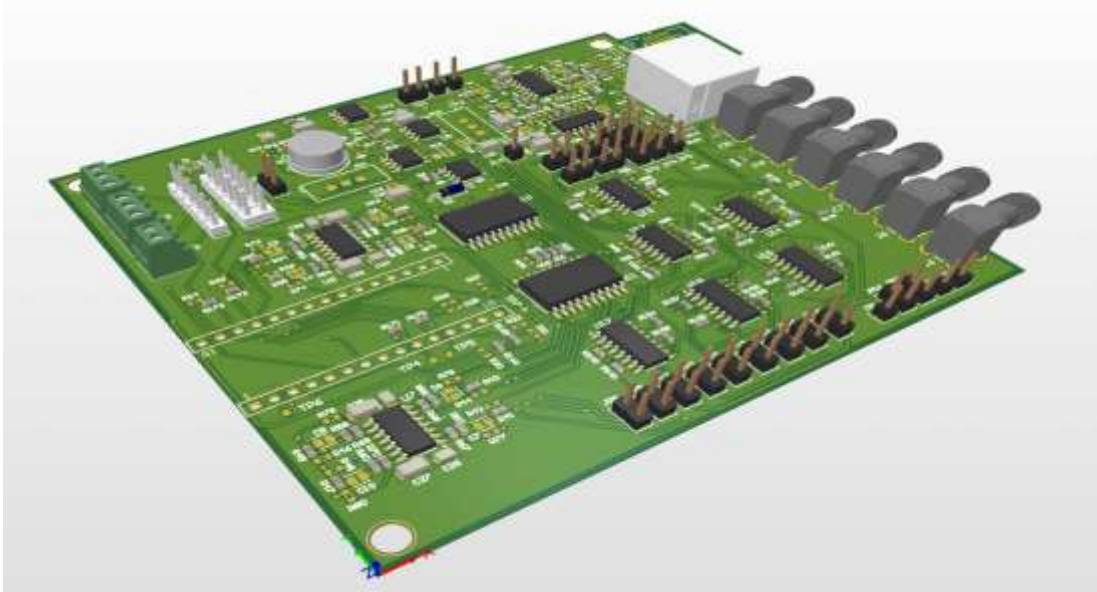




MODEL CURRICULUM



Qualification Name:
JR. TECHNICIAN (PCB FABRICATION)

Qualification Code:

Version: 2

NSQF Level: 3

Model Curriculum Version: 2

Submitted By:

MSME TECHNOLOGY CENTRE

O/o DC MSME, Ministry of Micro, Small and Medium Enterprises

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NOS / MODULE TEMPLATE

NOS /Module: Acquire the concepts of Basic Electronics

NOS /Module Code: MSME/CCPCBF/01

Outcomes:

After completion of course Student should be able to:

- Follow safety rules.
- Lab Safety procedure.
- Lab accidents and precautions.
- Explain structure of matters.
- Explain the working principles of cells and batteries.
- Calculate the value of resistance with the colour code.
- Explain semi-conductor theory.
- Explain working principal of diode and its uses.
- Explain working principal of transistor and its uses.
- Test the electronic component as per its specifications.
- State the need and importance of symbols.
- Draw and identify the symbols for components and instrument used in electronic assembly.
- Use of various electronic instruments.
- Explain the binary number system.
- Convert number from one number system to other.
- Explain the logic families (Nomenclature and brief features).
- Identify different packaging system.
- Describe logic rules.
- Explain digital logic system.
- Draw basic logic symbols.

Theory Hours: 90

Practical Hours: NA

Theory Marks: 100

Practical Marks: NA

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	TH Marks
UNIT-I	Safety Precautions	After completion of this unit student should be able to: <ul style="list-style-type: none"> • How to handle the chemicals. • How to handle the laminates. • How to handle the films. 	Lab Safety Rules Electricity Safety and First Aids Lab accident and its precautions. Safety precautions for handling chemicals. Safety precautions for handling Tools. Safety precautions for handling 1-phase and 3-phase Machine.	10	20
UNIT-II	Basic Electronics	After completion of this unit student should be able to: <ul style="list-style-type: none"> • Explain semi-conductor theory. • Explain working principal 	Introduction of Electronics. Atomic Structure Structure of matter. Conductors, Insulators and Semiconductors.	60	50

