1. TELECOM SECTOR SKILL COUNCIL (TSSC)

1.1 Telecom (Passive Infrastructure)

ESDM Courses

Level Code:	L4	**Vertical Name:**	Telecom (Passive Infrastructure)

Course Code:	TL/S/L4/C002	**Course Name:**	1.1.1 Tower Technician

Objective of the Course:

The person should be able to maintain tower sites which are live 24x7, maintain and repair level-1 faults/issues at telecom tower site, undertake preventive and corrective maintenance of the site equipment (Generator, Battery Banks, ACs, SMPS) and analyse & report/escalate faults.

Learning Outcomes:

By the end of the training, the person should be able to perform the following activities:

Site safety and hygiene
Preventive Maintenance of site equipment
Site Management
Reporting and Documentation
Corrective Maintenance of site equipment

Expected Job Roles:

Tower Technician

Duration of the Course (in hours)	350 Hours

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Minimum Eligibility Criteria and pre-requisites, if any	10+2 and/or ITI Diploma in Electrical/Mechanical Including final year candidates

Professional Knowledge:

Functional knowledge of all site equipment, system components, special tools & equipments used for system repairs

Professional Skill:

Planning and Execution
Relationship Building
Analytical Skills
Technical Skills

Core Skill:

Comprehension Skills
Reading Skills
Oral Communication Skills

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
01		

Total Theory / Lecture Hours:	180
Total Practical / Tutorial Hours:	90
Total Hours:	90

Recommended Hardware:

D G Set, Air Conditioner, Power Interface Unit (PIU), SMPS, Battery bank

Recommended Software:

NIL

Text Books:

Training Material for students supported through affiliated Training Providers.

Reference Books:

NIL

ESDM Courses

Level Code:	L2	Vertical Name:	Passive Infra

Course Code:	TL/S/L2/C011	Course Name:	1.1.2 Telecommunications Installation and Repair Worker

Objective of the Course:

To prepare candidates to Install, set-up, rearrange, or remove switching, distribution, routing, and dialling equipment used in corporate offices or at customer's premises. Also to service or do preliminary repair of telephone, Internet connection and other communications equipment on customers' premises.
May install communications equipment or communications wiring in office/Residential buildings

Learning Outcomes:

- Understand the installation process
- Acquire the knowledge, skills and attitudes required to install cables and telecommunications equipment in telecommunications central offices
- Usage of proper tools and methods and follow work instructions as per industry norms.

Expected Job Roles:

Communication Equipment installers and repairers

Duration of the Course (in hours)	200 Hours

Minimum Eligibility Criteria and pre-requisites, if any	Class 10+2 / ITI

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1.	Introduction to Telecom equipment used in corporate offices and Residential customer premises.	10 Hr
2	Installation and Commissioning of telecom equipment hardware • Install, arrange, remove and maintain small telephone exchanges/ intercoms, telephone equipment, wiring and associated hardware • Making of Earth and Earthing of telecom equipment. • Test previously installed telephone systems to locate transmission/ equipment faults • Repair or replace defective and damaged telephones, wire and associated equipment. • Indoor wiring to provide connectivity to the Telecom equipment/ or to become part of network. Switch network installers and repairers perform some or all of the following duties: • Install electronic and digital trunking/ switching systems, circuits and equipment in telecommunications central offices and switching centres • Inspect and test systems, circuits and equipment • Analyse test results and adjust, change or repair switching system, network, associated equipment and software. • Install, remove and maintain various telecommunications equipment and related systems such as facsimile machines, scanners, mobile radios, cellular telephones, pagers and other related telecommunications equipment • Configure operating systems and install software for access to the Internet • Inspect and test operation of telecommunications equipment	60 Hr

	• Diagnose and locate equipment faults, and adjust, replace or repair telecommunications equipment.	
3	Service Testing of the telecom equipment • Operate computerized testing systems to conduct service tests on customer lines and equipment • Determine the nature, cause and location of service trouble • Initiate the dispatch of appropriate repair personnel • Complete test reports and maintain test and service records • May assist repair personnel to test lines, circuits and systems, isolate and clear cable faults and verify records.	30 Hr
4	Communication Skills • Effective Communication • Verbal and Non-Verbal Communication • Body Language • Listening Skills	10 Hr
5	Health and Safety • Ensure compliance with site risk control, OHS, environmental and qualityrequirements as per company's norms	10Hr

• Ensure that work is carried out in accordance to the level of competence and legal requirements • Ensure that hazards associated with the workplace that have not beenpreviously controlled, are reported in accordance with appropriate procedures • Ensure compliance with all organizational security arrangements and approved procedures • Ensure co-ordination is carried out for the infra technicians and other third party vendor. • Ensure proper earthing of the equipment. • Ensure that Personal protection equipment like anti-static bands appropriately used as required • Ensure compliance to health and safety guidelines both contractually and onsite by the third party vendors and infra technician. • Ensure availability of first aid box at site	

Total Theory / Lecture Hours:	120 Hr
Total Practical / Tutorial Hours:	80 Hr
Total Hours:	200 Hr

Recommended Hardware:	Circuit tester — In-line modular adapters; Polarity testers GFI circuit testers — Cable fault finders; Receptacle analyzers Multimeters — Digital multimeters Stripping tools — T-strippers Voice data video cable tester — Bridge tap detectors; Modem verification units; Pocket toners; Telecom test sets

Recommended Software:	TechAdvisor Field Access System Presentation software — Microsoft PowerPoint Spreadsheet software — Microsoft Excel Word processing software — Microsoft Word

Text Books:	

ESDM Courses

Level Code:	L4	Vertical Name:	Passive Infra

Course Code:	TL/S/L4/C018	Course Name:	1.1.3 Telecommunications Tower Equipment Installer and Integrator

Objective of the Course:

To prepare the participant repair, install or maintain mobile or stationary radio transmitting, broadcasting, and receiving equipment and two-way radio communications systems used in cellular telecommunications, mobile broadband and radio equipment in service and emergency vehicles.

Learning Outcomes:

- Understand the installation process
- Acquire the knowledge, skills and aptitude required to install cables and telecommunications equipment in telecommunications central offices
- Usage of proper tools and methods and follow work instructions as per industry norms.
- Read work orders, blueprints, plans, datasheets or site drawings to determine work to be done.
- Inspect completed work to ensure all hardware is tight, antennas are level, hangers are properly fastened, proper support is in place, or adequate weather proofing has been installed.
- Bolt equipment into place, using hand or power tools.
- Test operation of tower transmission components, using sweep testing tools or software.
- Run appropriate power, ground, or coaxial cables.

Expected Job Roles:

Tower Equipment Installer and Integrator

Duration of the Course (in hours)	350 Hours

Minimum Eligibility Criteria and pre-requisites, if any	10+2 pass / ITI

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1	Introduction to telecom tower equipment installation - Understanding the telecom industry - Telecom equipments i.e. BTS Hardware equipment, Various antennae , PIU, Battery Bank, DG , ACs, SMPS and cabling etc.	30 hours

2	• Installation & Commissioning of different equipment.	70 Hours
	- Read work orders, blueprints, plans, datasheets or site drawings to determine work to be done. - Installation — Installing equipment (Antenna, pole mount, microwave equipment) machines, wiring, or programs to meet specifications. - Integration - cellular telecommunications, mobile broadband and radio equipment in service and emergency vehicles. - Equipment Maintenance — Performing routine maintenance on equipment and determining when and what kind of maintenance is needed. - Repairing —First Level Repairing of equipments or systems using appropriate tools. - Troubleshooting — Determining causes of operating errors and deciding what to do about it. - Reading Comprehension — Understanding written sentences and paragraphs in work related documents. - Reporting of various Data, faults and inventory of spares to concerned personnel.	
3	Site Maintenance/Management - comply with Beat plan execution, - conduct site PM (preventive maintenance) - Check on site up-time. - health check on site like checking engine oil, voltage and hardware equipment etc - check premature ageing of Battery Bank, Diesel Generator, Air Conditioner, PIU and SMPS - close maximum number of complaints registered - provide timely resolutions to trouble reported - monitor readings as per EB (electricity bill) against reading on PIU (power interface unit) - timely collect and submit the EB (electricity bill) at the office - check number of alarms active at the site	70 Hours

	- check site for faulty alarms - attend alarms within the defined SLA - identify the reasons for site lock - co-ordinate with service providers for quality fuel to be filled - interact with site owners w.r.t. rent, access issues etc.	
3	Communication Skills • Effective Communication • Verbal and Non-Verbal Communication • Body Language • Listening Skills • Coordination — adjusting actions in relation to others' actions.	10 Hours
4	Health and Safety • Ensure compliance with site risk control, OHS, environmental and quality requirements as per company's norms • Ensure that work is carried out in accordance to the level of competence and legal requirements • Ensure that hazards associated with the workplace that have not been previously controlled, are reported in accordance with appropriate procedures • Ensure compliance with all organizational security arrangements (like using valid ID cards) and approved procedures • Ensure that Personal protection equipment like anti-static bands appropriately used as required • Ensure compliance to health and safety guidelines both contractually and onsite by the third party vendors and infra technician. • Ensure availability of first aid box and fire fighting equipment at site Ensure escalation of safety incidents to relevant authorities as per guidelines	20 Hours

Total Theory / Lecture Hours:	200 Hours
Total Practical / Tutorial Hours:	150 Hours
Total Hours:	350 Hours

Recommended Hardware:	Frequency analyzers — Antenna analyzers; Digital spectrum analyzers; Radio frequency RF monitors; Signal probe kits Screwdrivers — Double ended screwdrivers; Phillips head screwdrivers; Phone outlet testers; Straight screwdrivers Slip or groove joint pliers — Groove-joint pliers; Ignition pliers; Slip joint pliers Stripping tools — Coaxial cable stripping tools; Wire strippers

Recommended Software:	Analytical or scientific software Electronic mail software — Microsoft Outlook Facilities management software — Maintenance documentation software Map creation software — Caliper Maptitude; Location mapping software Spreadsheet software — Microsoft Excel

Text Books:	

Reference Books:	

1.2   Telecom (Handset)

ESDM Courses

Level Code:	L4	Vertical Name:	Telecom (Handset)

Course Code:	TL/S/L4/C003	Course Name:	1.2.1 Handset repair Engineer (Level II)

Objective of the Course:

The person should be able to perform handset / tablet repair including hardware and software components and testing the handset for adequacy post repair.

