Syllabus for Machine Operator

Course Name	**Machine Operator**
Sector	Capital Goods
Course Code	CGM/2023/MAOP-RPL/264
Level	RPL LEVEL 3
Occupation	**Machine Operator**
Job Description	Machine Operator plays the role of operation and maintenance of machinery associated with air conditioning systems, will be proficient in operating and controlling compressors, condensers, dryers, and other essential components. They will also responsible for monitoring and adjusting settings to maintain specified operating conditions for temperature and pressure, performing routine maintenance to ensure optimal performance, troubleshooting and addressing equipment malfunctions, and adhering to safety protocols.
Course Duration	Total Duration 80 Hrs. (T-23, P-57) RPL
Trainees' Entry Qualification	Grade 8 with more than 5 Year Experience in the relevant Field
Trainers Qualification	Degree or Diploma in Mechanical Engineering with 1 yr experience in relevant field OR ITI in relevant trade with 3 yr experience in relevant field

Structure of Course:

Module No.	Module name	Outcome	Theory (Hrs)	Practical (Hrs)	Total (Hrs)
1.	**Workplace Safety**	Apply safe working practices in the industry	1	1	2
2.	**Basic Engineering Drawing**	Practice & interpret technical drawings	2	6	8
3	**Introduction to Fitting Tools**	Identify different fitting tools along with their application	2	6	8
4	**Precision Fittings Machinery practices**	Identify the types, specifications, and maintenance procedures of fitting machineries along with the utilization of measuring instruments in manufacturing.	2	6	8
5	**Insights into Compressor Dynamics and Condenser Technologies**	Identify various types & application of Compressor and Condenser and explain the effect of choked and descaling process of air-cooled condenser.	6	10	16

6	**Overview of Drier and Desicants**	Identify types, applications of Drier and Desicants along with their advantages	2	6	8
7	**Evaporator and accumulator system in Refrigeration and Air Conditioning**	Identify the types, functions of evaporators and accumulator along with their application	2	6	8
8	**Refrigeration and air conditioning motor dynamics**	Identify the types, functions, construction of motors used in refrigeration and air conditioning system along with their starting method.	2	6	8
9	**Working principle of inverter technology**	Demonstrate working principle of inverter technology	2	6	8
10	Employability Skill	As per guided curriculum	2	4	6
		TOTAL:	23	57	80

SYLLABUS:

Module No. 1: Workplace Safety

Outcome: Apply safe working practices in the industry

Theory Content:

1. Awareness of safety norms.
2. Safety-PPE usage and its benefits
3. Fire prevention and personal safety.
4. Ergonomic safety and health principles.
5. Use various PPE while working.
6. Safety during machine / material handling

Practical Content:

1. Accident prevention and safety regulations while material handling, eliminating unsafe conditions, unsafe actions, discovering causes of accidents.
2. Fire prevention and personal safety.
3. Safety during machine handling.
4. Emergencies, rescue and first aid procedures.
5. Familiar with Personal protective Equipment's and clothes Different Type of Safety Sign, First Aid Box, Safety instrument and clothing

Tools & Equipment needed:

Protective clothing (aprons, gloves), eye and hearing protection, respiratory gear, steel-toed boots, hard hats, welding helmets, ventilation systems, first aid kits, PPE, fire safety equipment, and organizational tools like anvil stands.

Module No. 2: Basic Engineering Drawing

Outcome: Practice & interpret technical drawings

Theory Content:

- Introduction of technical drawing and lettering
- Use and care drawing boards and different drawing instruments, Drawing sheets and their sizes.
- Explain Types of Lines: Horizontal, Vertical, Inclined, parallel lines.
- Concept of using Scales in Drawing – Enlarging, Full Size & Reducing Scale.

Practical Content:

Introduction of technical drawing and lettering

- How to begin a drawing – Layout of drawing sheet.
- Drawing of — i) Horizontal lines, ii) Vertical lines, iii) Inclined lines, iv) Parallel lines,
- Single stroke Lettering by conventional method.
- Dimensioning—System of Dimensioning

Geometrical Construction

- Geometrical construction of Polygons (Pentagon, Hexagon & Octagon) by general method.

