

DRAFT Syllabus For Junior Refrigeration and Air Conditioner Mechanic

Course Name	Junior Refrigeration and Air Conditioner Mechanic
Course Code	STC-ELE/JRAC/1010
Occupation	Asst. Mechanic / Asst. Technician for Refrigerator / Air-conditioner
Job Description	Servicing / troubleshooting / maintenance of refrigerator / air conditioner - work as an Junior Refrigeration and Air Conditioner Mechanic
Anticipated Volume of Training	600 Hrs (Theory- 130 Hrs + Practical- 410 Hrs) Employability Skill : 60 Hrs
Trainees' Entry Qualification	Class 8 pass and pursuing continuous regular schooling, OR Class 8 Pass with 1 year experience, OR Class 8 Pass + ITI, OR Class 10 Pass OR previous relevant qualification of NSQF Level 2 with 1 yr experience
Trainers Qualification	B.E/B.TECH In Electronics / Electrical Engineering / Mechanical Engineering, Diploma in Electronics / Electrical / Mechanical Engineering / ITI in Electronics Mechanic Trade Experience: 2 years for BE/B.TECH, 3 years for Diploma / ITI

Structure of Course:

Module No.	Outcome	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
1	Describe different Types of Refrigerator and Air conditioner and associated terms.	40	90	130
2	Demonstrate the use of different tools and electrical instruments required for servicing of Refrigerators and Air conditioners.	30	90	120
3	Demonstrate overhauling and servicing of Refrigerator	25	110	135
4	Demonstrate overhauling and servicing of Air Conditioner	25	105	130
5	Apply safe working practices	10	15	25
TOTAL :		130	410	540

Employability Skill : 60 Hrs**SYLLABUS:****Module No. 1:** Types of Refrigerator and Air Conditioner and related terms**Outcome:**

Describe different Types of Refrigerator and Air conditioner and associated terms.

Theory Content:

- 1.1 Definition of Refrigeration, refrigerating effect, COP, Capacity of Refrigeration.
- 1.2 Definition of Air Conditioning Psychrometry, DBT, WBT, RH

- 1.3 Describe the importance of Refrigeration and Air conditioning in domestic, commercial and industrial field.
- 1.4 Labelled Flow diagram of Vapour Compression Refrigeration Cycle.
- 1.5 Labelled Flow Diagram of Vapour Absorption Refrigeration System.
- 1.6 Components of Single Door Refrigerator and Double Door Refrigerator.
- 1.7 Different systems of Air Conditioning, such as-Summer Air conditioning system, Winter Air Conditioning system, Year Round Air Conditioning System
- 1.8 Components of Window Air Conditioner and Split Air Conditioner.

Practical Content:

- 1.1 Identification of Different components of Single Door Refrigerator.
- 1.2 Identification of Different components of Double Door Refrigerator
- 1.3 Identification of different components of Window Air Conditioner
- 1.4 Identification of different components of Split Air Conditioner.

Module No. 2: Identification of different tools and electrical instrument required for servicing of Refrigerators and Air conditioner

Outcome:

Demonstrate the use of different tools and electrical instruments required for servicing of Refrigerators and Air conditioners.

Theory Content:

- 2.1 Name, specification and use of different hand tools like Hand tools-Screw driver, Pliers, Knife, Wrench, Allen key set , Torque wrench Oil can, Soldering iron, Hammer, Hack saw, Files, Engineers' rule, measuring Tape Chisel, Scriber, Divider, Calliper, centre punch, Bench vice.
- 2.2 Name, Specification and use of different servicing tools required for RAC like Servicing Tools- Flaring tool set, Swaging tool, Bending tool, Pipe Cutter, Ratchet spanner, pinch off tool, Pressure gauge, Serviceman thermometer, Gas leak detector.
- 2.3 Name, specification and use of different electrical and electronic instrument like Electrical Instrument Voltmeter, Ammeter, Wattmeter, Multi meter, Transistor tester
- 2.4 Concept of current, voltage, resistance, power, energy, series and parallel connection, AC motor, capacitor, condenser.