Learning Outcomes:

By end of the training, the person should be able to perform the following activities:

Obtain handsets / tablets from customer/ relevant teams
Arrange for tools and spares
Undertake Handset repair activities
Safety requirements (Equipment & Self)
Record parameters and generate compliance reports
Determine change requirement
Test effectiveness & close activity

Expected Job Roles:

Handset Repair Engineer (Level II)

Duration of the Course (in hours)	350

Minimum Eligibility Criteria and pre-requisites, if any	10+2 / ITI(Including final year candidate)

Professional Knowledge:

Functionality / features of handset, specific operating system (OS), hardware components like chipsets, processor etc., basic knowledge of GSM / CDMA, Windows & Android OS.
Test equipments
Handset repairing process, procedures
Troubleshooting techniques (software, fault finding)

Professional Skill:

Equipment operating Skills
Handset Repairing Skills
Handset/Component Handling skills
Troubleshooting Skills
Software Skills
Tablet Repairing Skills
Tablet Handling Skills

Core Skill:

Reading, Writing and Communication Skills
Time Management Skills
Analytical Skills
Interpersonal Skills
Oral Communication (Listening & Speaking Skills)

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours

1.	Introduction and Job role overview	10
2.	Communication Skills	6
3.	Procedures / processes for repair	15
4.	Problem solving, Fiber testing and splicing	76
5.	Health and Safety & Reporting and Documentation	9

Total Theory / Lecture Hours:	54
Total Practical / Tutorial Hours:	66
Total Hours:	120

Recommended Hardware:	Test Bench, test equipment (multimeters, frequency generators etc); Setup for end-to-end diagnostics and repair, software jigs

Recommended Software:	NIL

Text Books:	Training material for students supported through affiliated training partners.

Reference Books:	NIL

1.3   Telecom (Network Managed Services)

ESDM Courses

Level Code:	L3	Vertical Name:	4.3 Telecom

Course Code:	TL/S/L3/C001	Course Name:	1.3.1 Optical Fiber Splicer

Objective of the Course:

The person should be able to undertake the efficient splicing of the optical fibre cables and support in optical fibre installation including fibre joint testing.

Learning Outcomes:

By the end of the training, the person should be able to carry out all activities pertaining to a role of Optical Splicer. Broadly these include the following:

Prepare cable for splicing operations
Ensure availability of tools and spares for splicing and testing
Perform splicing operations
Carry out route Inspection for laying of fiber
Coordinate trenching, cable laying, jointing and cable blowing activities
Test effectiveness & close activity
Health and Safety
Record parameters and generate compliance reports

Expected Job Roles:

Optical Fiber Splicer

Duration of the Course (in hours)	250 Hours

Minimum Eligibility Criteria and pre-requisites, if any	8th

Professional Knowledge:

Principle of OFC Communication
Characteristics of OFC
Important parameters of OFC Communication
Optical Test Equipments
Optical Cable Laying methods, procedures and processes

Professional Skill:

Equipment Operating Skills
OFC splicing and splice testing skills
Technical Interpretation Skills
Problem Solving Skills

Core Skill:

Basic Reading and Writing Skills
Communication Skills
Basic Project Management Skills
Interpretation Skills
Interpersonal Skills

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1.	Introduction and Job Role Overview	
2.	Communication, Reading & Writing Skills	

3.	Details of Fiber splicing, Cable Laying	
4.	Health and Safety & Reporting and Documentation	

Total Theory / Lecture Hours:	
Total Practical / Tutorial Hours:	
Total Hours:	250 Hours

Recommended Hardware:

Optical Splicing Equipment
Optical test equipment like OTDR, light meter and power meter

Recommended Software:

NIL

Text Books:

Training material for students supported through affiliated Training Providers.

Reference Books:

NIL

ESDM Courses

Level Code:	L4	Vertical Name:	Telecom

Course Code:	TL/S/L4/C005	Course Name:	1.3.2 Optical Fiber Technician

Objective of the Course:

The person should be able to guide/oversee 'Optical Fibre Splicer' and optical cable rollout activities and in carrying out efficient optical splicing, test its effectiveness by undertaking periodic preventive maintenance activities and ensuring effective fault management in case of fault occurrence and support installation and commissioning of optical fiber cables as per route plan.

Learning Outcomes:

By end of the training, the person should be able to perform the following activities:

Carry out Inspection of route plan and obtain necessary clearances
Arrange for tools and spares
Coordinate trenching, cable laying, jointing and cable blowing activities
Test effectiveness & close activity
Obtain maintenance schedule and patrol assigned route section
Carry out maintenance testing of dark/ spare OFC, equipments at points of Presence (POPs)
Carry out planned repairs to the OFC
Carry out maintenance of equipments at Points of Presence (POPs)
Handling fault notifications on prompt basis
Fault localization and rectification

Expected Job Roles:

Optical Fiber Technician

Duration of the Course (in hours)	350 Hours

Minimum Eligibility Criteria and pre-requisites, if any	10+2

Professional Knowledge:

Principle of OFC Communication
Characteristics of OFC
Important parameters of OFC Communication
Optical Test Equipments
Optical Cable Laying methods, procedures and processes

Professional Skill:

Equipment Operating Skills
OFC splicing and splice testing skills
Technical Interpretation Skills
Problem Solving Skills
Managerial Skills

Core Skill:

Basic Reading and Writing Skills
Communication Skills
Basic Project Management Skills
Interpretation Skills
Interpersonal Skills

Detailed Syllabus of Course

Module. No	**Module. Name**	**Minimum No. of Hours**

1.	Introduction and Job Role Overview	
2.	Communication, Reading & Writing Skills	
3.	Details of Fiber splicing, Cable Laying	
4.	Fault Notification, Rectification	
5.	Cable maintenance & Problem solving	
6.	Health and Safety & Reporting and Documentation	

Total Theory / Lecture Hours:	
Total Practical / Tutorial Hours:	
Total Hours:	350

Recommended Hardware:	Optical Splicing Equipment Optical test equipment like OTDR, light meter and power meter

Recommended Software:	NIL

Text Books:	Training material for students supported through affiliated Training Providers.

Reference Books	NIL

ESDM Courses

Level Code:	L5	Vertical Name:	Telecom

Course Code:	TL/S/L5/C006	Course Name:	1.3.3 Installation Engineer – SDH & DWDM

Objective of the Course:

An Installation engineer is responsible for installing SDH DWDM/L2-L3 equipment in the site and carrying out site acceptance testing. As an optional responsibility the engineer may need to undertake commissioning of the site based on network topology.

Learning Outcomes:

By end of the training, the person should be able to perform the following activities:

Installation of Equipment
Acceptance Testing of Equipment
Commissioning of Equipment

Expected Job Roles:

Installation Engineer
Testing & Commissioning Engineer

Duration of the Course (in hours)	400 Hrs

Minimum Eligibility Criteria and pre-requisites, if any	Diploma (including final year candidate)

Professional Knowledge:

Basics of Telecom equipment & categories.
Transmission media – Optical, Electrical.
Equipment Safety (Earthing/lightning protection etc)
Types of cables and connectors
Site installation checklist and critical punch points.
Installation procedures
Acceptance Test process and procedures
Commissioning of equipment and handing over
Occupational Health & Safety

Professional Skill:

Equipment Installation/Operating Skills
Testing & Calibration skills
Technical Interpretation Skills
Analytical Skills
Problem Solving Skills
Managerial Skills

Core Skill:

Basic Reading and Writing Skills
Communication Skills
Basic Project Management Skills
Interpretation Skills
Interpersonal Skills

Detailed Syllabus of Course

Module.	Module. Name	Minimum No. of Hours

No		
1.	Equipment Installation	
2.	Equipment Acceptance	
3.	Equipment Commissioning	
Total Theory / Lecture Hours:		
Total Practical / Tutorial Hours:		
Total Hours:	400	

Recommended Hardware:	SDH/DWDM Equipment or L2/L3 Equipment All requisite Installation material including cables and connectors Tools and equipment

Recommended Software:	System Software <will be bundled with equipment>

Text Books:	Training material for students supported through affiliated Training Providers.

Reference Books	NIL

ESDM Courses

Level Code: | L5 | **Vertical Name:** | Telecom

Course Code: | TL/S/L5/C007 | **Course Name:**

| 1.3.4 | Installation Engineer –Networking Layer2 & Layer3 |

Objective of the Course:

An Installation engineer is responsible for installing L2-L3 equipment in the site and carrying out site acceptance testing. As an optional responsibility the engineer may need to undertake commissioning of the site based on network topology.

Learning Outcomes:

By end of the training, the person should be able to perform the following activities:

Installation of Equipment
Acceptance Testing of Equipment
Commissioning of Equipment

Expected Job Roles:

Installation Engineer
Testing & Commissioning Engineer

Duration of the Course (in hours) | 400 Hrs

Minimum Eligibility Criteria and pre-requisites, if any	Diploma

Professional Knowledge:

Understand basic Equipment category, transmission media (Optical / Electrical)
Need and requirement of earthing, mechanism to maintain earthing pit to absolute zero
Usage of cable connectors, cable ties and cable tray
Understand Site installation checklist and critical punch points
OSI, LAN, MAN, WAN architecture and protocols
Internet Protocol – TCP/IP, IP addressing, sub-netting
IP Routing protocols – RIP, OSPF, IGRP
Ethernet Networking, functionality of Ethernet test equipment
Layer 2 switching technologies

Professional Skill:

Equipment Installation/Operating Skills
Testing & Calibration skills
Technical Interpretation Skills
Analytical Skills
Problem Solving Skills
Managerial Skills

Core Skill:

Basic Reading and Writing Skills
Communication Skills
Basic Project Management Skills
Interpretation Skills
Interpersonal Skills

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1.	Equipment Installation	
2.	Equipment Acceptance	
3.	Equipment Commissioning	

Total Theory / Lecture Hours:	
Total Practical / Tutorial Hours:	
Total Hours:	400

Recommended Hardware:	L2/L3 Equipment All requisite Installation material including cables and connectors Tools and equipment

Recommended Software:	System Software <will be bundled with equipment>

Text Books:	Training material for students supported through affiliated Training Providers.

Reference Books:	NIL

1.4 Service Providers

ESDM Courses

Level Code:	L4	Vertical Name:	4.4 Telecome

Course Code:	TL/S/L4/C004	Course Name:	1.4.1 Broadband Technician

Objective of the Course:

The person is responsible for installation, configuration and testing of CPE (modem, routers, and Switches) for broadband access. He also establishes connectivity between CPE and end-user device (CPU, Laptop, tablets, Smart/IP TV etc.) at customer premises and carries out basic trouble-shooting for identifying, localizing & rectifying cable, connectivity and equipment fault in coordination with NOC.

Learning Outcomes:

By the end of the training, the person should be able to perform the following activities:

Prepare and undertake for wiring and equipment installation
Configure CPE, establish connectivity between CPE and end user device
Establish connectivity with service provider gateway
Record configuration setting and testing steps for customer
Locate and trouble shoot cable & connector fault
Rectify the faults with cable, connectors and CPE
UPS Installation and its handling
Complete documentation and clean-up worksite

Expected Job Roles:

Broadband Technician

Duration of the Course (in   350 Hours approx.

hours)	

Minimum Eligibility Criteria and pre-requisites, if any	10+2

Professional Knowledge:

Knowledge of Customer Premise Equipment (CPE), Cable Laying, Connectorisation, structured cabling norms   Basic concepts of Network topologies, TCP/IP, Broadband Network Elements, Gateways, IP Address, Subnet masks, Ethernet and MAC Address, IPv4, IPv6   Identification of cables and cable pairs and their maintenance   Basic knowledge of EMI / EMC   Basic knowledge of UPS and its handling

Professional Skill:

Equipment installation / Task Management Skills   Technical interpretation   Equipment Configuration / Operating Skills   Problem solving skills   Analytical Skills   Planning and Execution

Core Skill:

Basic Reading & Writing Skills   Communication Skills   Reading Skills   Oral communication Skills

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1	System wiring and equipment installation at customer premises	

2	Configuration of equipment and establishing Broadband connectivity		
3	Trouble-shoot to localize and rectify faults		
4	UPS installation & Domestic Power Supply checks		

Total Theory / Lecture Hours:	120-150 Hours
Total Practical / Tutorial Hours:	
Total Hours:	350

Recommended Hardware:

Recommended Software:

NIL

Text Books:

Training material for students supported through affiliated training partners.

