

COURSE SYLLABUS

Level Code: L5 **Vertical Name:** Electronic System Design Manufacturing

Course Code: To be filled by PMU **Course Name:** ESM-2 Electronic Product Supervisor

Objective of the Course:

An objective of the course is to acquire skills required for working technician in the industry in the areas of related to production, testing, electronics, quality and reliability of computer-based boards, Ability to manage teams and lead several projects at the same time, and to handle pressure and tight deadlines, Familiarity with the company's technology and how its products work.

Learning Outcomes:

- Perform production operations, involved in manufacturing electronic boards.
- Integrate electronic products from sub-assemblies.
- Test Electronic and electromechanical components, boards, sub-assemblies & products.
- Understand and follow the safety, health, environmental and process standards.
- Leadership, Planning, Executing ability, Communication skills with fellow workers as well as seniors on all aspects of manufacturing operations.
- Able to develop SOP on his/her own for the team and to generate reports.

Expected Job Roles:

Will acquire the skill required for the roles Production Supervisor, Production Manager, Test Engineer, Shift Engineer, Line Supervisor, Operator/Technician required in the Electronics and Hardware Industry or production unit in various verticals of ESDM.

**Duration of the Course
(in hours)**

442 Hrs

**Minimum Eligibility
Criteria and pre-
requisites, if any**

Diploma in Electronics/Electrical/Mechanical Engineering

Professional Knowledge:

- Good electronics background i.e. knowledge of the techniques and theories characteristic of electronics, such as a knowledge of basic electricity and electronic theory, algebra, and elementary physics.
- Familiar with ISO compliance
- Analog and digital electronics, schematics (reading and drawing)
- Proven communication skills. Effective in training other technical team members.
- Knowledge of electronic equipment design, development, evaluation, testing, installation, and maintenance;
- Electronics technicians are required to be versatile in order to handle sales prospecting, commercial negotiations and after-sales service.
- Study the specifications
- Assist the electronics engineer in part design
- Conduct conformity tests
- Thorough knowledge of the technical environment
- Good knowledge of basic computer programming
- Good writing skills.

Professional Skill:

- Component Level Repair: electronic repair to board and component level equipment, Identified faults, replaced parts, rewired equipment, and adjusted Communication systems and electronic circuits, Extensive knowledge of component circuit operational theory and analysis techniques, Interpreted test information in the form of test work requests, manufacturing procedures, drawings, schematics and verbal instructions from supervisors.
- Component level installation and design: Semiconductor Devices, Digital Signal Processing, Digital Design, Electronic Controls.
- Equipment Installing/Testing/Troubleshooting: Diagnosed equipment problems using manuals, schematics, and various test equipment, Diagnosed system hardware, software and operation problems, and implemented corrective action, Determined and tested power supply requirements and configuration.
- Assembled wiring, insulation, and electronic components following method layouts, Designed and modified circuits to increase functionality
- Complete and maintain the reports, such as time and production records, inventories, and test results etc.
- Documentations and Drafting: AutoCAD, CAD Drafting, Technical Writing, Standard Operating Procedures.
- Ability to communicate to people across a matrix of skills.

- Leadership/Supervision
- Critical Thinking
- Decision Making, Critical Problem Analysis/Resolution
- Policy and Procedures Development, Training and Development.

Core Skill:

Skills will be specific to vertical/fields in the ESDM sector; will be acquired during the On job training as part of Training program.

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1	Raw Material	50
2	PCB Types and Soldering Techniques	20
3	Sub-Assemblies	20
4	Integrated Testing	16
5	Quality Assurance and Standards	10
6	Manufacturing Techniques	10
7	Supervisor Development	30
8	Quality Management System (QMS)	15
9	Safety Practises	9
10	Advanced Topics in SMT Techniques	20
11	Advanced Manufacturing Techniques	20
12	Standard Operating Procedures (SOP)	12
13	Overview –Sector Specific Manufacturing	10
14	Safety Health and Environmental Standards (SHE)	4
15	Interpersonal Skill and Communication/Reporting	4
16	On Job Training / Project with Instructor Assistance	192
Total Vocational/Practical / Tutorial / Lecture Hours:		442 hrs

**Recommended
Hardware:**

Class Room: One with 30 seating with all modern teaching aids.
Laboratory: One lab housing 10 Independent Electronic work benches (03 in one capacity).
The electronic test/work bench shall have built in power points /power supplies of various levels. In addition every bench must have Digital Multi Meter, CRO, Bread board systems, Soldering/ De soldering stations, Trainer kits, Table and furniture etc.