		<p>of diode and its uses.</p> <ul style="list-style-type: none"> • Explain working principal of transistor and its uses. • Calculate the value of resistance with the colour code. • Test the electronic component as per its specifications. • Refer the data book of component for extra, required information and also for equivalents. • State the need and importance of symbols. • Draw and identify the symbols for components used in electronic assembly. 	<p>Active Components & Passive Components Semiconductor physics.</p> <p>Semiconductor Physics</p> <p>Semiconductor diode & its characteristics.</p> <p>Forward & Reverse biasing of a diode.</p> <p>Special Purpose Diode-LED,</p> <p>Zener diode & its characteristics.</p> <p>Half wave & Full wave rectifier.</p> <p>Integrate Circuit & its Application.</p> <p>Transistor & its type</p> <p>Transistor Biasing</p> <p>Simple voltage regulator circuit.</p> <p>Analog Circuits(Amplifiers Circuits, Oscillators Circuits, Filter circuits, AC to DC Converter, Comparators, Voltage Regulators, Oscillators.)</p> <p>Discrete Circuits.</p> <p>Switching circuits.</p> <p>Cell & Battery</p> <p>Signals.</p> <p>Soldering & De-soldering</p>		
UNIT-III	Digital Electronics	<p>After completion of this unit student should be able to:</p> <ul style="list-style-type: none"> • Explain the binary number system. • Convert number from one number system to other. • Explain the logic families (Nomenclature and brief features). • Identify different packaging system. • Describe logic rules. • Explain digital logic system. • Draw basic logic symbols. 	<p>Number System & Codes.</p> <p>Digital Arithmetic's</p> <p>Conversion from one number system to other.</p> <p>Logic Gates and Circuit Diagrams.</p> <p>Logic Families.</p> <p>Boolean Algebra & simplification Technique.</p> <p>Basic Logic Operations and Logic Expressions.</p>	20	30

COURSES / MODULE TEMPLATE

NOS /Module: Designing of PCB using CAD/CAM software

JR. TECHNICIAN (PCB FABRICATION)

NOS /Module Code: MSME/CCPCBF/02

Outcomes:

After completion of course Student should be able to

- State rules and regulations of PCB design.
- Place the components.
- Minimize the size of PCB.
- Convert schematic diagram to layout diagram.
- Place ground lines and power supply.
- Maintain the mounting holes.
- Maintain the angular ring.
- Maintain the air gaps.
- Maintain the track width.
- Do tracking
- Generate drilling drawing.
- Generate mechanical drawings.
- Explain CAD fundamentals.
- Draw schematic diagram.
- Place schematic components.
- Edit a library path.
- Do wiring.
- Generate netlist.
- Placement of component for layout designing.
- Library editing in layout.
- NC Drill file generation.
- Gerber file generation.
- Convert Design file to Gerber file and vice versa.
- How to take printout.

THEORY HOURS: - 20 PRACTICAL HOURS: 170 THEORY MARKS: - PRACTICAL MARKS: 100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	PR hours	PR Marks
UNIT-I	CAD & CAM Fundamental	After completion of this unit student should be able to: <ul style="list-style-type: none">• Explain CAD fundamentals.• Understand CAD structure• Explain Advantages	Introduction to CAD. Introduction to CAM Introduction to software like Or-CAD, CAD STAR, Protel, Altium, CAM350, Gerber Viewer. Features of CAD & CAM Basic CAD & CAM Operation. Advantages of CAD & CAM.	10	20

UNIT-II	PCB CAD Design	<p>After completion of this unit student should be able to:</p> <ul style="list-style-type: none"> • Minimize the size of PCB. • Convert schematic diagram to layout diagram. • Place ground lines and power supply • Maintain the mounting holes. • Maintain the angular ring. • Maintain the air gaps. • Maintain the track width. • State rules and regulations of PCB design. • Outline designing. • Placement of component for layout designing. • Library editing in layout. • Tracking. • Generate NC drill files. • Generate Gerber file. • Convert design file to Gerber file and vice versa. 	<p>Fundamental of schematic Diagram.</p> <p>Electronic Symbols.</p> <p>Define and read schematic.</p> <p>General Design Guideline of Schematic.</p> <p>Design different circuits</p> <p>Fundamental of Manual PCB Layout Design</p> <p>Layout Planning</p> <p>Electronic Layout Symbols.</p> <p>Component Placement & Connection Rule.</p> <p>General Design Guideline of Layout.</p> <p>Board Layout Ground Rules (Conductor width, Signal, Power/ground tracks., Design Rule for Analog, Digital & other Circuits, Describe component layout, Pad size ,Hole diameter& Component Mounting, Clearance- Track Clearance, PAD clearance etc.)</p> <p>Introduction to the PCB Design with example.</p> <p>Project Structure and the PCB Editor Tool</p> <p>Making and editing Components Parts.</p> <p>Making and editing footprints.</p> <p>PCB Design Examples.</p> <p>Circuit Simulation</p> <p>Different types of reports-Gerber File, NC Drill File, Pick and Place File, BOM etc.</p> <p>Computer Aided Manufacturing (CAM) software- Gerber data editing, NC drill data editing, panel creation.</p> <p>PCB Copy (Reverse Designing).</p>	160	80
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COURSES / MODULE TEMPLATE

