Syllabi of Courses

for

Skill Development in ESDM sector

Under the
"Scheme for Financial assistance to select States/UTs for Skill Development in ESDM sector" (Scheme-1)
and
"Skill Development in ESDM for Digital India" (Scheme-2)

of

Department of Electronics and Information Technology
Ministry of Communications & Information Technology,
Government of India

1 Summary of ESDM Course List from ESSCI/ NIELIT / TSSC

Course Code: **AB/C/DE/FGH I** where
AB: EL/NL/TL (ESSCI/NIELIT/TSSC), **C**: S or M (S-Service, M-Manufacturing), **DE**: Level (e.g. L1/L2/L3...), **FGHI**: Course Number (C001, course no.1...)

S. No	Course Code	Agency	Course	Industry Vertical	Level	Duration (in hour)	Eligibility	Sector
1	EL/S/L2/ C001	ESSCI	DTH Set-top-box Installer and Service Technician	Communications Electronics	L2	200	8th Pass	Service
	TL/S/L2/ C022	TSSC						
2	EL/S/L2/ C002	ESSCI	DAS (Digital Addressable System) Set-top-box Installer and Service Technician	Communications Electronics	L2	200	8th Pass	Service
	TL/S/L2/ C023	TSSC						
3	EL/S/L3/ C003	ESSCI	Field Technician- Air conditioner	Consumer Electronics	L3	350	10th Pass	Service
4	EL/S/L3/ C004	ESSCI	Installation Technician - Computing and Peripherals	IT Hardware	L3	350	10th Pass	Service
	TL/S/L3/ C024	TSSC						
5	EL/S/L4/ C005	ESSCI	Field Engineer - RACW (Refrigerator, AC & Washing Machine)	Consumer Electronics	L4	350	12th Pass/ITI	Service
6	EL/S/L4/ C006	ESSCI	Field Technician – Computing and Peripherals	IT Hardware	L4	350	12th Pass	Service
7	EL/S/L4/ C007	ESSCI	Solar Panel Installation Technician	Solar Electronics	L4	350	12th Pass	Service
	TL/S/L4/ C025	TSSC						
8	EL/S/L4/ C008	ESSCI	Pick and Place Assembly Operator	PCB Assembly	L4	350	12th Pass	Service
	TL/S/L4/ C026	TSSC						
9	EL/S/L5/ C009	ESSCI	Field Technician – Networking and Storage	IT Hardware	L5	400	Diploma	Service
	TL/S/L5/ C027	TSSC						
10	EL/S/L1/ C010	ESSCI	Testing of Emergency Light & Solar Lantern	Photovoltaic Segment (Solar Panel)	L1	200	8th Pass having Knowledge of Basic Science	Service
11	EL/S/L2/ C011	ESSCI	Wireman-Control Panel	Industrial Electronics	L2	200	8th Pass	Service
	TL/S/L2/ C028	TSSC						
12	EL/M/L3/ C012	ESSCI	Through Hole Assembly Operator	PCB Assembly	L3	350	10th + ITI or 12th pass	Manufacturing
	TL/M/L3/ C029	TSSC						
13	EL/M/L3/ C013	ESSCI	Circuit Imaging Operator	PCB Assembly	L3	350	10th pass	Manufacturing
	TL/M/L3/ C030	TSSC						