Practical Content:

- 2.1 Identification of different hand tools like Hand tools-Screw driver, Pliers, Knife, Wrench, Allen key set , Torque wrench Oil can, Soldering iron, Hammer, Hack saw, Files, Engineers' rule, measuring Tape Chisel, Scriber, Divider, Calliper, centre punch, Bench vice.
- 2.2 Identification of different Servicing tools required for RAC like Servicing Tools- Flaring tool set, Swaging tool, Bending tool, Pipe Cutter, Ratchet spanner, pinch off tool, Pressure gauge, Serviceman thermometer, Gas leak detector.
- 2.3 Identification of different electrical and electronic instrument like Electrical Instrument Voltmeter, Ammeter, Wattmeter, Multimeter, Transistor tester
- 2.4 Measurement of current, voltage, resistance, electrical power, electrical energy.

Module No. 3: Overhauling and servicing of Refrigerator for Domestic purpose

Outcome:

Demonstrate overhauling and servicing of Refrigerator.

Theory Content:

- 3.1 Some Common problems as listed below in Refrigerators possible causes and remedy
- ✓ Fridge Not Cooling
 - ✓ Fridge Not Defrosting
 - ✓ Freezer is Cool, but Fridge Stays Warm
 - ✓ Fridge Leaking Water
 - ✓ Fridge Freezing Food
 - ✓ Light Not Working
 - ✓ The ice maker isn't working

Practical Content:

- 3.1 Overhauling, oiling and servicing of components like Cylinder, Piston, piston Ring, Crankshaft, Cylinder head valve plate assembly, Shaft seal, connecting rod etc. and assemble them. Charging of compressor oil
- 3.2 Testing for leakage through condenser and repairing the leakage.
- 3.3 Checking of capillary tube, Automatic & Thermostat Expansion Valve, fault detection and repair and replacement of the faulty parts.
- 3.4 Charging of refrigerant
- 3.5 Vacuumising, Drying.
- 3.6 Repairing of copper tube by Cutting, bending and joining, Flaring, Swaging, Silver soldering.
- 3.7 Servicing of refrigerator cabinet –Checking of door liner and body inside liner, replacement of door liners and door gasket, Adjustment of door liners and door gasket.

Module No. 4: Overhauling and servicing of Air-conditioning for Domestic purpose

Outcome:

Demonstrate overhauling and servicing of Air Conditioner

Theory Content:

- 4.1 Some Common problems as listed below in Window Air conditioner, possible causes and remedy.
- ✓ Water dripping from the front of a window AC
 - ✓ Compressor cycles between ON and OFF too frequently
 - ✓ Ice formation on window AC
 - ✓ Window AC not starting problem
 - ✓ Window AC with low cooling performance
 - ✓ Compressor switching off too early without cooling
- 4.2 Common problems of Indoor and outdoor unit of split A.C., possible causes and remedy.
- 4.3 Classification of refrigerant, Primary Refrigerant and Secondary Refrigerant, CFC, HFC, HCFC, HC, Azeotropic and Zeotropic blend, Importance of Eco friendly refrigerant.

Practical Content:

- 4.1 Routine maintenance of window and split air conditioner.

4.2 Checking of thermal overload protector, motor starting relays and capacitors and Servicing of the above components.

Module No. 5: Trade related general safe working practices

Outcome:

Apply safe working practices

Theory Content:

- 5.1 Personal protection in work place.
- 5.2 Personal safety and prevention of accident.
- 5.3 Basic First Aid
- 5.4 Safety sign for danger, warning, caution and personal safety message
- 5.5 Use of fire extinguisher
- 5.6 Electrical safety precautions
- 5.7 Hazards due to leakage of refrigerant and precautionary measures.
- 5.8 Hazards due leakage of lubricant and water and precautionary measures.
- 5.9 Electrical Safety precautions
- 5.10 Use of PPE's during servicing of Refrigerator.

Practical Content:

- 5.1 Demonstration of the use of different bandages and medicines commonly present in a first aid box.
- 5.2 Demonstration of basic first aid and use them under different circumstances.
- 5.3 Demonstration of Safety sign for Danger, Warning, caution and personal safety message accurately.
- 5.4 Identification of different fire extinguishers and to use the same as per requirement.
- 5.5 Demonstration of Precautionary measures in case of leakage of refrigerant.
- 5.6 Demonstration of use PPE's during servicing of Refrigerator.