Orthographic Projection of Line & Lamina

- Projector; Plane of projection – Vertical Plane, Horizontal Plane & Profile Plane. Concept of 1st angle
- Projection; 3rd angle Projection. Reference Line – Symbol of methods of projection. (Demonstration with models).
- Projection of Points, Lines & Lamina (Square, rectangular, triangular, hexagonal, pentagonal and circular) parallel to VP and angle with HP & vice versa.

Freehand Sketch

Introduction – Necessity.

b) Free hand sketches of rolled steel sections – i) T-section, ii) I-section, iii) Angle section, iv) Channel section, v) Circular section, vi) Rectangular Section, vii) Steel flat, viii) Double ended wrench, ix) Screw driver, x) Nail puller

Tools & Equipment needed: Drawing instrument box, Drawing instrument box, Set square celluloid 30°-60°, French-curves (set of 12 celluloid), T-Square or Mini drafter, Drawing board.

Module No. 3: Introduction to Fitting Tools

Outcome:

Identify different fitting tools along with their application

Theory:

- An overview on fitting hand tools and power tools.
- Understanding application of fitting hand Tools and power tools: Screwdrivers, Wrenches, Pliers, Hammers, tapes, rulers, electric drills, impact wrenches, grinders, Saws etc
- Identifying Internal mechanisms of fitting tools and the materials used in their construction
- Read and interpret tool specifications, and understand the factors influencing tool selection
- Emphasizing the importance of safety in tool operation

Practical:

- Hands-on exercises for hand tools (such as screwdrivers, wrenches, etc.) and Power tools (such as electric drills, impact wrenches, grinders, saws etc.)
- Demonstration on effective integration of fitting tools into machine operation

Tools and equipment:

Projector and Screen, Whiteboard, Laptop or Computer
Fitting hand tools : Wrenches, Screwdrivers, Pliers, Hammers, Measuring Tools such as tapes, rulers
Power tool: electric drills, impact wrenches, grinders, saws etc

Module No. 4: Precision Fittings Machinery practices

Outcome:

Identify the types, specifications, and maintenance procedures of fitting machineries along with the utilization of measuring instruments in manufacturing.

Theory:

- Introduction to various types and specification of drilling machines (e.g., pillar drill, radial drill) and grinding machines (e.g., surface grinder, cylindrical grinder).
- Overview the use of measuring instrument such as calipers, micrometers, and depth gauges.
- Importance of regular maintenance, Troubleshooting common issues and preventive measures for prolonging machinery life.

Practical:

- Identifying different types of fitting machineries.
- Hands-on Operation of Fitting Machineries like drilling machines, grinding machines.

Tools and Equipment:

Drilling Machines: Pillar drill and radial drill.
Grinding Machines: Surface grinder, cylindrical grinder for practical demonstrations.
Measuring Instruments: Vernier calipers, micrometers, depth gauges for precision measurements.
Safety Equipment: Safety glasses, ear protection, gloves, and appropriate attire for workshop safety.
Drill bits, grinding wheels, and other accessories compatible with the machines.
Maintenance Tools: Lubricants, cleaning tools, and basic maintenance equipment for drilling and grinding machines.
Workpieces: Various metal or plastic workpieces for students to practice drilling and grinding.

Module No. 5: Insights into Compressor Dynamics and Condenser Technologies

Outcome:

Identify various types & application of Compressor and Condenser and explain the effect of choked and descaling process of air cooled condenser.

Theory:

- Introduction to Condenser and fixed speed & variable speed compressors
- Understanding construction and application of Condenser and fixed speed & variable speed compressors
- Understanding the impact of a choked condenser
- Techniques used in descaling of air-cooled condenser and its advantages

Practical:

- Identifying different types of compressor and condenser
- Demonstration on the components of air-cooled condenser and various types of compressors
- Hands on exercise on operation of an air-cooled condenser, fixed speed and variable speed compressors.
- Practical session on descaling procedures for air-cooled condensers.