14	EL/S/L3/ C014	ESSCI	CCTV Installation technician	IT Hardware	L3	350	10th pass	Service
	TL/S/L3/ C031	TSSC						
15	EL/S/L3/ C015	ESSCI	Access Controls Installation Technician	IT hardware	L3	350	10th pass	Service
16	EL/M/L4/ C016	ESSCI	LED Mechanical Assembly Operator	LED Lighting	L4	350	10th + ITI, 12th Pass, Other non-Science graduates	Manufacturing
17	EL/M/L4/ C017	ESSCI	Assembly Operator-RAC(Refrigerator, AC)	Consumer Electronics	L4	350	10th + ITI or 12th pass	Manufacturing
18	EL/M/L4/ C018	ESSCI	Certificate Course in LED Light Mechanical Assembly	LED & Photovoltaic	L4	350	12th Pass	Manufacturing
19	EL/S/L4/ C019	ESSCI	Security System Installer	Electronic Security	L4	350	ITI/ Diploma	Service
20	EL/S/L4/ C020	ESSCI	Tech Support	Solar Electronics	L4	350	ITI/ Diploma /Graduates	Service
21	NL/S/L1/ C001	NIELIT	Installation & Maintenance of Photocopiers and Printers	Office Automation	L1	200	8th Pass/ITI	Service
22	NL/S/L3/ C002	NIELIT	Certificate Course in Electronic Product Testing	Electronic Product Design	L3	360	10th / 12th Pass with Science background	Service
	EL/S/L3/ C021	ESSCI						
	TL/S/L3/ C032	TSSC						
23	NL/S/L3/ C003	NIELIT	Repair & Maintenance of Power Supply, Inverter & UPS	Industrial Electronics	L3	350	10th Pass/ITI	Service
	EL/S/L3/ C022	ESSCI						
	TL/S/L3/ C033	TSSC						
24	NL/S/L3/ C004	NIELIT	Repair & Maintenance of Dental equipment	Medical Electronics	L3	350	10th Pass	Service
25	NL/S/L3/ C005	NIELIT	Repair & Maintenance of Imaging Equipment (X-Ray & Ultrasound machine)	Medical Electronics	L3	350	10th Pass	Service
26	NL/S/L3/ C006	NIELIT	Repair & Maintenance of Electrocardiogram (ECG) and Intensive Coronary Care Unit (ICCU) Equipment	Medical Electronics	L3	350	10th Pass	Service
27	NL/S/L4/ C007	NIELIT	Diploma in Installation & Repair of Consumer Electronics Products	Consumer Electronics	L4	350	ITI or 12th Pass	Service
	EL/S/L4/ C023	ESSCI						
28	NL/S/L5/ C008	NIELIT	Post Diploma in Repair & Maintenance of Hospital Equipment	Medical Electronics	L5	400	Diploma Holder / B.Sc	Service
29	NL/S/L5/ C009	NIELIT	Diploma in Repair & Maintenance of Industrial Instrumentation &Automation System	Industrial Automation	L5	400	ITI / Diploma / BSc	Service
	EL/S/L5/ C024	ESSCI						
30	NL/S/L2/ C010	NIELIT	Assembly & Maintenance of PCs	Computer Hardware	L2	240	Polytechnic Diploma/Graduation/ ITI/12th/10th	Service

31	NL/S/L2/ C011	NIELIT	Installation Repair & Maintenance. Of EPABX System	Telecom Segment	L2	200	9th Pass	Service
	TL/S/L2/ C034	TSSC						
32	NL/M/L4/ C012	NIELIT	Automation Technology-Basic Level	Industrial Automation	L4	For Technical Students : 330 Hrs	Diploma in /Electronics/Instrumentation/ Mechanical/ Electrical – for Technical students. Non Technical Students: 12th pass with science background and affinity towards technical studies	Manufacturing
	EL/M/L4/ C025	ESSCI				Non Technical Students : 390 Hrs		
33	NL/M/L4/ C013	NIELIT	Certificate in Robotic Programming & Maintenance	Industrial Automation	L4	325	12th pass	Manufacturing
	EL/M/L4/ C026	ESSCI						
34	NL/S/L4/ C014	NIELIT	Telecom Technician-PC Hardware and Networking	Office Automation, IT & networking	L4	350	12th Pass	Service
	TL/S/L4/ C035	TSSC						
	EL/S/L4/ C027	ESSCI						
35	NL/M/L4/ C015	NIELIT	Computer Aided Product Design	Electronic Product Design	L4	360	Polytechnic Diploma/ Graduation/ ITI/12th/ 10th	Manufacturing
	TL/M/L4/ C036	TSSC						
	EL/M/L4/ C028	ESSCI						
36	NL/M/ L5/C016	NIELIT	Embedded System Design using 8-Bit Microcontroller	Embedded System & VLSI	L5	400	Diploma	Manufacturing
	TL/M/ L5/C037	TSSC						
	EL/M/ L5/C029	ESSCI						
37	NL/M /L5/C017	NIELIT	Post Diploma in VLSI Design, Tools & Technology	Embedded System & VLSI	L5	400	Diploma Holder or BSc. Graduate	Manufacturing
	EL/M /L5/C030	ESSCI						