DMM-6.5/5.5/4.5/3.5 digits
Electrical safety tester

PCB TYPES AND SOLDERING TECHNIQUES

Types of PCB: Stripboard Permanent, soldered ,Printed Circuit Board-Permanent, soldered

Basic Soldering Tools: Soldering Iron. Solder, Flux Remover, Hot Plate, Pliers, Knife, Multi-Meter, and Magnifier, A Weller soldering stations-Digital, analog, Touch screen.

Desoldering station-hot air stations, Heat gun, Preheat plates.SMT/SMD Rework stations, Electric screw driver with Torque control Tweezer,cutter,plier

SUB-ASSEMBLIES:

SMT,Logic probes, logic pulser,logic analyzer

INTEGRATED TESTING:

PXI instrumentation for testing

Interface adaptor

ATE for test for analog IC,Mixed signal.

QUALITY ASSURANCE AND STANDARDS:

filler content, infrared (IR) analysis, thermo gravimetric analysis (TGA) and differential scanning calorimetry

MANUFACTURING TECHNIQUES:

Lpkf

Above requirement is an indicative one, level-wise detailed infrastructure will be supplied along with application form .

**Recommended
Software:**

PCB TYPES AND SOLDERING TECHNIQUES

Alias/Sculpt 3D

PROE,Ansys,MASTERCAM,Simulation package for CNC Machining

SUB-ASSEMBLIES:**SMT**

SMTrue™ Run Optimize Software

INTEGRATED TESTING:

Teredyne 2286, 2287LX-PDP-11
PDP-11 emulator (Software)

MANUFACTURING TECHNIQUES:

CircuitPro, LPKF BoardMaster, CircuitCAM Lite, CircuitCAM PCB

Text / Reference Books:**Raw Material:**

Electronics Devices And Circuits By P J Paul
Testing Active and Passive Electronic Components By Richard Powell
Electronic Devices and Circuit Theory By Boylestad
PCB Assembly and Test by Ronald D. McCleary –Springer
Quality Hand Soldering and Circuit Board Repair by H. Ted Smith

PCB types and Soldering techniques

PCB Assembly and Test by Ronald D. McCleary –Springer
Quality Hand Soldering and Circuit Board Repair by H. Ted Smith
Printed Circuit Boards: Design, Fabrication, Assembly and Testing By R. S. Khandpur
Electronic Packaging and Interconnection Handbook (fourth edition) (TMH Charles Harper

Integrated testing:

PCB Assembly and Test by Ronald D. McCleary –Springer
Practical Electronic Fault Finding and Trouble shooting by Robin Pain Newnes, Reed Educational and professional publishing Ltd., 1996
The Fundamentals of Digital Semiconductor Testing , Floyd, Pearson Education India, Sep-2005.

Quality and Reliability Concepts:

Fundamentals of Quality control and improvement” By Amata mitra
Quality Assurance and Total Quality Management by K C Jain and A K Chitale
Managing Quality by Barrie G. Dole, - Blackwell publishing

Manufacturing Techniques:

1) Printed Circuit Board Manufacture 5th Edition by Clyde F. Coombs Jr
2) Printed Circuit Boards: Design, Fabrication, and Assembly (McGraw-Hill Electronic Engineering) by R. Khandpur
3) A Comprehensive Guide to the Design and Manufacture of Printed Board Assemblies Vol. 1 & 2 by William Macleod Ross publisher: Electrochemical Publications Limited, GB

Safety Health and Environmental Standards:

- 1) Health & Safety, Environment and Quality Audits by Stephen Asbury
- 2) Safety, Health, and EnvironmentCAPT(Center for the Advancement of Process Tech) by Pearson