Tools and Equipment:

Projector and Screen, Whiteboard, Laptop or Computer.
Compressor Cutaway Model: A model displaying the internal components of both fixed speed and variable speed compressors
Condenser Samples: Physical samples of different condenser types, especially air-cooled.
Descaling Practice Kit, Choked Condenser Simulation Kit

Module No. 6: Overview of Drier and Desicants
Outcome:

Identify types, applications of Drier and Desicants along with their advantages

Theory:

- Introduction to Drier and Desicants.
- Understanding the purpose and application of Drier and Desicants.

Practical:

- Identifying different types of drier and desicants.
- Hands on inspection of actual drier and desicants used in refrigeration or air conditioning systems.

Tools & Equipment List:

Projector and Screen, Whiteboard, Laptop or Computer
Physical samples of different types of driers, Samples of desiccant materials

Module No. 7: **Evaporator and accumulator system in Refrigeration and Air Conditioning**
Outcome:

Identify the types, functions of evaporators and accumulator along with their application.

Theory:

- Understanding the fundamental working principles and functions of evaporators.
- Explore various types of evaporators used in different applications, including refrigerators, water coolers, bottle coolers, and window and split air conditioners
- Explaining the concept of superheating in evaporators
- Understanding the function of accumulators in refrigeration systems and exploring different accumulator types.

Practical:

- Identify different types of Evaporator and accumulator
- Demonstration on different evaporators used in refrigeration and air conditioning systems
- Hands on activity on measurement of superheating in evaporators.
- Demonstrating the function of accumulators.

Tools & Equipment:

Evaporator Models : Physical models of various evaporators used in refrigeration and air conditioning applications,
Accumulator Demonstration Setup: Operational models or cutaway versions of accumulators,
Superheating Measurement Tools: Instruments such as thermocouples and pressure gauges for measuring and analyzing superheating in evaporators.

Module No. 8: Refrigeration and air conditioning motor dynamics

Outcome:

Identify the types, functions, construction of motors used in refrigeration and air conditioning system along with their starting method.

Theory:

- Understanding the role and significance of motors used in refrigeration and air conditioning system
- Explore various types of motors used in refrigeration and air conditioning system
- Analyzing the construction details and working principles of motors employed in refrigeration and air conditioning applications.
- Understanding different motor starting methods

Practical:

- Identifying different types of motors used in refrigeration and air conditioning system
- Demonstration on cutaway models of various motors
- Practical exercise on setting up of operational motors
- practical demonstrations of different motor starting methods

Tools & Equipment:

Motor Cutaway Models: Physical models illustrating the internal components and construction of different

motors

Module No. 9: Working principle of inverter technology

Outcome:

Demonstrate working principle of inverter technology.

Theory:

- Understanding the fundamental principles of inverter technology
- Identifying the diverse applications of inverter technology
- Exploring the benefits of inverter-driven systems
- Understanding different components of inverter

Practical :

- Demonstration on working models of inverter technology
- Hands-on Assembly of Inverter Components

Tools & Equipment:

Inverter Technology Kits, Operational models of appliances with inverter technology

Module No. 10: Employability Skills

Detail Content

- **Basic English Skills**

1. Converse using basic English sentences.
2. How to Greet others
3. Read and interpret text written in basic English
4. Write a short note/paragraph / letter using basic English

- **Communication Skills**

1. Demonstrate how to communicate effectively using verbal and nonverbal communication Etiquette.
2. Discuss the significance of working collaboratively with others in a team

- **Financial Skills**

1. Outline the importance of selecting the right financial institution, product and service
2. Demonstrate how to carry out offline and online financial transactions, safely and securely like net banking, wallet payment, UPI.
3. List the common components of salary and compute income, expenditure, taxes, investments etc.