38	NL/M/L5/ C018	NIELIT	Automation Technology- Intermediate Level	Industrial Automation	L5	Technical Students –400 Hrs	Diploma in /Electronics /Instrumentation/ Mechanical /Electrical – for Technical students.	Manufacturing
	EL/M/L5/ C031	ESSCI				Non-Technical Students –450 Hrs	Non Technical Students: Diploma	
39	NL/M/L5/ C019	NIELIT	Automation Technology- Advanced Level	Industrial Automation	L5	520	Diploma in Electronics/Instrumentation/ Mechanical/ Electrical / Graduates, with science background and affinity towards technical studies	Manufacturing
	EL/M/L5/ C032	ESSCI						
40	NL/S/L4/ C020	NIELIT	CHM-'O' Level	Office Automation, IT & Networking	L4	400 hrs	12th Pass/ITI/Diploma, graduation or more	Service
41	NL/S/L4/ C021	NIELIT	Installation, Repair and Maintenance of Home Appliances	Consumer Electronics (Home Appliances)	L4	350 Hours	10th + ITI, 12th pass, non-science graduates	Service
	TL/S/L4/ C038	TSSC						
	EL/S/L4/ C033	ESSCI						
42	NL/M/L4/ C022	NIELIT	Solar-LED Lighting Products (Design and Manufacturing)	Solar Electronics	L4	350 hrs	10th + ITI, 12th pass	Manufacturing
	EL/M/L4/ C034	ESSCI						
43	NL/S/L5/ C023	NIELIT	CHM-'A' Level	Office Automation, IT & Networking	L5	470 hrs	Diploma	Service
44	TL/S/L3/ C001	TSSC	Optical Fiber Splicer	Telecom	L3	350	10th Pass	Service
45	TL/S/L4/ C002	TSSC	Tower Technician	Telecom	L4	350	10+2 and/or ITI Diploma in Electrical/ Mechanical including final year candidates	Service
46	TL/S/L4/ C003	TSSC	Handset repair Engineer (Level II)	Telecom	L4	350	10+2 / ITI(including final year candidates)	Service
47	TL/S/L4/ C004	TSSC	Broadband Technician	Telecom	L4	350	10+2	Service
	EL/S/L4/ C035	ESSCI						
48	TL/S/L4/ C005	TSSC	Optical Fiber Technician	Telecom	L4	350	10+2	Service

49	TL/S/L5/ C006	TSSC	Installation Engineer SDH(Synchronous digital hierarchy) & DWDM(Dense wavelength Division Multiplexing)	Telecom	L5	400	Diploma(including final year candidate)	Service
50	TL/S/L5/ C007 EL/S/L5/ C036	TSSC ESSCI	Installation Engineer Networking Layer2 & Layer3	Telecom	L5	400	Diploma(including final year candidate)	Service
51	TL/M/L2/ C008	TSSC	Telecom Test Technician	Telecom Electronics	L2	200	a) ITI - Electronics, Electrical, Instrumentation, b) Diploma – Electronics, Electrical, Instrumentation c) Vocational Education Training (Final year candidate pursuing in ITI/Diploma)	Manufacturing
52	TL/M/L3/ C009 EL/M/L3/ C037	TSSC ESSCI	Board Bring Up Engineer	Telecom Electronics	L3	350	10th,Undergoing ITI, Electronic/ Electrical/ Mechanical(including final year candidates)	Manufacturing
53	TL/M/L4/ C010 EL/M/L4/ C038	TSSC ESSCI	Telecom Embedded Hardware Developer	Telecom Electronics	L4	350	Diploma (including final year candidate)	Manufacturing
54	TL/S/L2/ C011	TSSC	Telecom Installation and repair worker	Passive Infra	L2	200	8th	Service
55	TL/S/L3/ C012	TSSC	Telecom Industry Network Security Technician	Telecom Industry Engineer	L3	350	ITI/ Diploma	Service
56	TL/M/L4/ C013	TSSC	Electrical testing of telecom assemblies	Telecom Manufacturing	L4	350	ITI / Diploma (electronics) or Bsc.(Electronics)	Manufacturing
57	TL/S/L4/ C014 EL/S/L4/ C039	TSSC ESSCI	Grass Root telecom Provider	Network Management	L4	350	10th + ITI, 12th pass	Service
58	TL/M/L4/ C015 EL/M/L4/ C040	TSSC ESSCI	IPC(Institute of Printed Circuits) acceptability criteria of Telecom PCB(Printed Circuit Board) assemblies	Telecom Manufacturing	L4	350	ITI / Diploma (electronics) or Bsc.(Electronics)	Manufacturing
59	TL/M/L4/ C016	TSSC	SMT(Surface Mount Technology) process for telecom boards	Telecom Manufacturing	L4	350	ITI / Diploma (electronics)	Manufacturing