Quality management system

- 1) Quality Management Systems: A Practical Guide by Howard S Gitlow
- 2) ISO 9000 quality management system design: **optimal design rules for documentation, implementation, and system effectiveness** by Jay J. Schlickman
- 3) Quality Management System Handbook for Product Development Companies by Vivek Nanda CRC press
- 4) Lean Distribution: Applying Lean Manufacturing to Distribution, Logistics, and Supply Chain by Kirk D. Zylstra

Advanced Topics in SMT Techniques

Designing PCBs for Surface-Mount Assemblies by Mike Marsh

Standard Operating Procedures

Standard Operating Procedures and Guidelines by John Lee Cook

Annexure: Detailed Syllabus

Raw Material:

- d) Identification of various Electronic /Electro-mechanical components and understand the specifications. Identification of components, Active components, Passive Components, Switches, Plugs, Sockets, Panel controls, Integrated Circuits, Pin identification and numbering convention, IC handling and installation, Electrostatic Discharge (ESD) Protection.
- e) Use of Component testers for validation. Multimeters, Non-polar Capacitor (electrolytic), "Open" Resistor – damaged, Opto-couplers, Piezo Diaphragms, Piezo Buzzers, Potentiometers, Soldering, Spark Gaps, Super Probe MkII, Surface Mount – Packs, Transformers, Voltage Regulators, Voltages on a circuit, Yokes, Audio Stages, Batteries – testing, Burnt Resistor, Cells - batteries, Co-Ax Cables Colour Code (Resistor), Coils.
- f) Components handling, electronic stores management as per environmental conditions and maintenance of official records. Bill of Materials, Inventory management, Environment and climatic conditions.

PCB types and Soldering techniques:

- e) PCB and their types
Single-side, double-side and multi-layer, Circuit complexity, Available space, Cost Process of making PCB Boards demystified, PCB Board Fabrication, Basic Circuit Development on Software, Designing the Circuit PCB Routing, PCB board fabrication
- f) Bare PCB handling and testing.
Etching process, PCB Design on Board Etched, Checking for proper etching of design on board, Removing the extra residue left, Water cooling to 25° C, Trim to clean out extruded epoxy, Punch/Drill holes for alignment, Make circuit on PCB (lithography) Drill through holes (for component leads).
- g) Component stuffing/mounting on PCB's.
Automatic soldering, Application of the solder resist, Flux application, Solder Application, Automatic removal of solder bridges: Hot air-jet knives, Types of circuit boards Special considerations for SMT boards.
- h) Soldering techniques.
Inspection of populated PCB Board.

Sub-assemblies:

- c) Sub-assemblies, integration with Electronic boards.
- d) Wire Harnessing

Integrated testing:

- c) Board level testing/functional testing.
- d) Calibrations.

Quality Assurance and Standards:

- d) Handling of advanced Electronics equipment.
- e) Electronic Packaging.

- f) Quality assurance and standards.

Manufacturing Techniques:

- d) Handling/Operation of fully-automated/semi-automated manufacturing & testing machines.
- e) Surface Mount Technology (SMT)/ Working with Wave soldering/Reflow oven.
- f) Working with SMT Rework station.

Supervisory Development:

- a) Communication Skills
- b) Presentation Skills
- c) Working in a team

Quality Management System (QMS):

- a) ISO 9001, Global adoption, Contents of ISO 9001, Numbering, Summary of ISO 9001:2008 in informal language, Certification, Evolution of ISO 9000 standards: 1987 version, 1994 version, 2000 version, 2008 version
 - Auditing
 - Industry-specific interpretations
 - Effectiveness
 - Advantages
 - Criticisms of ISO 9000
- b) Total Quality Maintenance (TQM)
- c) Total Production Management (TPM)
- d) Lean Manufacturing
- e) Just in time production
- f) Kaizen – improve for the better

Interpersonal Skill and Communication/ reporting.

Overview – Sector Specific Manufacturing *

* Telecom, Energy, Biomedical, Industrial Automation, Embedded System, Consumer Electronics, Manufacturing, Healthcare, Automotive

Safety Practices

Advanced Topics in SMT Techniques

Advanced Manufacturing Techniques

Standard Operating Procedures (SOP)

Safety Health and Environmental Standards (SHE)

On Job Training / Project

On Job Training / Project with Instructor Assistance (After completion of General Contents) for a period of 8 hours per day/6 days a week leading to 48 hours per week. (Approx 4 weeks/month)