NIL

Reference Books:

1.5 Telecom Electronics

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ESDM Courses

Level Code:	L2	Vertical Name:	Telecom Electronic

Course Code:	TL/M/L2/C008	Course Name:	1.5.1 Telecom Test Technician

Objective of the Course:

Train Test Technician

Learning Outcomes:

The student will be gaining strong knowledge on "Hands-on experience in Electronics and Telecommunication field"
The student will be gaining good knowledge on wireless communication
The student will be able to get Exposure on automation and automatic test handling equipment
The student will be able understand electronic circuit
The student will be able to get hands-on on basic knowledge on MS office
The Student will be able to get good knowledge on RF instruments and measuring equipment's system
The student will be capable of analysis and action against any equipment failure
The student will be able to learn good communication skills

Expected Job Roles:

Test Technician
Candidates will experience the "Hands-on experience in Electronics and Telecommunication field" , good knowledge,
on automation and automatic test handling equipment, knowledge on RF instruments and measuring equipment's
system.

Duration of the Course (in	200 Hours

hours)

Minimum Eligibility Criteria and pre-requisites, if any	a. ITI - Electronics, Electrical, Instrumentation b. Diploma – Electronics, Electrical, Instrumentation c. Vocational Education Training (Final year candidates pursuing in ITI/Diploma)

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1	Introduction to Telecom Electronic Circuits	10 Hours
2	Testing - Components - Products - Systems - Results analysis, presenting&Documentation	10 Hours

3	Hands on Electronic and Telecommunication
	
	- Computer operating systems
	- Schematics readability and traceability
	- Telecommunication Fundamentals
	- Wireless communication
	    o Bluetooth
	    o GSM
	    o WCDMA
	    o Wi-Fi, ZigBee
	- Digital and AnalogTelecomm Electronics
		24 Hours

4	Process - Safety Awareness - Maintenance Awareness - Production and process - Quality Control Practices & Measurements	10 Hours

	- Definition of test criteria - Workplace essentials	

5	Failure analysis
	
	   o Failure Analysis Methods
	   o Common Failure Analysis Techniques
	   o Implementing FMEA
	   o FMEA Procedure
	   o Fault Tree Analysis (FTA)
	   o Identifying TO events
	   o FTA vs. FMEA
		20 Hours

5	Test Program Generation and Handling
	
	   - Manual Tests
	   - Automated Tests
	   - Automated Test Vs. Manual Tests
	   - Best Practices
		24 Hours

6	Basic Computer Knowledge
	
	   - Basic Computer Concepts
	        o What is a computer
	        o Software and Hardware
	        o Operating System Software
	        o Software Applications
	        o Hardware Accessories
	   - Computer Troubleshooting and Repair Basics
		15 Hours

6	MS Office
	
	   - MS Word
	   - MS Excel
	   - MS Power Point
	   - MS Access
		9 Hours

7	RF - Introduction to RF Fundamentals	30 Hours

		Basic Building Blocks of an RF System	

		- Basic Building Blocks of an RF System
		    o Available frequency bands
		    o RF communication systems
		    o Modulation and demodulation
		    o Basic building blocks of an RF system – components
		    o Extending range
		    o Key RF parameters
		- RF Parameters and RF Measurement Equipment
		    o Vector Network Analyzers
		    o Spectrum Analyzers
		    o Signal Generators
		    o Power Meters
		    o Oscilloscopes
		    o Function and Arbitrary Waveform Generators
		    o Spread spectrum systems – DSSS / FHSS / Frequency Agility
		- RF Toolkits
		    o LTE & NLOS Environment
		    o Timing and Synchronization for LTE Networks
		    o Test Execution and Data Management
		    o Trigger Synchronization and Phase Alignment
		    o Advanced RF Calibration Using Power Meter
		    o Applications for Cellular Test
		    o Testing methods	

		Maintain Telecom Test Equipment
		
		- Care and maintenance
		- Failure Reporting
		    o Collecting data
		    o Reporting Equipment Failure
		    o Reporting Software Problems
		    o Logging Data
		- Analysis
		    o Failure Analysis
		    o Failure review
			6 Hours

	o Failed Equipment Procurement - Cleaning, disinfection and sterilization - Disposal of waste	

8	Communication skills
	
	    o Level of communication
	    o Total communication process
	    o Barriers in communication
	    o Basic reasons we Do Not Listen
	    o Level of listening
	    o Improve listening skills
	    o Body Language and types
	    o Most common way to communicate
		12 Hours

7	- SMT, TELECOM PCBs
	    o TELECOM PCB Basics and Surface Finishes like HASL and ENIG
	    o Surface Finishes OSP, Immersion Tin, Immersion Silver
	    o Paste, stencils, printing and how they are interrelated
	    o Types of TELECOM PCB
	    o SMT Materials Component Placement
	    o SMT Components Reflow Soldering
	    o Line Balancing (Downtime, line design)
	    o Component placement with a focus on equipment
	    o Performance calculations for pick and place machines
	    o Reflow soldering, component damage, profile shapes, vapor phase, and oven calculations
	    o Wave soldering, selective soldering, and dispensing
	    o Testing, defects, and inspection
		10 Hours

8	ESD
	
	        o Introduction
	        o Basics of ESD controls
	        o Sevens Sins of ESD Control
	        o Static Electricity
	        o ESD Mathematics
	        o Static Charge Generation
	        o Triboelectric Series Chart
		20 Hours

	o Discharge Times	
	o IC upsets from ESD EMI	
	o Storage and Handling	
	o Humidity and ESD Control	
	o Ray's ESD Prevention Secrets	
	o ESD Protection	

Total Theory / Lecture Hours:	120
Total Practical / Tutorial Hours:	80
Total Hours:	200

Recommended Hardware:	Soldering Station SMD Rework Station Solder Sucker with Silicone Nozzle Hand Held hot Air gun SMD Hot Tweezers & Station Multimeter Tools and Materials

Recommended Software:	MS Office

Text Books:	Printed Circuit Design & Engineering Schools / TELECOM PCB Technical Training / Tutorials Reworking Printed Circuit Board (TELECOM PCB) Solder Joints – by Jeannette Plante Prototype Universal TELECOM PCB Print Circuit Board – by Banggood TELECOM PCB Rework and Repair Guide Effective Communication skills

www.daytonastate.edu/cbi/files/Certified%20Production%20Technician%20Flyer.pdf

Reference Books:

http://www.circuitrework.com/guides/guides.shtml
http://www.allaboutcircuits.com
http://www.mindtools.com/page8.html
http://managementhelp.org/communicationsskills/
http://www.selfgrowth.com/comm.html

ESDM Courses

Level Code:	L3	Vertical Name:	Telecom Electronics

Course Code:	TL/M/L3/C009	Course Name:	4.5.2 Board Bring Up Engineer

Objective of the Course:

To train students on industry standard practices, flows and tools involved in assembly, test, debug, and enablement of Hardware boards and make them ready for system integration and commissioning.

Learning Outcomes:

Participants successfully completing this course will:

- Have the ability to do PCB Bare Board Testing
- Have the ability to do Board Assembly
- Shall be able to operate various test and measurement tools used in Board Bring-Up
- Shall be able to test and debug Power, Analog, Digital, High Frequency Sections and connector interfaces on a PCB board
- Ability to Flash Firmware codes

Expected Job Roles:

- Hardware maintenance Engineer
- Board Bring Up Engineer
- PCB Assembly & Debug Engineer
- Entrepreneur: PCB Assembly, BBT, Test & Measurement Services

Duration of the Course (in hours)	350 Hours

Minimum Eligibility Criteria and pre-requisites, if any	10th,Undergoing ITI,Electronic/Electrical/Mechanical (Including final year candidates)

Professional Knowledge:

An individual on the job needs to know and understand:
- Basic and advanced Test & Measurement Set-ups and Equipment   - Should possess basic knowledge of electronics   - Should have good working experience of PCB Assembly   - Should be able to read and understand Technical Specifications   - Should be familiar with various Hardware Testing techniques   - Should be familiar with Black box and White box testing

Professional Skill:

An individual should have following Professional Skills

- Ability to work withTest & Measurement tools like Multimeter, CRO, RLC Meter, Function Generator
- Ability to assemble complex PCBs
- Ability to do Functional, Stress, Parametric & Use Case Testing of Hardware Boards
- Should be able to troubleshoot, debug and fix defects
- Able to prepare high quality Test Case Documents
- Should be able to prepare and submit reports on progress and status of all testing procedures.
- Should be able to Flash Firmware
- Should be able to use Emulators & Debuggers

Core Skill:

An individual on the job should have following Core Skill

- Basic knowledge of electronics.

- Familiarity with Electronic Product Life Cycle

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1.	Introduction and Job role overview	20
2.	Introduction to Commonly Used Test & Measurement Equipment used in Board Bring Up: • Multimeter, LCR Meter, Function Generator	

	• CRO, Logic Analyzer, IR Thermometer • Power Supplies		20
3.	Bare Board Testing • BBT Techniques & Industry Practices • Reading Netlist& Schematic and Correlation with PCB Layout • Impedance Testing • Fault Isolation • Writing Test Routines • BBT Jig Design • Reverse Engineering		20
4.	**Electronic Design Overview** Understanding the coding standards, failure modes, specifications and measurement parameters of electronic components: • Passive Components • Active Components • Sensors • Cables & Connectors • Batteries • Antenna Topologies • Basic introduction to MCU Testing		50
5.	**Circuits & Design Sections** Understanding operation, failure modes, specifications and measurement parameters of commonly used circuits and design sections: • Power blocks: Voltage Converters, Regulators • Analog Sections: Amplifiers, Driver circuits, Signal Converters • Digital Sections: Encoders, Decoders, Arithmetic Circuits, Displays • High Frequency Interfaces • Connectors & Interfaces		80
6.	**PCB Assembly & Testing** Introduction to PCB Assembly tools, techniques and industry practices • PCB Workbench • Soldering/De-soldering Tools & Techniques • Section wise Assembly		

	• Section wise Testing • Common Assembly Defects & Their Fixes • Troubleshooting & Debug	50
7.	**MCU Related Testing** • Introduction to IDE Basics • Introduction to Debuggers & Their Usage • Single Stepping, Breakpoints • Introduction to Emulators • Firmware Flashing • Basics Test & Measurement Techniques for MCU designs • Introduction to Commonly Used Communication Protocols & Their Testing in Simplex, Duplex & Loopback Modes	30
8.	**Detailed Testing** • Functional Testing • Stress Testing • Parametric Testing • Use Case Testing	20
9.	**Design Enablement** • Readying Board for Commissioning • System Integration • Maintenance • HOT state Debug, Troubleshooting	40
10.	Communication Skills, soft skills, Life skills	10
11.	Health and Safety (including electrical safety) & Reporting and Documentation	10
	Practical	200
	Theory	150
	Total Hours	350

Test & Measurement Tools & Equipment, PCB Workbench Tools, BBT Practice Kit, Component Learning Kit, Mixed Signal Design Learning Kit, Digital Design Learning Kit, MCU Development Kit

Recommended Hardware:	

Recommended Software:	**Express PCB** **R8C 1A/1B / PIC IDE, Debugger, Emulator**

Text Books:	1. Electronic Principles (Special Indian Edition) (English) 7th Edition
	2.Electronic Devices and Circuits (English) 3rd Edition
	3.Modern Electronic Instrumentation And Measurement Techniques (English) 2nd Edition

ESDM Courses

Level Code:	L4	Vertical Name:	Telecom Electronics

Course Code:	TL/M/L4/C010	Course Name:	4.5.3 Telecom Embedded Hardware Developer

Objective of the Course:

To train students on industry standard design techniques, flows and tools involved in design, debug and commissioning of Telecom Embedded Hardware designs, systems and products.