	EL/M/L4/ C041	ESSCI					or Bsc.(Electron ics)	
60	TL/M/L4/ C017	TSSC	Soldering of telecom board assemblies	Telecom Manufacturing	L4	350	ITI / Diploma (electronics) or Bsc.(Electron ics)	Manufacturing
	EL/M/L4/ C042	ESSCI						
61	TL/S/L4/ C018	TSSC	Telecom tower equipment installer and integrator	Passive Infra	L4	350	10+2/ITI	Service
62	TL/S/L4/ C019	TSSC	Telecom industry network specialist	Network Operation & Maint.	L4	370	ITI/ Diploma	Service
63	TL/S/L4/ C020	TSSC	Tele-health Technician	Medical Electronics	L4	350	10th +ITI /Diploma (Electronics, Instrumentati on, Biomedical	Service
64	TL/M/L4/ C021	TSSC	Telecom Quality Technician	Telecom Manufacturing	L4	350	ITI / Diploma (Electrical, electronics, Instrumentati on)	Manufacturing
	EL/M/L4/ C043	ESSCI						
65	TL/M/L5/ C039	TSSC	Line Repair Technician	Telecom Manufacturing	L5	630	12th Pass + Certified in Line Assembler L4 course.	Manufacturing
66	NL/M/L5/ C024	NIELIT	Additive Manufacturing/3 D Printing	Digital Fabrication	L5	400 Hours	Diploma Holder or B Sc Graduate and not less than 18 Years of age	Manufacturing
	EL/M/L5/ C044	ESSCI						
67	NL/M/L5/ C025	NIELIT	3 D Scanning and CNC routing	Digital Fabrication	L5	400 Hours	Diploma Holder or B Sc Graduate and not less than 18 Years of age	Manufacturing
68	EL/S/L4/ C045	ESSCI	Electronic Security System Technician	IT Hardware	L4	350	ITI / 12th Pass	Service
69	EL/S/L4/ C046	ESSCI	Digital Cable TV Technician	Communication Electronics	L4	350	ITI / 12th Pass	Service
Category – Telecom/Mobile Assembly								
70	TL/M/L4/ C040	TSSC	Line Assembler	Telecom Manufacturing	L4	630	12th Pass	Manufacturing
71	EL/M/L4/ C047	ESSCI	Mobile Phone Assembly Operator	Consumer Electronics	L4	350	ITI/ 12th Pass	Manufacturing
Category – Telecom/Mobile Quality Technician/ Inspector								
72		TSSC	Telecom Quality Technician– **Already approved TL/M/L4/C021**	Telecom Manufacturing	L4	350	ITI / Diploma (Electrical, electronics,	Manufacturing

							Instrumentation)	
	EL/M/L5/ C048	ESSCI	Mobile Phone quality Inspector	Consumer Electronics	L5	400	Diploma / Other Graduates	Manufacturing
Category – Mobile Handset Repair Technician/ Engineer								
73		TSSC	Handset repair Engineer (Level II) – **Already approved TL/S/L4/C003**	Telecom	L4	350	10+2 / ITI(including final year candidates)	Service
	EL/S/L4/ C049	ESSCI	Mobile Phone hardware Repair Technician	Consumer Electronics	L4	350	ITI/12th Pass	Service

2 Service Sector

2.1 Consumer Electronics

ESDM Courses

Level Code:	III	**Vertical Name:**	Consumer Electronics

Course Code:	EL/S/L3/C003	**Course Name:**	2.1.1 Field Technician – Air conditioner (ESSCI)

Objective of the Course:

To train the person, who installs the air conditioner and interacts with customers to diagnose the problem and assess possible causes. Once the problem and causes have been identified, the individual rectifies minor problems or replaces faulty modules for failed parts or recommends factory repairs for bigger faults.

Learning Outcomes:

NOS # ELE/N3101 - Engage with customer for service:

1. Interact with the customer prior to visit
2. Interact with customer at their premises
3. Suggest possible solutions to customer
4. Achieve productivity and quality as per company's norms

NOS # ELE/N3108 - Install Air Conditioner

1. Undertake pre-installation site visit
2. Remove packaging and check accessories
3. Place the air conditioner at identified location
4. Check air conditioner's functioning
5. Complete the documentation
6. Interact with supervisor or superior
7. Achieve productivity and quality as per company's norms

NOS # ELE /N3109 - Repair dysfunctional Air conditioner

1. Understand the symptoms in the air-conditioner and identify the fault
2. Replace dysfunctional module in the air conditioner unit
3. Confirm functionality of the repaired unit
4. Achieve productivity and quality as per company's norms