NOS /Module: Prepare for Image Transfer Technique

NOS /Module Code: MSME/CCPCBF/03

Outcomes:

After completion of course Student should be able to perform

- Define the artworks required to manufacture a PCB.
- Read mechanical and drilling drawing.
- Name the types of laminates.
- Find out the thickness of laminates.
- Properties of glass epoxy laminates.
- Properties of Teflon.
- Properties of Aluminum based laminates.
- Properties of double sided laminates.
- Characteristics of Lith film.
- Characteristics and developing of five star films.
- Characteristics and developing of Chromo line film.
- Characteristics of Photo Polymer Dry Film Resist.
- Process for developing and fixing of lith films.
- Process for making negative and positive films.
- Process of retouching of lith films.
- Observe precautions to protect the Photo Polymer Dry Film Resist.
- Carry out process of single side lamination.
- Carry out process of double side lamination.
- Carry out process of exposing.
- Carry out process of developing of dry film.
- Fabricate screen.
- Select fabrics.
- Measure tension of screen.
- Prepare stencils.
- Use squeeze.
- Use ink.
- Carry out after printing process for drying.
- Understand PCB waste management.
- Recycle and recovery technique.
- Minimize wastages.

THEORY HOURS: - 10 PRACTICAL HOURS: 120 THEORY MARKS: - PRACTICAL MARKS: 100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	PR hours	PR marks
UNIT-I	PCB Standards	After completion of this unit student should be able to: <ul style="list-style-type: none"> • Understand IPC and NEMA standard 	Types of PCB IPC different rules- Generic Standards Applications	10	10

		<ul style="list-style-type: none"> Understand Base material characteristics Understand Properties of base material 	<p>Introduction to Base Materials</p> <p>IPC and NEMA standard</p> <p>Base Material Components</p> <p>Base Material Manufacturing Processes.</p> <p>Properties of Base Materials.</p> <p>Introducing Base Materials into the PCB Manufacturing Process</p>		
UNIT-II	Film Master Preparation	<p>After completion of this unit student should be able to:</p> <ul style="list-style-type: none"> Process for developing and fixing of lith films. Process for making negative and positive films. Process of retouching of lith films. Process for preparation of multi ups. 	<p>Photosensitive Materials</p> <p>Use of reprographic cameras.</p> <p>Photo Film Preparation.</p> <p>Developer.</p> <p>Fixer/Hardener.</p> <p>Film Washing.</p> <p>Drying.</p> <p>Retouching desks.</p>	30	20
UNIT-III	Photo Printing	<p>After completion of this unit student should be able to:</p> <ul style="list-style-type: none"> Observe precautions to protect the Photo Polymer Dry Film Resist. Carry out process of single side lamination. Carry out process of double side lamination. Carry out process of exposing. Carry out process of developing of dry film. 	<p>Introduction to Photo Printing</p> <p>Methods of photo printing</p> <p>Dry-Film Resists</p> <p>Used dry photo resist laminator.</p> <p>Resist Processing- Exposing, Developing & Drying</p>	30	30
UNIT-VI	Screen Preparation and Printing	<p>After completion of this unit student should be able to:</p> <ul style="list-style-type: none"> Fabricate screen. Select fabrics. Measure tension of screen. Prepare stencils. Use squeeze. Use ink. Carry out after printing process for drying. 	<p>Screen Frame.</p> <p>Introduction to Screen Printing.</p> <p>Screen Printing Technique-Direct Method, Indirect Method, Direct-Indirect Method</p> <p>Masking Process</p> <p>Legend Printing Process</p> <p>Developing</p> <p>Drying</p>	30	30

Unit- V	Environmental Concern	<p>After completion of this unit student should be able to:</p> <ul style="list-style-type: none"> • Understand PCB Rules and Regulation • Understand PCB waste management • Recycle and recovery technique. • Minimize wastages 	<p>Pollution Rules and Regulations.</p> <p>Process Waste minimization and Treatment- Introduction,</p> <p>Regulatory Compliance,</p> <p>Major Sources and Amounts of Wastewater in a Printed Circuit Board Fabrication Facility,</p> <p>Waste Minimization,</p> <p>Pollution Prevention Techniques , Recycling and Recovery Techniques, Alternative Treatments ,</p> <p>Chemical Treatment Systems , Advantages and Disadvantages of Various Treatment Alternatives</p>	20	10
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COURSES / MODULE TEMPLATE