Learning Outcomes:

Participant shall learn

1. Telecom Industry Standard practices used in development of Embedded Hardware Products.
2. About Analog, Mixed Signal, Digital & Programming Sub-sections on a typical Telecom Product and associated applications.
3. Embedded C and Communication Protocol Programming
4. About architecture of 16/32-bit industrial grade Microcontrollers, specifically used in Telecom Products, Servers & applications.
5. Interfacing various real time data acquisition and control sensors using Analog to digital and Digital to Analog converters
6. Industry Standard Tool Chains for Embedded Design
7. Working across communication interfaces like I2C, SPI, UART, Infrared, RF, GSM and GPS
8. Realization of Adhoc Communication Networks utilizing Embedded Hardware.
9. Realization of Gyro-sensing based mobile application
10. Trouble shooting and Debugging

Expected Job Roles:

1. Telecom communication equipment design, support and maintenance
2. Troubleshooting and debugging of Protocol based communication system networks
3. Telecom Product Master Technician - Trouble shooting of Intelligent Telecom electronic systems/products
4. Entrepreneur - Development of small, intelligent communication and networking gadgets and applications

Duration of the Course (in hours)	350 hrs

Minimum Eligibility Criteria and pre-requisites, if any	Diploma (Including final year candidate)

Professional Knowledge (Acquired):

The participant shall know and understand

11. Basics of Embedded Hardware design for Telecom Devices and Equipment
12. Basics of Core Programming of Telecom Devices and Equipment
13. Acquire knowledge of basic Communication Protocols
14. Basics of Circuits and Architectures used in Telecom Systems and Devices

Professional Skill (Acquired):

Reading and writing skills

- To read and comprehend System Requirement Specs of Telecom Device and Equipment
- To read and comprehend Test & Measurement Specs of Telecom Device and Equipment
- To read the standard operating procedures for Telecom Device and Equipment

Tool Usage

- To work with Industry Standard Embedded Systems Tools such as compiler, assembler, linker, debugger and emulators.

Core Skill:

- Telecom communication equipment design, support and maintenance
- Troubleshooting and debugging of Protocol based communication system networks
- Trouble shooting of Intelligent Telecom electronic systems/products
- Various real time data acquisition and control systems
- Development of small, intelligent communication and networking gadgets and applications

Detailed Syllabus of Course

Module No	Module Name	No. of Hours
		Theory / Practical
•	Introduction and Job role overview	10/0

•	Overview of Telecom Embedded Hardware Design from Concept to Commercialization	10/10
•	Introduction to key electronic and electrical components found in a typical Telecom Device/Equipment to cover: • Basic Theory of operation • Component Networks • Types • Applications • Coding standard • Failure modes • Reading Data Sheets • Tools and techniques used to do test, measurements and debug of circuits using those components	10/40
•	Embedded C • Introduction to Embedded C programming • Data Structures • Generating Function Calls & SW Routines Embedded C Programming with HEW	25/50
•	Industrial Grade Microcontroller Architecture • Architecture of 16/32-bit MCUs used in Telecom Networking Equipment, Consumer Devices & Products • Choosing a MCU for your Telecom application	10/20
•	Introduction to Development & Debug Tool Suites: • Introduction to IDE • Introduction to Emulators • Introduction to MCU Programmers	10/20

•	Working with & developing basic firmware blocks of Application Software
	
	    • Display on Character LCD
	    • Keypad Interactions
	    • Accessing External Memory
	    • Analog Interactions
	    • Lighting Display
		15/45

•	Introduction to Communication Protocol Programming	10/50
•	Working across communication interfaces like I2C, SPI, UART, Infrared, RF, GSM and GPS	20/80
•	Realization of Adhoc Communication Networks utilizing Embedded Hardware Realization of Gyro-sensing based mobile application Interfacing to peripheral devices	20/60
•	Communication Skills, soft skills, Life skills	20/30
•	Health and Safety (including electrical safety) & Reporting and Documentation	30/0

Theory / Lecture Hours:	210 hrs
Practical / Tutorial Hours:	395 hrs
Total Hours:	605hrs

Recommended Hardware:	• R8C2XX/TI OMAP/ freescale S12XX/MCF5XX Microcontroller Design Suite • Interfacing boards for Communication Peripherals • Electronic Components for Project as per requirement

Recommended Software:	1. HEW or similar Embedded C Compiler & MCU Tool Chain

Text Books:	• **Renesas R8C25, R8c 1A/1B Hardware Manual** • **Renesas R8C25, R8c 1A/1B User Guide**
Reference Books:	• **Network Processors: Architectures, Protocols and Platforms by Panos C. Lekkas** • **Testing Embedded Software by Bart Broekman**

1.6   Telecom Industry Engineer

ESDM Courses

Level Code:	L3	**Vertical Name:**	Telecom Industry Engineer

Course Code:	TL/S/L3/C012	**Course Name:**	1.6.1 Telecom Industry Network Security Technician

Objective of the Course:

Telecom Industry Network Technician is a program for entry-level network engineers. The Telecom Industry Network Technician validates the ability to install, configure, operate, and troubleshoot medium-size routed and switched networks.

Learning Outcomes:

The Telecom Industry Network Technician course tests a candidate's knowledge and skills required to install, operate, and troubleshoot a small to medium size enterprise branch network. It also test his knowledge to migrate changes required by employer in their current network design.

Expected Job Roles:

- Telecom Network Administrator

- Telecom Network L1 Engineer

Duration of the Course (in hours)	350 Hours

Minimum Eligibility Criteria and pre-requisites, if any	ITI / Diploma

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1	**Operation of IP Data Networks** • Recognize the purpose and functions of various network devices such as routers, switches, bridges and hubs • Select the components required to meet a given network specification • Identify common applications and their impact on the network • Describe the purpose and basic operation of the protocols in the OSI and TCP/IP models • Predict the data flow between two hosts across a network • Identify the appropriate media, cables, ports, and connectors to connect network devices to other network devices and hosts in a LAN	10 Hours
2	**LAN Switching Technologies** • Determine the technology and media access control method for Ethernet networks • Identify basic switching concepts and the operation of switches	20 Hours

	• Configure and verify initial switch configuration including remote access management
	    - A hostname
	    - Managing IP address
	    - IP default-gateway
	    - Local user and password
	    - Enable secret password
	    - Console and VTY logins
	    - Exec-timeout
	    - Service password encryption
	    - Copy run start
	• Verify network status and switch operation using basic utilities
	Describe how VLANs create logically separate networks and the need for routing between them
	• Explain network segmentation and basic traffic management concepts
	Configure and verify VLANs
	Configure and verify trunking on switches
	• dtp (topic)
	• auto-negotiation
	Identify enhanced switching technologies
	• RSTP
	• PVSTP
	• Ether channels
	Configure and verify PVSTP operation
	• Describe root bridge election
	• Spanning tree mode	

3	**IP Addressing (IPv4/IPv6)** Describe the operation and necessity of using private and public IP addresses for IPv4 addressing Identify the appropriate IPv6 addressing scheme to satisfy addressing requirements in a LAN/WAN environment Identify the appropriate IPv4 addressing scheme using VLSM and summarization to satisfy addressing requirements in a LAN/WAN environment. Describe the technological requirements for running IPv6 in	20 Hours

	conjunction with IPv4 Describe IPv6 addresses	

4	**IP Routing Technologies**
	 Describe basic routing concepts
	 Configure and verify utilizing the CLI to set basic Router configuration
	Configure and verify operation status of a device interface
	Verify router configuration and network connectivity using
	Configure and verify routing configuration for a static or default route given specific routing requirements
	Differentiate methods of routing and routing protocols
	Configure and verify OSPF
	Configure and verify interVLAN routing (Router on a stick)
	    • sub interfaces
	    • upstream routing
	    • encapsulation
	Configure SVI interfaces
	 Manage IOS Files
	Configure and verify EIGRP (single AS)
		25 Hours

5	**IP Services**
	 Configure and verify DHCP (IOS Router)
	    • Configuring router interfaces to use DHCP
	    • DHCP options (basic overview and functionality)
	    • Excluded addresses
	    • Lease time
	Describe the types, features, and applications of ACLs
	    • Standard (editing and sequence numbers)
	    • Extended
	    • Named
	    • Numbered
	    • Log option
	
	 Configure and verify ACLs in a network environment
	
	Describe SNMP v2 and v3
		25 Hours

6	**Network Device Security** Configure and verify network device security features Configure and verify Switch Port Security Configure and verify ACLs to filter network traffic	10 Hours

	Configure and verify ACLs to limit telnet and SSH access to the router	
7	**Troubleshooting** Troubleshoot and correct common problems associated with IP addressing and host configurations Troubleshoot and resolve VLAN problems trunking problems on switches ACL issues Troubleshoot and resolve Layer 1 problems Identify and correct common network problems Troubleshoot and resolve spanning tree operation issues Troubleshoot and resolve routing issues Troubleshoot and resolve OSPF problems Troubleshoot and resolve EIGRP problems Troubleshoot and resolve interVLAN routing problems Troubleshoot and resolve WAN implementation issues Monitor Net Flow statistics TS Ether Channel problems	20 Hours
8	**WAN Technologies** Identify different WAN technologies Configure and verify a basic WAN serial connection Configure and verify a PPP connection between routers Configure and verify Frame Relay on routers Implement and troubleshoot PPPoE	20 Hours
9.	**Health and Safety & Reporting and Documentation** - Ensure appropriate disposal of the cut fibers, sleeves and cable pieces - Ensure compliance with site risk control, OHS, environmental and quality requirements as per company's norms - Ensure that work is carried out in accordance to the level of competence and legal requirements - Ensure that sites are assessed for health and safety risk as per company's guidelines prior to commencement of work - Ensure that Personal protection equipments like helmets, knee pads, safety boots, safety glasses and	50 hours

	trench guards are appropriately used as required • Ensure adherence to emergency plans in case of safety incidents • Ensure escalation of safety incidents to relevant authorities • Ensure cable id/ make and drum numbers are recorded for future fault localization	
Total Theory / Lecture Hours:		200
Total Practical / Tutorial Hours:		150
Total Hours:		350

Recommended Hardware:	Router's and Switches of Cisco, Juniper, Nortel or Equivalent, Computers, Projector and Internet.