NOS # ELE/N9901 - Interact with colleagues

1. Interact with supervisor or superior
2. Coordinate with colleagues

Expected Job Roles:

Filed Technician – Air Conditioner

Duration of the Course (in hours)	350 hours
Minimum Eligibility Criteria and pre-requisites, if any	10^{th} Passed

Professional Knowledge:

NOS # ELE/N3101 - Engage with customer for service:

KB1. company's products and recurring problems reported in consumer appliances
KB2. how to communicate with customers in order to put them at ease
KB3. basic electrical and mechanical modules of various appliances
KB4. electronics involved in the type of appliance

Knowledge of the company / organization and its processes

NOS # ELE/N3102 - Install the Air Conditioner

KB1. Installation-site requirements (structural requirements, ventilation, etc.)
KB2. Different types of air conditioners such as window, split, cassette etc.
KB3. different features and functionalities of various models
KB4. safety precautions to be taken while installing

NOS # ELE/N3103 - Repair dysfunctional Air Conditioner

KB1. different types of air conditioners, e.g., window, split air, cassette conditioners and differences in their operation
KB2. features of different air conditioners of the company

KB3. functioning of the appliance and its various modules
KB4. method of air conditioning, its use and functioning of sealed system
KB5. Basics of types of refrigerants such as R12, R22, R134a, R290, R600a, R410, R32 use of different brazing sticks, types of brazing torches and their application
KB6. types of brazing torches, types of fluxes and their application
KB7. basic electronics (knowledge of components such as diode, transformer, LED, photo transistor, capacitor, resistor, inductor, thermisters)
KB8. functioning of various electromechanical parts of the air conditioner

Professional Skill:

1. **Interpersonal skills**
2. **Communication skills**
3. **Behavioural skills**
4. **Reading, writing and computer skills**
5. **Teamwork and multitasking**
6. **Documentation Skills**
7. **Reflective thinking**
8. **Critical Thinking**
9. **Decision Making**

Core Skill:

1. **Air conditioner operation**
2. **Using tools and machines**
3. **Fault diagnosis skills**

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
	As per the NOSs listed in the Qualification pack	
	Total Theory / Lecture Hours:	150
	Total Practical / Tutorial Hours:	200
	Total Hours:	350

Recommended Hardware:

1. Different type of Air conditioner
2. Multi-meter & Oscilloscope
3. Electrical Drill
4. Clamp meter, tube cutter, tube bender, vacuum pump, weigh scale, gas cylinder, temperature meter, pressure gauges

Recommended Software:	NA
Text Books:	NA
Reference Books:	NA

ESDM Courses

Level Code:	IV	**Vertical Name:**	Consumer Electronics

Course Code:	EL/S/L4/C005	**Course Name:**	2.1.2 Field Engineer – RACW (Refrigerator, AC & Washing Machine) (ESSCI)

Objective of the Course:

To train the person, who interacts with customers to install the appliance and diagnose the problem to assess possible causes of malfunction. Once the problem and causes have been identified, the individual rectifies minor problems or replaces faulty modules for failed parts or recommends factory repairs for bigger faults.

Learning Outcomes:

NOS # ELE/N3101 - Engage with customer for service:

1. Interact with the customer prior to visit
2. Interact with customer at their premises
3. Suggest possible solutions to customer
4. Achieve productivity and quality as per company's norms

NOS # ELE/N3112 - Install newly purchased refrigerator

1. Remove packaging and check accessories
2. Place the appliance to appropriate location
3. Check refrigerator's functioning
4. Complete documentation
5. Interact with superior
6. Interact with and train service technicians
7. Achieve productivity and quality as per company's standards

NOS # ELE /N3113 - Attend to service complaints - refrigerator

1. Understand the symptoms and identify the fault
2. Replace dysfunctional module in the refrigerator unit
3. Confirm functionality of the repaired unit
4. Achieve productivity and quality as per company's standards

5. Interact with and train technicians

NOS # ELE /N3114 - Install newly purchased air conditioner

1. Undertake pre-installation site visit
2. Remove packaging and check accessories
3. Place the air conditioner at identified location
4. Check air conditioner's functioning
5. Complete the documentation
6. Interact with supervisor or superior
7. Interact with and train service technicians
8. Achieve productivity and quality as per company's norms

NOS # ELE /N3115 - Attend to service complaints – Air Conditioner

1. Understand the symptoms in the air-conditioner and identify the fault
2. Replace dysfunctional module in the air conditioner unit
3. Confirm functionality of the repaired unit
4. Interact with and train service technicians
5. Achieve productivity and quality as per company's norms