List of Tools, Equipment & materials needed for 30 Trainees:

JUNOR REFRIGERATOR AND AIR CONDITIONER MECHANIC (For batch of 30 candidates)			
Sl. No.	Name of the Tool & Equipment	Specification	Quantity
1	File flat rough double cut	200mm	30 + 1 nos.
2	File, half round, fine double cut	length 150mm	30 + 1 nos.
3	File, round, fine double cut	length 150mm	30 + 1 nos.
4	File flat, fine double cut	length 150mm	30 + 1 nos.
5	File square, fine double cut	length 150mm	30 + 1 nos.
6	File triangular fine double cut	length 150mm	30 + 1 nos.
7	Try square	150 mm	30 + 1 nos.
8	Hammer ball pane	220 gms	30 + 1 nos.
9	Engineers rule	300mm long	30 + 1 nos.
10	Tape measuring	10m graduation in mm	30 + 1 nos.
11	Pliers combination insulated	length 200mm	30 + 1 nos.
12	Pliers long nose	200 mm	30 + 1 nos.
13	Pliers flat nose	150mm	24 + 1 nos.
14	Line tester	500 v heavy duty	30 + 1 nos.
15	Oil can	500 ml	5 nos.
16	Bench vice	150 to 300mm jaw	15 nos.
17	Hack saw tubular metal frame adjustable	300mm	15 nos.
18	Snip sheet metal straight nose	200 mm	15 nos.
19	Snip sheet metal curved nose	200 mm	15 nos.
20	Wooden mallet /Nylon mallet	500 gm good finish	5 nos.

21	Electrical drill portable drill with chuck and key	capacity 6.4mm	5 nos.
22	Screw driver, plastic handle,	6mm TIP length 100mm to 150mm	6nos.
23	Screw driver, plastic handle, Flat tip	10mm TIP length 200mm & 250mm	6 nos. each
24	Philips screw driver -	complete set in leather case	5 nos.
25	Screw driver, plastic handle, Flat tip	handle 3mm TIP length 100mm to 150mm insulated	5 nos.
26	Soldering iron exchangeable copper tip	65 watts	15 nos.
27	Knife folded stainless steel -	150mm	15 nos.
28	Tong tester (clamp on multi meter)	0-10-30 amps 0-500 v	5 nos.
29	Fire extinguisher	ABC dry powder type 2 kg capacity	2 no.
30	Fire buckets	10 Litre	3 nos.
31	Ring spanner	6 -32 mm	5 set
32	Quick couples, process tube adopter	1/4" & 3/8"	4 nos. each
33	Tong Close mouth and pick		1 no.
34	Welding table for gas/Arc	1200x760	1no. each
35	Flaring tool set, single type for tube.	4.7mm to 16mm O.D	5 nos.
36	Swaging tool, punch type, set of size for tube.	4.7mm to 16mm O.D	5sets
37	Bending spring external type, for copper tube	3mm to 16mm DIA	5sets
38	Pipe cutter miniature for copper tube	3mm to 16mm DIA	5sets
39	Pinch of tool, for copper tube,	6mm to 18mm DIA	5sets
40	Ratchet spanner	6.4 sq.mm reversible	5sets
41	Capillary plug gauge		5sets
42	Piercing pliers & reversing valve with access fitting	6-18mm	5sets
43	Spanner double ended	4.7mm to 16mm	5sets
44	Ring spanner off set	4.7mm to 16mm	5sets