Recommended Software:	ACIT/GNS3 Simulators

Text Books:	ACIT E-Learning Workbooks

Reference Books:	

ESDM Courses

Level Code:	L4	Vertical Name:	Telecom Manufacturing

Course Code:	TL/M/L4/C013	Course Name:	1.7.1 Electrical Testing of Telecom Assemblies

Objective of the Course:

To teach the trainee, Electrical testing of bare boards (DS & Multilayer Board) using Dedicated Bare Board Tester, Universal Bare Boards Tester and Flying Probe Tester and Electrical testing assembled boards using In-circuit Tester. Basic knowledge of preparation of test fixtures for bare board testing and assembled board testing.

Learning Outcomes:

Upon successful completion of training, trainee will be able to do the bare board testing of bare Telecom PCB's using BBT machine and testing of assembled boards using In-circuit tester.

Expected Job Roles:

1. Telecom BBT Operator / Supervisor

2. Telecom In-circuit Tester Operator / Supervisor

Duration of the Course (in hours)	350 Hours

Minimum Eligibility Criteria and pre-requisites, if any	ITI / Diploma in Electronics , Telecom or B.Sc. in Electronics

Professional Knowledge:

1. Knowledge of electrical testing of bare boards for telecom sector.
2. Knowledge of electrical testing of assembled boards using In-circuit tester.
3. Basic knowledge of CAM software for creation of BBT program
4. Basic Knowledge of test fixture making.
5. Main machine & materials used for electrical testing & fixture making.
6. Ability to trace fault such as open, shorts, missing components, wrong components in bare boards and assembled boards.
7. Operating knowledge of Dedicated Bare Board testing machine, Universal Bare Board Testing machine, Flying Probe testing machine and In-circuit tester.
8. Applicable IPC standards for bare board testing and in-circuit testing.

Professional Skill:

1. Operation of Bare Boards testing machine and fault repairs.
2. Operation of In-circuit testing machine and fault tracing on assembled board.
3. Program generation for bare board testing & in-circuit testing.
4. Basic test fixture preparation skill for BBT & In-circuit testing.
5. Acceptable quality requirement regarding bare boards and assembled boards.
6. Ability to troubleshoot and reduce machine down time.
7. Ability read schematic and trace faults in assembled boards

Core Skill:

1. To be able to understand various machine and equipments operating manual in order to identify and fix minor faults that occur during telecom boards electrical testing.
2. To be able to understand operating procedures and work instruction of the different machine used for electrical testing of bare boards and assembled boards.
3. To maintain pace of the through put as per production requirements.
4. To effectively communicate with superiors on repetitive machine failure & commonly observed fault in boards.
5. To be able to write reports in log books and on line job tracking software.
6. To co-ordinate with other team members in order to collect inputs and deliver output to the next process
7. To share knowledge with team members for smooth work flow.

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours	
		Theory	Practical
1	**Telecom Bare Board Test Objective and Definitions** Introduction, Why Test, Telecom Circuit Board faults, What is Gerber data, Basics of CAM software	4	6
2	**Bare Board Test Methods** Introduction, Non-Electrical Test Methods, Specialized Electrical Test	10	35

	Methods, Data & Fixture Preparation, Combined Testing Methods		
3	**Bare Board Test Equipments** Introduction, System Alternatives, Universal Grid Systems, Flying Probe/ Moving Probe Systems, Verification & Repair, Test Department Planning and Management	12	38
4	**Design for Testing** Introduction, AD-HOC Design for Testability, Structured Design for Testability, Standard Based Testing	10	35
5	**Telecom Assembled Board Testing** Introduction, The Process of Testing, Testing Approaches, In-circuit Test Techniques, Alternate to conventional Electrical Tests, Tester Comparisons	12	38
	Sub Total	48	152
6	**Safety, Health & Environment** - Awareness of electrical hazards - How to eliminate electrical hazards in the workplace - What to do during an electrical accident - Types of electrical injuries - Fire Safety Smoke detector and fire alarm Threats to fire safety - Classification of fire - Types of fire extinguishers - Fire extinguisher Operating technique - Safety accessories: Safety gloves, safety harness and helmet - Security Management System,SMS processes - Duties & responsibilities of static security - Fuel Management System, Cell Site Audit - House Keeping & Scrap Management Earthing: Earth resistance < 2 ohms, Measurement of Earth electrode resistance, Periodic maintenance of earth system in cell sites	30	

7	**Safety, Reporting and Documentation** • Ensure appropriate disposal of the cut fibers, sleeves and cable pieces • Ensure compliance with site risk control, OHS, environmental and quality requirements as per company's norms • Ensure that work is carried out in accordance to the level of competence and legal requirements • Ensure that sites are assessed for health and safety risk as per company's guidelines prior to commencement of work • Ensure that Personal protection equipments like helmets, knee pads, safety boots, safety glasses and trench guards are appropriately used as required • Ensure adherence to emergency plans in case of safety incidents • Ensure escalation of safety incidents to relevant authorities Ensure cable id/ make and drum numbers are recorded for future fault localization	40
8	**Communication, Reading & Writing Skills** • Demonstrate effective communication Skills to liaise and coordinate with third party vendors, supervisor and peers filling technical forms, activity logs in required format	50
9	**Maintaining Reports and Records** • Document site acceptance testing as per AT specified format • Site Acceptance Testing (SAT) includes: Integration Testing, Performance Testing, User Acceptance Testing • Types of documentation: General, Commercial, Project documents • Organizational Context: Policies, Processes, Procedures, Work instruction	30

	Core Skills/Generic Skills • Write acceptance testing report as per the specified report format • Reporting: Test script/cases, Recommendations and risk strategy, Test input and output information, used and created by conducting the tests, Test results, both detailed and summary • Resources	
		350 Hours

Total Course Theory / Lecture Hours: 198 Hours

Total Course Practical / Tutorial Hours: 152 Hours

Total Course Hours: 350 Hours

Recommended Hardware:	Telecom Bare Boards & Assembled Boards, Bare Board Testing machines , In-circuit Tester, BBT Fixtures for bare boards and assembled boards, X-acto knife. Circuit schematic and Gerber data including Bill of Materials of assembled boards.

Recommended Software:	CAM software

Text Books:	Printed Circuits Handbook , 6th Edition by Clyde F. Coombs Jr. Chapter 36-39, 54-55.

Reference Books:	http://en.wikipedia.org/wiki/Printed_circuit_board http://www.eurocircuits.com/Electrical-test http://webstds.ipc.org/files/documents2/2515A.pdf https://www.smtnet.com/library/files/upload/IPC-9252A-considerations.pdf http://www.ietlabs.com/pdf/Handbooks/Introduction%20to%20In-

Circuit%20Testing.pdf
http://en.wikipedia.org/wiki/In-circuit_test
http://www.ee.ncu.edu.tw/~jfli/test1/lecture/ch05

Evaluation criteria: Based on attendance, assignments, internal assessment and final evaluation by third party approved by TSSC.

ESDM Courses

Level Code: L4   **Vertical Name:** Telecom Manufacturing

Course Code: TL/M/L4/C015   **Course Name:**

1.7.2   IPC Acceptability Criteria of Telecom PCB Assemblies

65

Objective of the Course:

To teach the trainee, IPC Acceptability Criteria of Telecom PCB Assemblies based on Telecom IPC Standard IPC-A-610E.

Learning Outcomes:

Upon successful completion of training, trainee will be able to do the inspection of the electronic assemblies as per international standard IPC-A-610E.

Expected Job Roles:

- Telecom In –process / Final Quality Inspector

- Telecom In-process / Final Quality Supervisor

Duration of the Course (in hours)	350 Hours

Minimum Eligibility Criteria and pre-requisites, if any	ITI / Diploma in Telecom , Electronics or B.Sc. in Electronics

Professional Knowledge:

- Knowledge of applicable IPC standards for Telecom Electronic Assemblies.
- Knowledge of Acceptability Criteria for Telecom Electronic Assemblies
- Classification of Electronic Assemblies
- Terms and definition used in EMS industry
- Acceptability requirement about solderability

Professional Skill:

- Ability to inspect to Telecom Electronics Assemblies as IPC-A-610E.
- Acceptable quality requirement regarding bare boards and assembled boards.
- Ability to report defects to the production departments to prevent reoccurrence of defects.
- Ability to prepare Quality report and entry of the same MIS.
- Ability to do root cause analysis with colleagues

Core Skill:

- To be able to understand, inspection requirements for assembled boards as per IPC and customer requirements.
- To maintain pace of the through put as per production requirements.
- To effectively communicate with superiors on repetitive commonly observed defects in electronic assemblies.
- To be able to write reports in log books and on line job tracking software.
- To co-ordinate with other team members in order to collect inputs and deliver output to the next process
- To share knowledge with team members for smooth work flow.

Detailed Syllabus of Course

Unit No	Unit Name	Duration In Hours
1	**Introduction to Telecom IPC Standard & its importance:** IPC Classification of Telecom PCB,s, Definition of Requirements, Terms & Definitions, Inspection Methodology, Magnification Aids	4
2	**Handling Telecom Electronic Assemblies:** EOS/ESD Prevention, EOS/ESD Safe Work Stations, Handling Consideration.	4
3	**Telecom Hardware Installation Requirements** Hardware Installation, Jack post Mounting, Connector Pins, Wire Bundle Securing, Routing.	8
4	**Telecom Acceptability Requirement for Soldering** Soldering Acceptability Requirements', Soldering Defects	6
5	**Telecom Terminal Connection Requirements** Swaged Hardware, Insulation, Conductor, Service Loops and Terminals	16
6	**Telecom Through-Hole Technology** Component Mounting, Telecom Component Securing, Supported / Un-supported Holes, Jumper Wires	24
7	**Telecom Surface Mount Assemblies** Staking Adhesive, SMT Leads, SMT Connections, Specialized SMT Components, Surface Mount Connector, Jumper Wires	30
8	**Component Damage** Loss of Metallization, Chip Resistor Element, Leaded/ Leadless Devices, Ceramic Chip Capacitors, Connectors, Relays, Transformer core Damage, Edge Connector Pins, Press Fit Pins, Backplane Connector Pins, Heat Sink Hardware.	6
9	**Telecom Printed Circuit Boards related Defects**	16