NOS # ELE /N3116 - Install newly purchased washing machine

1. Remove packaging and check accessories
2. Place the washing machine at appropriate location
3. Check washing machine's functioning
4. Complete documentation
5. Interact with superior
6. Interact with and train service technicians
7. Achieve productivity and quality as per company's standards

NOS # ELE /N3117 - Attend to service complaints –washing machine

1. Understand the symptoms and identify the fault
2. Repair the washing machine
3. Confirm functionality of the repaired unit

4. Achieve target as per company's policy
5. Interact with and train service technicians

NOS # ELE/N9901 - Interact with colleagues

1. Interact with supervisor or superior
2. Coordinate with colleagues

Expected Job Roles:

Filed Engineer - RACW

Duration of the Course (in hours)	350 hours
Minimum Eligibility Criteria and pre-requisites, if any	12th Pass/ITI

Professional Knowledge:

NOS # ELE/N3101 - Engage with customer for service:

KB1. company's products and recurring problems reported in consumer appliances
KB2. how to communicate with customers in order to put them at ease
KB3. basic electrical and mechanical modules of various appliances
KB4. electronics involved in the type of appliance

Knowledge of the company / organization and its processes

NOS # ELE/ NOS # ELE/N3112 - Install newly purchased refrigerator:

KB1. Installation site requirements (structural requirements, ventilation, etc.)
KB2. different types of refrigerators such as traditional, frost-free, Peltier
KB3. different features and functionalities of various models
KB4. safety precautions to be taken while installing
KB5. manual-based procedure of installing the refrigerators
KB6. packaging waste disposal procedures
KB7. use of test equipment and tools such as multi-meter, oscilloscope
KB8. other products of the company

NOS # ELE /N3113 - Attend to service complaints - refrigerator

KB1. different types of refrigerators, e.g., frost free, direct cool and peltier refrigerators and differences in their

operation
KB2. features of different refrigerators of the company
KB3. refrigeration cycle and functioning of the appliance and its various modules
KB4. method of refrigeration, its use and functioning of refrigerator sealed system
KB5. types of refrigerants such as R12, R22, R134a, R290, R600a, R410, R32 use of different brazing sticks, types of brazing torches and their application
KB6. types of brazing torches, types of fluxes and their application
KB7. basic electronics (knowledge of components such as diode, transformer, LED, photo transistor, capacitor, resistor, inductor, thermistor, ICs
KB8. functioning of various electromechanical parts of the refrigerator
KB9. fundamentals of electricity such as ohms law, difference between ac and dc, calculation of energy consumption of appliances, understanding of domestic wiring, understanding of series and parallel connections

NOS # ELE /N3114 - Install newly purchased air conditioner

KB1. Installation site requirements (structural requirements, ventilation, etc.)
KB2. different types of air conditioners such as window, split, cassette etc.
KB3. different features and functionalities of various models
KB4. safety precautions to be taken while installing
KB5. manual-based procedure of installing the air conditioner

NOS # ELE /N3115 - Attend to service complaints – Air Conditioner

KB20. Basics of types of refrigerants such as R12, R22, R134a, R290, R600a, R410, R32 use of different brazing sticks, types of brazing torches and their application
KB21. types of brazing torches, types of fluxes and their application
KB22. basic electronics (knowledge of components such as diode, transformer, LED, transistor, capacitor, resistor, inductor, thermistor, ICs
KB23. functioning of various electromechanical parts of the air conditioner
KB24. fundamentals of electricity such as ohms law, difference between ac and dc, calculation of energy consumption of appliances, understanding of domestic wiring, understanding of series and parallel connections
KB25. troubleshooting knowledge with respect to air conditioners
KB26. hazards, their causes and prevention/personal safety
KB27. frequently occurring faults such as poor/no cooling, noisy unit, condensation water over flowing
KB28. components/modules of the air conditioner and their prices
KB29. energy ratings such BEE rating and concepts of e waste

NOS # ELE /N3116 - Install newly purchased washing machine

KB1. installation-site requirements (structural and plumbing requirements)
KB2. different types of washing machines such as front load and top load
KB3. different features and functionalities of various models
KB4. safety precautions to be taken while installing
KB5. manual-based procedure of installing the washing machine

NOS # ELE /N3117 - Attend to service complaints –washing machine

KB7. troubleshooting knowledge with respect to washing machine
KB8. types of switches such as thermal, mechanical, electronic, magnetic, electromagnetic, electromechanical, pressure optical and bimetal
KB9. fundamentals of motors, types of motors and their working methods
KB10. functioning of components and parts such as solenoids and plungers