- **Essential Digital Skills**

1. Familiarization of working with computer
2. Discuss the significance of displaying responsible online behavior while browsing using various social media platforms, e-mails, etc., safely and securely
3. Send email with attachment. Receive email and download attachment

- **Customer Service Skills**

1. Explain the significance of identifying customer needs and responding to them in a professional manner.
2. Discuss the significance of maintaining hygiene and dressing appropriately

Learning Outcome – Assessment Criteria

Module No.	Outcome	Assessment Criteria
1	Apply safe working practices in the industry	**After completion of this module students will be able to:** 1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements. 1.2 Identify basic first aid and use them under different circumstances. 1.3 Identify different fire extinguisher and use the same as per requirement. 1.4 Identify safety alarms accurately 1.5 Follow about General safety precaution in industry with Blacksmithing Work
2	Practice & interpret technical drawings	**After completion of this module students will be able to:** 2.1 Draw plane figures applying drawing instruments with proper layout and folding of drawing sheets. 2.2 Construct Line, Lettering, Dimensioning, and Scale – Plain, Diagonal 2.3 Draw plan, elevation, side view of different objects with appropriate type of lines and dimensions as per standard convention. 2.4 Draw simple geometrical figure like square, rectangle, circle using CAD.
3	Identify different fitting tools along with their application	**After completion of this module students will be able to:** 3.1 Identify different fitting hand tools and power tools 3.2 Describe Internal mechanisms and materials used in their construction of fitting tools. 3.3. Demonstrate the application of fitting hand Tools and power tools 3.4 Evaluate the factor influencing tools selection 3.5 Demonstrate the importance of safety in these tools operation.
4	Identify the types, specifications, and maintenance procedures of fitting machineries along with the utilization of measuring instruments in manufacturing.	**After completion of this module students will be able to:** 4.1 Identify different types of drilling machines and grinding machines. 4.2 Describe the proper use of the fitting machineries.

Module No.	Outcome	Assessment Criteria
		4.3 Explain the use of measuring instruments. 4.4 Demonstrate the importance of regular maintenance of fitting machineries.
5.	Identify various types & application of Compressor and Condenser and explain the effect of choked and descaling process of air cooled condenser	**After completion of this module students will be able to:** 5.1 Identify different types of Compressor and condenser 5.2 Demonstrate the construction and application of Compressor and condenser 5.3 Identify different components of air-cooled condenser and various types of compressors. 5.4 Explain the effect of choked condenser 5.5 Demonstrate the techniques used in descaling of air-cooled condenser 5.6 Explain advantages of descaling in air-cooled condenser 5.7 Execute Hands on operation of an air-cooled condenser, fixed speed and variable speed compressors
6	Identify types, applications of Drier and Desicants along with their advantages	**After completion of this module students will be able to:** 6.1 Comprehend overview of Drier and desicants. 6.2 Explain the purpose and application of Drier and Desicants. 6.3 Identify different types of drier and desicants. 6.4 Execute hands on inspection of drier and desicants used in refrigeration or air conditioning systems.
7	Identify the types, functions of evaporators and accumulator along with their application.	**After completion of this module students will be able to:** 7.1 Identify various types of evaporators 7.2 Explain application of each type of evaporator 7.3 Demonstrate the concept of superheating in evaporators 7.4 identify different types of accumulator 7.5 Explain the function of accumulator. 7.6 Execute hands on exercises on measurement

Module No.	Outcome	Assessment Criteria
		of superheating in evaporators
8	Identify the types, functions, construction of motors used in refrigeration and air conditioning system along with their starting method	**After completion of this module students will be able to:** 8.1 Explain the role and significance of motors used in refrigeration and air conditioning system. 8.2 Identify various types of motors used in refrigeration and air conditioning system. 8.3 Illustrate the construction details and working principle of the motors. 8.4 Explain different methods of staring the motors.
9	Demonstrate working principle of inverter technology.	**After completion of this module students will be able to:** 9.1 Demonstrate fundamental working principles of inverter technology. 9.2 Explain different application of inverter technology 9.3 Identify various components of inverters 9.3 Illustrate the benefits of inverter driven systems.
10	Employability Skill	As per guided curriculum