	Gold Surface Contact Area, Laminate conditions, Conductors / Lands, Flexible and Rigid –Flex Printed Circuitry, Marking, Cleanliness, Solder Mask Coating, Conformal Coating & Encapsulation	
10	**Discrete Wiring in Telecom** Solderless Wrap, Number of Turns, Turn Spacing, End Tails, Insulation Wrap, Raised Turns Overlap, Connector Position, Wire Dress, Wire Slack, Wire plating, Damaged Insulation, Damaged Conductors and Terminals, Component Mounting- Connector Wire Dress, Strain/ Stress Relief, High Voltage Connections	6
11	**Safety, Health & Environment** • Awareness of electrical hazards • How to eliminate electrical hazards in the workplace • What to do during an electrical accident • Types of electrical injuries • Fire Safety Smoke detector and fire alarm Threats to fire safety • Classification of fire • Types of fire extinguishers • Fire extinguisher Operating technique • Safety accessories: Safety gloves, safety harness and helmet • Security Management System, SMS processes • Duties & responsibilities of static security • Fuel Management System, Cell Site Audit • House Keeping & Scrap Management Earthing: Earth resistance < 2 ohms, Measurement of Earth electrode resistance, Periodic maintenance of earth system in cell sites	30
12	**Safety, Reporting and Documentation** • Ensure appropriate disposal of the cut fibers, sleeves and cable pieces • Ensure compliance with site risk control, OHS, environmental and quality requirements as per company's norms • Ensure that work is carried out in accordance to the level of	

		competence and legal requirements	40
		• Ensure that sites are assessed for health and safety risk as per company's guidelines prior to commencement of work	
		• Ensure that Personal protection equipments like helmets, knee pads, safety boots, safety glasses and trench guards are appropriately used as required	
		• Ensure adherence to emergency plans in case of safety incidents	
		• Ensure escalation of safety incidents to relevant authorities	
		Ensure cable id/ make and drum numbers are recorded for future fault localization	
13		**Communication, Reading & Writing Skills**	50
		• Demonstrate effective communication Skills to liaise and coordinate with third party vendors, supervisor and peers	
		filling technical forms, activity logs in required format	
14		**Maintaining Reports and Records**	30
		• Document site acceptance testing as per AT specified format	
		• Site Acceptance Testing (SAT) includes: Integration Testing, Performance Testing, User Acceptance Testing	
		• Types of documentation: General, Commercial, Project documents	
		• Organizational Context: Policies, Processes, Procedures, Work instruction	
		Core Skills/Generic Skills	
		• Write acceptance testing report as per the specified report format	
		• Reporting: Test script/cases, Recommendations and risk strategy, Test input and output information, used and created by conducting the tests, Test results, both detailed and summary	
		• Resources	

Total	270

Total Course Theory / Lecture Hours: 270 Hours

Total Course Practical / Tutorial Hours: 80 Hours

Total Course Hours: 350 Hours

Recommended Hardware:	None

Recommended Software:	None

Text Books:	Acceptability of Telecom Electronic Assemblies, IPC-A-610 Revision E 2010.

Reference Books:	IPC-HDBK-001 : Handbook and Guide to Supplement IPC-J-STD-001 IPC-AJ-820: Assembly & Joining Handbook IPC-J-STD-001 : Joint Industry Standard " Requirements for Soldered Electrical & Electronic Assemblies"

Evaluation criteria:	Based on attendance, assignments, internal assessment and final evaluation by third party approved by TSSC.

ESDM Courses

Level Code:	L4	Vertical Name:	Telecom Manufacturing

Course Code:	TL/M/L4/C016	Course Name:	1.7.3 SMT Process for Telecom Boards

Objective of the Course:

To train students about different Telecom SMT process used in the manufacturing of telecom assemblies. To impart knowledge about different material, tool & equipments used for SMT process and SMT process control.

Learning Outcomes:

Upon successful completion of training, candidate will be able to operate the Telecom SMT line for assemblies of telecom boards. SMT Assembly process includes solder paste printing, placement of SMD components, reflow soldering and Automated inspection of assemblies.

Expected Job Roles:

1. Telecom SMT Line operator 2. Telecom SMT Process Supervisor 3. Telecom Automated Optical Inspection of Assembled Boards

Duration of the Course (in hours)	350 Hours

Minimum Eligibility Criteria and pre-requisites, if any	ITI / Diploma in Telecom, Electronics or B.Sc. in Electronics

Professional Knowledge:

1. Complete knowledge about Telecom SMT process used for telecom assemblies such as solder paste printing, pick & place machine programming, process of pick & place machine, Reflow soldering process and AOI. 2. Basic raw materials and chemicals used for Telecom SMT process. 3. Different test equipments, tools, machines and process used for Telecom SMT process. 4. Critical process parameters and acceptability quality requirement of Telecom SMT assemblies. 5. Awareness about surface mount devices used in Telecom telecom assemblies 6. Safety and environmental norms to be followed during SMT process. 7. Advantage of SMT components over though hole components.

Professional Skill

1. Operation of Telecom SMT line including AOI machine.
2. Setting & operation of solder paste printing machine
3. Programming and operation Pick & Place machine
4. Process control and setting critical process parameters of SMT line
5. To identify errors both in the input and in the in-process SMT assemblies
6. To spot process disruptions and delays in processes
7. Ability to improve work processes in Telecom
8. Ability to troubleshoot and reduce machine down time

Core Skill:

8. To be able to understand various machine and Telecom equipments operating manual in order to identify and fix minor faults that occur during telecom boards assembly by Telecom SMT process.
9. To be able to understand operating procedures and work instruction of the Telecom SMT process.
10. To maintain pace of the through put as per production requirements.
11. To effectively communicate with superiors on repetitive machine failure.
12. To be able to write reports in log books and on line job tracking software.
13. To co-ordinate with other team members in order to collect inputs and deliver output to the next process
14. To share knowledge with team members for smooth work flow.

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours	
		Theory	Practical
1	**Module 1: Basics of Telecom SMD Components** Electronic components classification, Different type of through hole components, Active and Passive components, Use of multimeter, surface mount components and SMD terminology, identification of different type	10	35

	of chip components. Marking of chip of components.		
2	**Module 2: Telecom SMT Process** Pick & place assembly process flow, Introduction to solder paste printing, solder paste types, solder stencil, solder paste printing process, printer operation, stencil cleaning, paste alignment, solder paste print quality, operation of paste printer. Pick & place machine operation, advantage of SMT over through hole process, Feeder, component pick head types, features of commonly used pick & place machines, PCB panelization requirement for Pick & Place process, PCB Fiducial Guidelines, Manual SMT assembly of PCB's. PCB Gerber data reading and paste data extraction, Hot Air Reflow process, operation of reflow machine, Setting of thermal profile of machine, heat transfer mode in reflow oven, reflow soldering reliability, Inspection of reflow board. Automatic optical inspection of SMT assembly, Rework of SMT assembly.	25	85
3	**Module 3: Safety Guidelines in Telecom - Pick & Place Assembly Process :** ESD Safety, cause of ESD, ESD effect on electronics, ESD protection, ESD 20:20 standard, ESD protected area & EPA basics, equipment used for ESD protection, Safety guidelines in solder paste printing, Pick & Place Assembly and Reflow Soldering.	5	15
4	**Module 4: Soft Skills** How to work with superior and colleagues, understanding work requirements, understating standard operating procedures, how to escalate problems that cannot be handled including repetitive defects, machine failures, potential hazards, process disruptions, repairs and maintenance of machine, Reporting and feedback, resolve personnel issue, communication about process flow improvements, Interacting with colleagues, Collect required spares and raw materials, Knowledge of the company, organization and its processes, communication skills, core and generic skills, teamwork and multi tasking, Decision making, reflective thinking, critical thinking. Understanding potential source of accidents, use of safety gears to avoid accidents, understanding of safety procedure	8	17

	followed by the company.		
	Sub- Total	48	152
5	**Safety, Health & Environment** • Awareness of electrical hazards • How to eliminate electrical hazards in the workplace • What to do during an electrical accident • Types of electrical injuries • Fire Safety Smoke detector and fire alarm Threats to fire safety • Classification of fire • Types of fire extinguishers • Fire extinguisher Operating technique • Safety accessories: Safety gloves, safety harness and helmet • Security Management System, SMS processes • Duties & responsibilities of static security • Fuel Management System, Cell Site Audit • House Keeping & Scrap Management Earthing: Earth resistance < 2 ohms, Measurement of Earth electrode resistance, Periodic maintenance of earth system in cell sites	30	
6	**Safety, Reporting and Documentation** • Ensure appropriate disposal of the cut fibers, sleeves and cable pieces • Ensure compliance with site risk control, OHS, environmental and quality requirements as per company's norms • Ensure that work is carried out in accordance to the level of competence and legal requirements • Ensure that sites are assessed for health and safety risk as per company's guidelines prior to commencement of work • Ensure that Personal protection equipments like helmets, knee pads, safety boots, safety glasses and trench guards	40	

	are appropriately used as required • Ensure adherence to emergency plans in case of safety incidents • Ensure escalation of safety incidents to relevant authorities Ensure cable id/ make and drum numbers are recorded for future fault localization	
7	**Communication, Reading & Writing Skills** • Demonstrate effective communication Skills to liaise and coordinate with third party vendors, supervisor and peers filling technical forms, activity logs in required format	50
8	**Maintaining Reports and Records** • Document site acceptance testing as per AT specified format • Site Acceptance Testing (SAT) includes: Integration Testing, Performance Testing, User Acceptance Testing • Types of documentation: General, Commercial, Project documents • Organizational Context: Policies, Processes, Procedures, Work instruction Core Skills/Generic Skills • Write acceptance testing report as per the specified report format • Reporting: Test script/cases, Recommendations and risk strategy, Test input and output information, used and created by conducting the tests, Test results, both detailed and summary • Resources	30

Total Course Theory / Lecture Hours: 198 Hours

Total Course Practical / Tutorial Hours: 152 Hours

Total Course Hours: 350 Hours

Recommended Hardware:	TelecomSMD components, Solder paste, bare PCB,s with mixed technology, assembled boards, de-soldering pump, hot air gun, tweezers, SMT line (including Loader, Solder paste printer, Pick & place machine, Reflow solder Machine, AOI, Unloader.

Recommended Software:	CAM350 software for editing pick & place machine program.

Text Books:	1. Lead Free Solders: Materials Reliability for Electronic Materials Reliability for Electronic by K. Subramanian 2. Reflow Soldering Processes: SMT, BGA CSP and Flip Chip Technologies 3. Essential of SMT : Practical Know –How by Youngbong Kang

Reference Books:	http://en.wikipedia.org/wiki/Surface-mount_technology http://www.ipc.org/TOC/IPC-7530.pdf http://www.ipctraining.org/dvd/47c/script.pdf http://link.springer.com/chapter/10.1007%2F978-1-4615-3910-0_4#page-1

Evaluation criteria:	Based on attendance, assignments, internal assessment and final evaluation by third party approved by TSSC.

ESDM Courses

Level Code: | L4 | **Vertical Name:** | Telecom Manufacturing

| **Course Code:** | TL/M/L4/C017 | **Course Name:** | 1.7.4   Soldering of Telecom Board Assemblies |

Objective of the Course:

To train students about different soldering techniques used in the manufacturing of telecom assemblies. To impart knowledge about different material, tool & equipments used for soldering process and soldering quality standards.

Learning Outcomes:

Upon successful completion of training, candidate will be able to operate the wave soldering machine, Hot air reflow soldering machine and fair expertise in manual soldering.