Professional Skill:

1. **Interpersonal skills**
2. **Communication skills**
3. **Behavioural skills**
4. **Reading, writing and computer skills**
5. **Teamwork and multitasking**
6. **Documentation Skills**
7. **Reflective thinking**
8. **Critical Thinking**
9. **Decision Making**

Core Skill:

1. **Refrigerator operation**
2. **Air conditioner operation**
3. **Using tools and machines**
4. **Fault diagnosis skills**

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
	As per the NOSs listed in the Qualification pack	
	Total Theory / Lecture Hours:	150
	Total Practical / Tutorial Hours:	200
	Total Hours:	350

Recommended Hardware:

1. Different type of Air conditioner
2. Different types of Refrigerator
3. Different types of Washing machine
4. Multi-meter & Oscilloscope
5. Electrical Drill
6. Clamp meter, tube cutter, tube bender, vacuum pump, weigh scale, gas cylinder, temperature meter, pressure gauges

Recommended Software:	NA
Text Books:	NA
Reference Books:	NA

ESDM Courses

Level Code:	L4	**Vertical Name:**	Consumer Electronics
Course ID:	**NL/S/L4/C007** **EL/S/L4/C023**	**Course Name:**	2.1.3 Diploma in Installation & Repair of Consumer Electronics Products (NIELIT/ESSCI)

Objective of the Course:

Objective of this course is to give knowledge and competencies regarding Installation, Servicing, Repair, Fault Diagnosis and Error Remover for Consumer Electronics Product like LCD-LED TV and Monitor, Cable TV and DTH Services, Induction Stove etc.

Learning Outcomes:

After successful competition of this course, participant will be acquainted with the necessary Hardware and Software skills for Installation, Repair, Maintenance and Trouble shooting of Consumer Electronics Product. Participants will be a "Ready to Observe" product for Consumer Electronics Product manufacturing sector or may be self-employed.

Expected Job Roles:

Participants Job Role includes

- Support Technician for Multi-National and National Desktop PCs Manufacturers
- Can Work In Call Centre for After Sale Support
- can be also absorbed in Local Markets
- Can start their own Small Scale business and can be self employed

Duration of the Course (in hours)	350 Hours
Minimum Eligibility Criteria and pre-requisites, if any	ITI or 12th pass

Professional Knowledge:

The individual on the job needs to know and understand:

PK1. Knowledge of spare management and repair & return process for faulty components
PK2. Protection equipment (anti-static wrist bands, shoes, dress, packaging, and other appropriate insulations) that are required to be used
PK3. First aid requirements in case of electrical shocks, cuts and other common injuries
PK4. Functionality and features/working of Consumer Electronics Products
PK5. Consumer Electronics Products specific Console Control and user interface
PK5. Functionality of hardware components of Consumer Electronics Products
PK6. Procedure to dismantle and assemble Consumer Electronics Products
PK7. Range of tools and testing equipment (multi meters, frequency generators etc) available and their functionality
PK8. ESD hazards and their effect on electronic components
PK9. Standard fault-finding (troubleshooting) techniques
PK10. Basic computer knowledge to be able to run diagnostic tools
PK11. Functionality of hardware components, software applications, screen, touchpad etc.
PK12. Consumer Electronics Products software related problems and their possible solutions
PK13. Standard repairing process

Professional Skill:

The individual on the job needs to know and understand:

Consumer Electronics Product Equipment operating Skills
PS1. Use and access all features and applications Consumer Electronics Product
PS2. Operate Consumer Electronics Product testing equipment's
PS3. Connect Consumer Electronics Product's PCB to PC/test equipment for diagnostics
Consumer Electronics Product repairing skills
PS4. Undertake fault diagnostic
PS5. Interpret test results to identify and localize faults
PS6. Utilize appropriate mechanisms and tools to rectify the faults
PS7. Utilize appropriate communication channels to escalate unresolved problems
PS8. Test Consumer Electronics Product to confirm and resolve of the reported fault
PS9. Undertake corrective repairs by software porting/updates
PS10. Undertake checks to confirm that the problem is resolved
Consumer Electronics Product Component Handling skills
PS11. Safely dismantle/assemble Consumer Electronics Product using the right tools
PS12. Safe remove/replace components using right tools
PS13. Compliance to ESD protection measures
Consumer Electronics Product Software Skills
PS14. Identifying correct software version/modules
PS15. Ascertain correct and complete porting/update of software in the Consumer Electronics Product
Consumer Electronics Product Troubleshooting Skills
PS16. How to approach a defect
PS17. Make use of standard OEM specified troubleshooting steps
PS18. Interpret intermediate results and progress fault rectification accordingly