45	Wrench adjustable	length 150mm	5sets
46	Wrench adjustable	length 200mm	5sets
47	Wrench adjustable	length 250mm	5sets
48	Valve key handle[Treated as consumable]	4.7mm & 6.4mm sq.	5sets
49	(Hollow) Punch hole for cutting gasket	4.7-16mm die	2sets
50	Scissor, gasket cutting stainless steel	length 25mm	5sets
51	L-Allen key	set size 1.5mm to 6.4mm	5 sets
52	T-Allen key set	size 5/32" to 1/8"	5sets
53	Pipe cutter with built in reamer and space cutter, for copper tube	3mm to 32mm	5nos.
54	Pipe /Tube bender lever type	3-16 mm	1 no each
55	Spanner double ended	19mm to 31.8 mm	5nos.
56	Pipe wrench	size 50mm to 150mm	5nos.
57	Puller 3 legged with flexible arm	300mm	5nos.
58	Hand blower portable complete	1/10 HP	2nos.
59	Spirit level precision metallic	200mm	2nos.
60	Tap set with matching drills	3 mm to 16mm	3nos.
61	Tap set with matching drills	V to 5/8"	3nos.
62	Refrigerant cylinder	2.5 Kg	3nos.
63	Heating kit with infrared bulb	(200 w capacity)	2nos.
64	Plumbing hammer weight	200 gm	2nos.
65	Cylinder 134 a	5 kg	1 no.
66	Torque Wrench	300mm-12.7mm	1 no.
67	Piercing Valve	¼ Inch	2 nos.
68	Feeler gauge	0.05mm to 1mm	3 nos.
69	Voltmeter, AC/DC portable precision grade Digital Panel board type	0 to 500 volts	5nos.
70	Ammeter, AC/DC portable precision grade Digital Panel board type	0 to 30 amp	5nos.
71	Megger	1000v	5nos.
72	Wattmeter multi-range up	1 KW	1no.

73	Multi meter digital type		5nos.
74	Pressure gauge Digital type	diameter 63mm with recalibration set	5sets
75	Service Thermometer in metal case	-30°C to + 110°C	5sets
76	Gas leak detector for halogen gas		2nos.
77	Electronic leak detector		2 nos.
78	Sling psychrometer mounted on aluminum back.	scale -10 ⁰ C to +110 ⁰ C	5nos.
79	Stop watch		2nos.
80	Vernier caliper	length 250mm	2nos.
81	Micrometer Outside	0 to 25 mm	2nos.
82	Tachometer digital, multi range	0 r m p to 3000 r m p. Portable small size in leather case	2nos.
83	Sensor thermometer (digital)	-50 degree Celsius to 150 degree Celsius	2nos.
84	Filler gauge	0.05 mm - 1 mm	3nos.
85	Wire gauge metric & British.	Steel plate embossing converse of British & Metric	2nos.
86	Dial thermometer remote control, armored capillary dial	75mm - 50C to +50 C	3nos.
87	Anemometer	Digital type	1no.
88	Compressors testers for small hermetic compressors	Fixed with electrical input/ output indicating facilities	2nos.
89	Digital thermometer	Graduated disc analogy type	1no.
90	Temperature & Humidity Recorder.	Capacity to record 24 hrs. record	1no.
91	Instrumentation screw driver set	100mm	5nos.
92	Capacitor start induction motor	1 HP, 230 V	1 no.
93	Star delta starter	2 HP	1 no.
94	Auto Transformer starter	3 HP	1 no.
95	D.O.L Starter	2 HP	1 no.
96	Portable air - LPG brazing kit	2 kg. LPG cylinder, torches, houses, stand make	1 no.

97	Core drill machine.		1 no
98	Bench Drilling machine	20 mm capacity,200-2500rpm	1 no.
99	Grinding Machine	200mm,3000rpm,Double ended ½ HP	1 no.
100	Evacuating and refrigerant charging station, consist of a) Rotary two stage vacuum pump and motor (with gas ballast and anti-suck back) b) manifold with gauges and valves and capable of pulling vacuum up to 50 microns of Hg and with provision of connecting to a microns level vacuum gauge b) Graduated charging cylinder with provision for temperature correction and all necessary isolating valves	(CAP. 2 kg. In lieu of (b)above and with accuracy of + / - g for charging hydrocarbons)	1 no.
101	Evacuating and charging station as above but fitted with weighing scale		1 no.
102	Two stage rotary vacuum pump, 3or 4 CFM.	Capacity approx. 60 - 100mp capable of evacuating to 50 microns of Hg and fitted with gas ballast, anti-suck valve and single phase motor.	1 no.
103	Dry N ² cylinder	2 stage regulator or commercial N ² in cylinder with drier unit and 2 stage regulator & meter cube	1 no.
104	Single door direct cool refrigerator, carrying with HFC and HC.	190 L	1 each