Expected Job Roles:

- Telecom Wave Soldering Machine operator

- Telecom Wave Soldering Machine Process Supervisor

- Telecom Hot Air Reflow Soldering Machine Operator

- Telecom Hot Air Reflow Soldering Process Supervisor

Duration of the Course (in hours)	350 Hours

Minimum Eligibility Criteria and pre-requisites, if any	ITI / Diploma in Telecom ,Electronics or B.Sc. in Electronics

Professional Knowledge:

- Complete knowledge about soldering process used for telecom assemblies such as Telecom wave soldering, hot air reflow soldering and manual soldering.
- Basic raw materials and chemicals used for soldering process.
- Different test Telecom equipments, tools, machines and process used for PCB soldering process.
- Critical process parameters and acceptability quality requirement of Telecom PCB's assemblies
- Awareness about through hole and surface mount devices used in telecom assemblies
- Safety and environmental norms to be followed during soldering process.
- Advantage of SMT components over though hole components.
- Best practices being followed for soldering of Telecom electronic assemblies.
- ROHS and non-ROHS soldering process requirements & process control

Professional Skill:

- Operation of Telecom wave soldering machine
- Operation of hot air soldering machine
- Manual soldering and rework of Telecom electronic assemblies
- Process control and setting critical process parameters of wave solder machine and reflow soldering machine
- To identify errors both in the input and in the in-process Telecom PCB assemblies
- To spot process disruptions and delays in processes
- Ability to improve work processes
- Ability to troubleshoot and reduce machine down time

Core Skill:

- To be able to understand various machine and Telecom equipments operating manual in order to identify and fix minor faults that occur during telecom boards soldering.
- To be able to understand operating procedures and work instruction of the different soldering processes.
- To maintain pace of the through put as per production requirements.
- To effectively communicate with superiors on repetitive machine failure.
- To be able to write reports in log books and on line job tracking software.
- To co-ordinate with other team members in order to collect inputs and deliver output to the next process
- To share knowledge with team members for smooth work flow.

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours

		Theory	Practical
1	**Basics of**Telecom **Soldering and soldering process** Basics of through Hole and SMD components, Raw materials used for soldering process such solder, flux and solder paste. Manual soldering and rework of telecom assemblies. Basics of wave soldering and Hot Air soldering process	10	35
2	**Wave Soldering of Telecom Assemblies** Operation of wave soldering machine, Equipment & jigs fixture used for wave soldering, control of critical process parameters, trouble shooting of process defects, daily & preventive maintenance of wave soldering machine.	15	45
3	**Hot Air Reflow Soldering of Telecom Assemblies** Operation of hot air reflow soldering machine, types of equipments used for hot air reflow soldering, control of critical process parameter and reflow profile setting, daily and preventive maintenance of reflow soldering machine, trouble shooting of process defects and how to control common soldering defects observed during reflow soldering.	15	45
4	**Safety & Environment norms for Soldering processes** ESD Safety of SMD components and ESD safe work area, 5 S , Safety precautions & pollution control during manual soldering, wave soldering and hot air reflow soldering.	8	27
	Total	48	152
	Safety, Health & Environment • Awareness of electrical hazards • How to eliminate electrical hazards in the workplace • What to do during an electrical accident • Types of electrical injuries • Fire Safety Smoke detector and fire alarm Threats to fire safety	30	

	- Classification of fire - Types of fire extinguishers - Fire extinguisher Operating technique - Safety accessories: Safety gloves, safety harness and helmet - Security Management System, SMS processes - Duties & responsibilities of static security - Fuel Management System, Cell Site Audit - House Keeping & Scrap Management Earthing: Earth resistance < 2 ohms, Measurement of Earth electrode resistance, Periodic maintenance of earth system in cell sites	
	Safety, Reporting and Documentation - Ensure appropriate disposal of the cut fibers, sleeves and cable pieces - Ensure compliance with site risk control, OHS, environmental and quality requirements as per company's norms - Ensure that work is carried out in accordance to the level of competence and legal requirements - Ensure that sites are assessed for health and safety risk as per company's guidelines prior to commencement of work - Ensure that Personal protection equipments like helmets, knee pads, safety boots, safety glasses and trench guards are appropriately used as required - Ensure adherence to emergency plans in case of safety incidents - Ensure escalation of safety incidents to relevant authorities Ensure cable id/ make and drum numbers are recorded for future fault localization	40
	Communication, Reading & Writing Skills - Demonstrate effective communication Skills to liaise and coordinate with third party vendors, supervisor and peers filling technical forms, activity logs in required format	50

	Maintaining Reports and Records	30
	• Document site acceptance testing as per AT specified format	
	• Site Acceptance Testing (SAT) includes: Integration Testing, Performance Testing, User Acceptance Testing	
	• Types of documentation: General, Commercial, Project documents	
	• Organizational Context: Policies, Processes, Procedures, Work instruction	
	Core Skills/Generic Skills	
	• Write acceptance testing report as per the specified report format	
	• Reporting: Test script/cases, Recommendations and risk strategy, Test input and output information, used and created by conducting the tests, Test results, both detailed and summary	
	• Resources	

Total Course Theory / Lecture Hours: 198 Hours

Total Course Practical / Tutorial Hours: 152 Hours

Total Course Hours: 350 Hours

Recommended Hardware:	Through Hole & SMD components kits, manual soldering stations, Soldering wire, Manual solder paste printer, bare PCB,s with mixed technology, assembled boards, de-soldering pump, hot air gun, tweezers, Solder reflow and wave soldering machines

Recommended Software:	NIL

Text Books:	• Handbook of Machine Soldering by Ralph W. Woodgate, 3rd Edition • Lead Free Solders: Materials Reliability for Electronic Materials Reliability for Electronic by K. Subramanian • Reflow Soldering Processes: SMT, BGA CSP and Flip Chip Technologies

Reference Books:	http://en.wikipedia.org/wiki/Wave_soldering http://www.ipc.org/TOC/IPC-7530.pdf http://www.ipctraining.org/dvd/47c/script.pdf http://link.springer.com/chapter/10.1007%2F978-1-4615-3910-0_4#page-1

Evaluation criteria:	Based on attendance, assignments, internal assessment and final evaluation by third party approved by TSSC.

ESDM Courses

Level Code:	L4	Vertical Name:	Telecom Manufacturing

Course Code:	TL/M/L4/C021	Course Name:	1.7.5 Telecom Quality Technician

Objective of the Course:

To Prepare the Technicians for the Telecom Quality function on the shop floor for Quality Control. The participant will be able to Supervise Inspection, collation of data and prepare for Quality improvement on the semi-finished/finished products

Learning Outcomes:

- Understanding of Telecom SQC tools
- Understanding of Basic knowledge of PCB assembly
- Usage of Telecom SQ tools to solve quality problems and improvements
- Be a part of the team to make improvements of the Quality of the Telecom PCB assembly process

Expected Job Roles:

- Telecom QC Technician

- Process Telecom QC Technician	
- Final Telecom QC Technician	

Duration of the Course (in hours)	350 Hours

Minimum Eligibility Criteria and pre-requisites, if any	Diploma in Telecom ,Electronics, electrical, Instrumentation

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
QT 001	7QC tools for Telecom , FMEA, Mitigation/Control plans, Review • Tally Sheet - Check sheet • Stratification (Data) • Pareto diagram • Fish bone diagram • Scatter diagram • Graphs (Line graph, Bar charts) • Histogram • Potential failure modes and effect analysis • RPN, Control plan and mitigation plan and review of PFMEA • Usage of 7 tools for analysis, improvements through CFTs	40 Hours
QT 002	Analytical Skills, New QC tools for Telecom • 7 QC tools, their usage and examples • Introduction to KAIZEN techniques, case study	15 Hours
QT 003	Risk Analysis • Risks associated with quality • Complex global supply chain • Risk –service and warranty management • Short product/part lifecycle • Risk- uncertain demand	5 Hrs

	• Risk- sustainability	
QT 004	Basic knowledge of TelecomPCB • Basic knowledge of PCB assembly – paste printing, placement, reflow soldering, PCBs and wave soldering • Types of PCBs • Material used in PCBs, legend markings and common terminology used in manufacturing. • PCBs used in SMD manufacturing, handling and safety • Various steps used in SMT • Types of mass soldering techniques • Introduction to reflow soldering, wave soldering	30 Hours
QT 004	Knowledge of ESD, MSD for Telecom • Understanding of static electricity • Source of static electricity on the shop floor • Charge generation during production activity in the shop floor • Understanding of ESD • Effect of ESD on components • ESD protection and control • ESD personal protective equipment • Understanding of MSD • Precautions of MSD • Preproduction and post production activities of MSD	10 Hours
QT 005	Team Management and Communication, System Log - Telecom • WHAT and WHYs of Teams • Understanding &Types of Teams • Roles & Responsibilities • Team Building & Group Dynamics • Team Barriers/problems • Tools used for problem solving • Leadership and other Personal Qualities required for Teams • Inter personal skills • Meetings • Managing Difficult People	10 Hours
	Safety, Health & Environment • Awareness of electrical hazards • How to eliminate electrical hazards in the workplace • What to do during an electrical accident • Types of electrical injuries	30 hrs

	• Fire Safety	
	Smoke detector and fire alarm	
	Threats to fire safety	
	• Classification of fire • Types of fire extinguishers • Fire extinguisher Operating technique • Safety accessories: Safety gloves, safety harness and helmet • Security Management System, SMS processes • Duties & responsibilities of static security • Fuel Management System, Cell Site Audit • House Keeping & Scrap Management	
	Earthing: Earth resistance < 2 ohms, Measurement of Earth electrode resistance, Periodic maintenance of earth system in cell sites	
	Safety, Reporting and Documentation • Ensure appropriate disposal of the cut fibers, sleeves and cable pieces • Ensure compliance with site risk control, OHS, environmental and quality requirements as per company's norms • Ensure that work is carried out in accordance to the level of competence and legal requirements • Ensure that sites are assessed for health and safety risk as per company's guidelines prior to commencement of work • Ensure that Personal protection equipments like helmets, knee pads, safety boots, safety glasses and trench guards are appropriately used as required • Ensure adherence to emergency plans in case of safety incidents • Ensure escalation of safety incidents to relevant authorities Ensure cable id/ make and drum numbers are recorded for future fault localization	40 hrs
	Communication, Reading & Writing Skills • Demonstrate effective communication Skills to liaise and	50 hrs

	coordinate with third party vendors, supervisor and peers filling technical forms, activity logs in required format	
	Maintaining Reports and Records • Document site acceptance testing as per AT specified format • Site Acceptance Testing (SAT) includes: Integration Testing, Performance Testing, User Acceptance Testing • Types of documentation: General, Commercial, Project documents • Organizational Context: Policies, Processes, Procedures, Work instruction Core Skills/Generic Skills • Write acceptance testing report as per the specified report format • Reporting: Test script/cases, Recommendations and risk strategy, Test input and output information, used and created by conducting the tests, Test results, both detailed and summary • Resources	30 hrs

Total Theory / Lecture Hours:	260
Total Practical / Tutorial Hours:	90 Hours
Total Hours:	350 Hours

Recommended Hardware:	Telecom Manufacturing Lines with SMT PB manufacturing, AOI, etc ISO 9001 Manuals, Procedures

Recommended Software:	System used like ERP, ISO 9001

Text Books:	- Telecom Quality Control on the shop floor by Krishnamuthy - Guide to Quality control- Ishikawa - Learn to Solder by Brian Jepson - Reflow soldering process by Nin-Cheng Lee
Reference Books:	- Telecom Statistical methods for Quality Improvement- Hitoshi Kume - The QC problem solving approach- by Katsuya Hosotani - Electronics Quality Mgt Handbook by Marsha Ludwig Becker - Handbook of Machine soldering by Ralph Woodgate

ESDM Courses

Level Code:	L4	**Vertical Name:**	Network Management

Course Code:	TL/S/L4/C014	**Course Name:**	1.8.1 Grass Root Telecom Provider

Objective of the Course:

To develop skills that allow an individual to keep ONT site operational, maintenance of hardware& repair of first level basic faults, promote use of devices among local population and provide services.
The individual will have working knowledge of following;
1. Functioning of E terminals, smart phones, CCU, SPV, TJB, Battery bank & fire extinguisher.
2. Troubleshooting for problems in equipment and carrying out basic repairs.
3. Preventive Maintenance of equipment at ONT site.