NOS /Module: Perform Mechanical & Chemical Operation to Manufacture PCB

NOS /Module Code: MSME/CCPCBF/04

Outcomes:

After completion of course Student should be able to perform

- Plan sheet cutting.
- Cut sheets by using shearing machine.
- Make mounting holes/slots by using punching machine.
- Final cutting by using angular cutting machine.
- Drill manually using drilling machine.
- CNC programming.
- CNC drilling.
- CNC routing.
- Knows the materials used in HAL machine.
- Understand how to flux before tinning.
- Understand how to tin on single as well as double side PCB.
- Remove the oxidation layer from copper surface by manual cleaning, chemical process.
- Remove the oxidation layer from copper surface by chemical process.
- Remove unwanted copper by using etching process.
- Spray etching.
- Splash etching.
- Bubble etching.
- Tank etching.
- Inspect the PCB with the help of BBT technique.
- Inspect open circuit and short circuit.
- Inspect for over etched/under etched.
- Inspect hole size.
- Inspect hole for conformity with pad.
- Inspect for missing/extra hole.
- Inspect overall PCB.

THEORY HOURS: -10

PRACTICAL HOURS: 90

THEORY MARKS: -

PRACTICAL MARKS: 100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	PR hours	PR Marks
UNIT-I	CNC and Manual Drilling Machine	After completion of this unit student should be able to: <ul style="list-style-type: none"> • Drill manually using drilling machine. • Carry out CNC programming. • Carry out CNC drilling. • Carry out CNC routing. 	Introduction to Gerber data and NC Drill data Introduction to Gerber Format Introduction to Excellon drill Format Materials Types as per IPC and NEMA standard Drilling Processes Machine Operation -Manual drilling, optical drilling,	30	40

			<p>NC drilling etc.</p> <p>Hole Quality</p> <p>Post drilling Inspection</p> <p>Drilling Cost per Hole</p> <p>High-Density Interconnect Drilling</p> <p>V-Grooving</p>		
UNIT-II	Plating	<p>After completion of this unit student should be able to:</p> <ul style="list-style-type: none"> • Carry out PTH process. • Carry out electroplating process- Copper. • Carry out electroplating process- Tin. • Understand thermal masking process. • Types of film used in masking. • Understand PISM. • Develop of PISM. 	<p>Introduction to Plating Process</p> <p>Preparing Boards of plating.</p> <p>Electroplating.</p> <p>Direct Plating.</p> <p>PISM</p>	20	20
UNIT-III	Etching, Brushing and Hot Air Leveling	<p>After completion of this unit student should be able to:</p> <ul style="list-style-type: none"> • Remove the oxidation layer from copper surface by manual cleaning, chemical process. • Remove the oxidation layer from copper surface by chemical process. • Remove unwanted copper by using etching process. • Spray etching. • Splash etching. • Bubble etching. • Tank etching. • Know the materials used in HAL machine. • Understand how to flux before tinning. • Understand how to tin on single as well as double side PCB. 	<p>Etching Process and Technologies- Introduction, General Etching Considerations and Procedures, Resist Removal, Etching Solutions, Other Materials for Board Construction, Metals Other than Copper, Basics of Etched Line Formation.</p> <p>Brushing Technique.</p> <p>Solder Resist Material and Processes</p> <p>Introduction to HAL machine</p> <p>Fluxing method.</p> <p>Maintenance of machine.</p> <p>Solder tin method.</p>	20	20

UNIT-IV	Quality Aspect	<p>After completion of this unit student should be able to:</p> <ul style="list-style-type: none"> Inspect the PCB with the help of BBT technique. Inspect open circuit and short circuit. Inspect for over etched/under etched. Inspect hole size. Inspect hole for conformity with pad. Inspect for missing/extra hole. Inspect overall PCB. 	<p>Process Capability and Control</p> <p>Bare Board Test Objectives and Definitions</p> <p>Bare Board Test Methods</p> <p>Bare Board Test Equipment</p> <p>Acceptability and Quality of Fabricated Boards.</p> <p>Acceptability of Printed Circuit Board Assemblies.</p> <p>Assembly Inspection.</p> <p>Design for Testing.</p> <p>Loaded Board Testing.</p> <p>Different PCB Board Testing- Physical Inspection, AOI testing, Optical Magnifier testing etc.</p>	20	20
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COURSES / MODULE TEMPLATE

NOS /Module: Employability Skill

NOS /Module Code: MSME/ES/01

THEORY HOURS: 30 PRACTICAL HOURS: - THEORY MARKS: 100 PRACTICAL MARKS: -

Refer Standard Curriculum developed by NCVET. (https://nqr.gov.in/downloads/pdfs/30-hours_MC_Employability_Skills.pdf)