenser cleaning • Evaporator cleaning • Air Handling unit, • Heat Exchanger • Chiller system • Repair/checking of Electrical components • Procedure for operation of Central Air Conditioning Plant <p>Performance testing., Setting of devices, dry bulb temperature, wet bulb temperature , performance of A/c plant</p> |
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9. List of Tools & equipment by which experiments are to be conducted

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| 1) Screw driver | 2) Line tester |
| 3) File | 4) Hammer |
| 5) Drilling Machine | 6) Pliers |
| 7) Crimping Tool | 8) Solder Iron |
| 9) ampere meter | 10) volt meter |
| 11) Megger | 12) Multi meter |
| 13) Dry bulb & wet bulb thermometer | 14) Tube cutter |
| 15) Hacksaw | 16) Pipe Wrench |
| 17) Torque Wrench | 18) Screw Wrench |
| 19) Vice | 20) Snip |
| 21) DE Spanner Set | 22) Ring Spanner Set |
| 23) Swaging tool | 24) Oxy Acetylene gas cylinder/Oxy LPG gas cylinder |
| 25) Blow torch | 26) Compressor |
| 27) E& C Unit | 28) Recovery Machine |
| 29) Gas Mani fold | 30) Compound Gauges |
| 31) Pressure Gauge | 32) Empty Cylinder for Refrigerant |
| 33) Nitrogen Cylinder with two stage regulator. | 34) Halide Torch |
| 35) A/c Plant (available/ Visit) | 36) Flaring tool set |

List of Expert/Trade Committee Members

CURRICULUM DEVELOPMENT FOR SHORT TERM COURSES BASED ON MODULAR EMPLOYABLE SKILLS

SECTOR/AREA: **Refrigeration & Air Conditioning**

Advanced Training Institute
Vidyanagar, Hyderabad-500 007

List of Members of Trade Committee Meeting in respect of Refrigeration & Air Conditioning under Informal Sector held on 15-5-2006 in the Chamber of Director, A.T.I, Vidyanagar, Hyderabad

- 1 Shi T. Virendra Nath, Manager, M/s Mega Services, Kutbiguda, Hyderabad.
- 2 Sri Shaik Ibrahim M/s Mega Services, Kutbiguda, Hyderabad
- 3 Sri A. Vaidyanathan Dy. General Manager, OL, ISTM, HRD, BDL, Kanchanbagh, Hyderabad. Phone > 24340081/2911, (R) 24042921, Fax: 24340284
- 4 Prof. Narayana Rao Principal/Head (Mechanical), Osmania University, Hyderabad.
- 5 Shri C. Chandrakanth M/s Beston Technical Services, 8-2-1/B/2, Punjagutta, Hyderabad 237477730, 9347547730
- 6 Shri M.A. Mukthadar Khan, M/s Quick Bird Refrigeration, 18-9-8/2, Chandrayanagutta, Hyderabad.
- 7 Shri SYEDALIMED ALI, M/s Iqra Electrical & Appl., Talabkatta, Hyderabad 24525364, 9885474615
- 8 Sri MD. NIZAMUDDIN M/s Iqra Electrical & Appl., Talabkatta, Hyderabad 9948081696
- 9 Shri Syed Rasool, M/s Cool Point Refrigeration, Kishanbagh, Hyderabad. 9848820254
- 10 Shri S.N. Pille, Chief Executive, M/s S.N. Engineers, F-1, First Floor, Suvidha Commercial Complex, Vanasthalipura 'X' Roads, Hyderabad – 500 070.
- 11 Sri V.M. Rao Director & Chairman of the Meeting, ATI
- 12 Sri S. Chatterjee, JDT, Member, Trade Committee Meeting, ATI, (V), Hyderabad -12
- 13 Sri S. Suryanarayana, DDT, ATI, Vidyanagar, Hyderabad
- 14 Sri E. Balakrishna, DDT, ATI, Vidyanagar, Hyderabad
- 15 Sri V.V. Subba Rao, DDT, ATI, Vidyanagar, Hyderabad
- 16 Ashwani Aggarwal Deputy Director of Training, DGET