Learning Outcomes:

By participating & successfully completing this course,
1. The Individual will have good communication skills for undertaking effective customer service role.
2. Develop competency to provide back up support in terms of Preventive Maintenance, basic repairs.
3. The Individual will have a clear understanding of job requirements at ONT site and will be able to better understand and analyse technical issues.

Expected Job Roles:

1. Executive ON the Site-operations, Maintenance & repair.	
2. Customer service support executive	

Duration of the Course (in hours)	350 hours

Minimum Eligibility Criteria and pre-requisites, if any	10th + ITI, 12th pass

Detailed Syllabus of Course

S.No.	Module. Name	Duration
1	Fundamentals & functions of computer • Understanding different component of a computer • Basic Function of computer • Hardware part of the computer	5 Hr.
2	Installation ,connections & Basic operation of computer • Understanding the different wire connection w.r.t socket like. Power cable, internal connection within CPU (Central Processing Unit), UPS and its connectivity.	5 Hr.
3	Typing & keyboard operations • Typing skills/Unicode multi language typing • Understanding and Handling of Laptop computer	10 Hr

4	Networking, LAN/WAN & Internet connectivity • Understanding the networking LAN/WAN and internet Connectivity. • Handling of Modems • Implement and troubleshoot switch administration • Layer- 2 WAN circuit technologies	10 Hr.
5	Functioning of modem, Routers & UPS • Understanding the connection of modem, router and UPS • Function and troubleshooting of modem, router and UPS	10 Hr.
6	Termination of OFC, Functionality of ONT, CCU, SPV, TJB, Battery Pack & fire extinguishers • Understanding the functionality of various equipments • Safe handling and use of each equipment	25 Hr
7	Basic electrical wiring patch cord &pigtails • Basic electrical connection, wiring of equipments.	10 Hr.
8	Installation of software, anti-virus programmes and Applications • Learning the method of how to install and uninstall a program of various types.	15 Hr
9	Introduction to MS Office& practical applications • Introduction to MS Office • Practical learning on MS – Word, Excel, Powerpoint	20 Hr
10	Preventive Maintenance-Need & objective	5 Hr.
10 (a)	Handling of variety of Land-line/ cordless phones, Mobile phones, Smart phones and their Battery Packs, Download of applications, use of SMS and MMS	10 Hr
11	Guidelines & schedules for preventive Maintenance for CCU,SPV,TJB, Battery Bank • Guided as per the Industry norm.	5 Hr.

12	Methodology & demonstration for PM	5 Hr.
13	Internet connectivity using LAN/WAN and Data cards, Benefits of broadband to people	5 Hr.
14	Reading ,writing & communication skills • Effective Communication ; Verbal and Non-Verbal Communication; Body Language; Listening Skills	5 Hr.
15`	Trouble shooting for faults • UPS, Router, SMPS, Modem, CPU system installation etc.	15 Hr.
4.	**Health and Safety & Reporting and Documentation** • Ensure appropriate disposal of the cut fibers, sleeves and cable pieces • Ensure compliance with site risk control, OHS, environmental and quality requirements as per company's norms • Ensure that work is carried out in accordance to the level of competence and legal requirements • Ensure that sites are assessed for health and safety risk as per company's guidelines prior to commencement of work • Ensure that Personal protection equipments like helmets, knee pads, safety boots, safety glasses and trench guards are appropriately used as required • Ensure adherence to emergency plans in case of safety incidents • Ensure escalation of safety incidents to relevant authorities • Ensure cable id/ make and drum numbers are recorded for future fault localization	50 Hr
	Total Theory/Lecture	210 hours
	Total Practical / Tutorial Hours:	140 hours

		Total Hours:	350 Hours

Recommended Hardware:

Desktops, laptops, Land-line/ cordless phones, smart phones, optical network terminal equipments, connectors, LAN, Data Card,CCU, SPV, TJB, Battery bank , Modem, UPS, fire extinguishers

Recommended Software:

MS Office

Text Books:

Reference Books:

1.9   Network Operation & Maintenance

ESDM Courses

	Vertical Name:	Network Operation & Maintenance

Level Code:	4	

Course Code:	TL/S/L4/C019	Course Name:	1.9.1 Telecom Industry Network Specialist

Objective of the Course:

It is designed for telecom network managers, professionals, senior network engineers and architects who are responsible for implementing and troubleshooting today's complex converged networks in enterprise networking environments.

Learning Outcomes:

Acquire skills required to install, operate, and troubleshoot a small to Large size enterprise branch network. It also enables the candidate to implement changes required by Service Provider in their current network design.

Expected Job Roles:

- Telecom Network Administrator
- Telecom Network L2/3 Engineer

Duration of the Course (in hours)	370 Hours

Minimum Eligibility Criteria and pre-requisites, if any	ITI / Diploma

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1	**Basic knowledge of Networking** Identify which devices the customer already has. Identify how many L2 devices would the customer need as per the design requirements. Identify number of nodes in each Department. Suggest which protocols should be used as per design. Identity applications handled and used in the network Identify internet connectivity pattern Ensure NOC is notified prior to undertaking the maintenance or change activity.	20 hrs
2	**Layer 2 Technologies** LAN switching technologies Layer 2 Multicast Layer 2 WAN circuit technologies Troubleshooting layer 2 technologies	50 Hours
3	**Layer 3 Technologies** - Addressing technologies - Layer 3 Multicast - Fundamental routing concept - RIP v2 - EIGRP [for IPv4 and IPv6] - OSPF [v2 and v3] - BGP - Troubleshooting layer 3 technologies	150 Hours
4	**VPN Technologies** - Tunnelling - Encryption - Troubleshooting VPN technologies	100 Hours

99

5	**Infrastructure Security** - Device security - Network security - Troubleshooting infrastructure security	50 Hours

Total Theory / Lecture Hours:	100
Total Practical / Tutorial Hours:	250
Total Hours:	370

Recommended Hardware:	Routers and Switches of Cisco, Juniper, Nortel or Equivalent, Computers, Projector and Internet.

Recommended Software:	ACIT/ GNS3 Simulators

Text Books:	ACIT E-Learning Workbooks

Reference Books:	Routing and Switching 200-120 Official Cert Guide Library By Wendell Odom

1.10   Medical Electronics

ESDM Courses

Level Code:	L4	Vertical Name:	Service

Course Code:	TL/S/L4/C020	Course Name:	1.10.1 Tele-health technician

Objective of the Course:

- Undertake installation, repair and maintenance of Telecom Equipment and tele-health equipment and peripherals to enable remote consultation, diagnostics and record towards health consultation, emergency and treatment via telecom media – Audio /video / text and telesignals
- Importance of telecom in medical field and its requirement.

Learning Outcomes:

- Qualifier would be able to install, operate, repair and maintain, update tele-health equipment and peripherals
- Able to store and maintain health records and keep back up.
- able to interconnect disparate peripherals to tele health equipment
- able to understand the various formats of signals and facilitate interoperability and integration
- able to facilitate connectivity of device with various telecommunication networks

Expected Job Titles:

Telehealth technician

Telehealth Biomedical Technician

Telehealth Instrumentation Technician

Telehealth administrator

Telehealth co-ordinator

Duration of the Course (in hours)	350 Hours

Minimum Eligibility Criteria and pre-requisites, if any	10th Pass + ITI / Diploma (Electronics, Instrumentation, Biomedical)

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1.	History , Definition and Current Applications • Understanding telecommunication in telehealth • What is Telemedicine and Telehealth? • How is telecommunication related to healthcare sector • Should be able to harness any telecommunications-related connectivity like the Internet, LAN (ISDN,POTS,VSAT) , WAN, WAP, CDMA, GSM ,Smart phones, VPN or even Cloud Computing that will permit the various EMRs of an individual to be integrated into a single lifelong electronic health record	20

	• Video conferencing room requirements	
2.	Tele health peripherals – integration - Examination Cameras Medical Scopes & Camera/ Illumination Systems Stethoscopes Vital Signs Monitors ECGs, Spirometers, and Holters Retinal Camera Ultrasound Probes Pulse Oximeter	40
3.	Telecommunication Technologies in Health care • Types of telecommunication connectivity – Fibre, DTH, Wireless, Wi-fi,Wi-max • Client-Server and Cloud computing communication • Connectivity peripherals – switches, routers, hubs, modems • Measuring Electromagnetic induction (EMI)	20
4.	Clinical Application and Special Setting – Electronic Medical Records (EMR), Health Information System (HIS) , Health Information Exchange (HIE), Integration of Health care Enterprise (IHE), Encounter management software, Computerised Physician Order Entry (CPOE), Computerized Patient Record (CPR):	30
5.	Computerization of Medical Records and E- Health Services - Method of generating computerised medical reports - E health Services - Payment Gateways	10
6.	Telecom equipments – interoperability and integration Interoperability Standards : UHID, HL7, DICOM, SNOMED-CT, RxNORM, CCD, CDA, ICD 10, LOINC, CPT, WHO-ICD-PCS, NIC/ NOC/ NANDA, OPCS4, UK, DSM,CD2,CFR10, Meta-data and data standards for health domain	20

7.	Privacy, Confidentiality, Security, Data Integrity HIPPA , Contraception and Medico Legal Case (MLC),Legal Aspects – PNDT Act	10
8.	Health and Safety - Cardiopulmonary resuscitation (**CPR**)	10
	Theory	160 Hrs
	Practical	190 Hrs
	Total Hours	350 Hrs

Recommended Software:	Web based comprehensive telemedicine solution (such as e-sanjeevani – CDAC), Skype, Viber

Recommended Hardware:	**Essential :** Computer with internet facility with minimum 512 KBPS bandwidth, HD camera, speakers, microphone, Telephone (landline/ mobile) Telehealthequipments and peripherals – Telesthethoscope, teleglucometer,Tele-BP meter,SPO2 meter, Vital Signs Monitors, ECGs, Spirometers, and Holters, probes, Digital slit lamp, medical film scanner. Compliance with interoperability standards – such as HL-7, DICOM **Desirable**: Medical scopes, digital microscope, LIMS, Vital signs monitor, Retinal camera
Text Books:	1. http://mohfw.nic.in/showfile.php?lid=1672 2. http://mohfw.nic.in/WriteReadData/l892s/24539108839988920051EHR%20Standards-v5%20Apr%202013.pdf 3. http://mohfw.nic.in/WriteReadData/l892s/Annexure-V%20Interim%20Measures%20as%20per%20MDDS.pdf