Core Skill:

The individual on the job needs to know and understand how to:

	Reading skills
CS1.	Read and understand technical manuals, work orders and reports
CS2.	Read and understand Consumer Electronics Product safety instructions
	Writing Skills
CS3.	Fill up record sheets clearly, concisely and accurately as per company procedures
	Communication Skills
CS4.	Clearly communicate relevant information to supervisors
CS5.	Respond appropriately to queries
CS6.	**Time Management Skills**
CS7.	Prioritize and execute tasks in a high-pressure environment
CS8.	Use and maintain resources efficiently and effectively
	Analytical Skills
CS9.	Analyse (and understand) Manufacturing Process based on Company need
CS10.	Interpret reports, readings and numerical data
CS11.	Keep up to date with new technology and performance issues
	Other Skills
CS12.	Create and maintain effective working relationships and team environment through collaboration
CS13.	Take initiatives and progressively assume increased responsibilities
CS14	Share knowledge with other team members and colleagues

Detailed Syllabus of Course

Module. No	Modules	Minimum No. of Hours (Theory/Practical)
1.	**LCD-LED TV and Monitor: -** Basic Principle, Working and Operation of LCD-LED TV and Monitor, Installation, Repair Maintenance and Serving and Practice, Fault Diagnosis and Error Remover Techniques and Practices	25/80
2.	**Cable TV and DTH Services: -** Basic Principle, Working and Operation of Cable TV and DTH Services, Installation and Checking, Repair Maintenance, Serving and Practice, Fault Diagnosis and Error Remover Techniques and Practices.	25/70
3.	**VCD-DVD Player and Home Theatre System: -** Basic Principle, Working and Operation of VCD-DVD Player and Home Theatre System, Installation, Repair, Maintenance, Serving and Practice, Fault Diagnosis and Error Remover Techniques and Practices.	25/50
4.	**FM Radio- Cordless Phone-Hair Dryer: -** Basic Principle, Working and Operation of FM Radio- Cordless Phone-Hair Dryer, Installation, Repair, Maintenance, Serving and Practice, Fault Diagnosis and Error Remover Techniques and Practices.	10/25
5.	**Induction Stove and Microwave Oven: -** Basic Principle, Working and Operation of Induction Stove and Microwave Oven, Installation, Repair, Maintenance, Serving and Practice, Fault Diagnosis and Error Remover Techniques and Practices.	15/25
	Total Theory / Lecture Hours:	100
	Total Practical / Tutorial Hours:	250
	Total Hours:	350

Recommended Hardware:

For a Batch of 50 No's

- Trainer Kits of all Consumer Product as mentioned in Detail Syllabus of Course Content: 10 No's Each

	• For those Consumer Electronics Product whose Trainer Kits are not Available product will be purchased and dismantle by Trainer for individual Practice: 10 No's each. • Complete Electronics-Electrical Tool Kit: 10 No's Each
Recommended Software:	As prescribed and provided by Consumer Electronics Product Manufacturer. No need to purchase externally and can be downloaded from respective manufacturer web sites
Text Books:	BPB Publication Books on Installation Repair, Maintenance and Servicing of Consumer Electronic Products in Hindi
Reference Books:	User Manual as provided by Consumer Electronics Product Manufacturer.

ESDM Courses

Level Code:	L4	**Vertical Name:**	Consumer Electronics (Home Appliances)
Course Code:	NL/S/L4/C021 TL/S/L4/C038 EL/S/L4/C033	**Course Name:**	2.1.4 Installation, Repair and Maintenance of Home Appliances (NIELIT/TSSC/ESSCI)

Objective of the Course:

The module has been designed to provide an understanding of the basics of Electrical and Electronic with an introduction to various electronic active & passive components and test equipments. The participants would be acquainted with the Electrical Hazards along with work place safety instructions and precautions that need to be taken while handling the Electrical and Electronic equipment and appliances. It covers the basic know how required for *Installation, Repair and Maintenance of Washing Machine, Microwave Oven, Juicer-Mixer-Grinder & Water purifier*. In addition, the participants would get the knowledge about Soldering & De-soldering technique.

Learning Outcomes:

Students shall be able to

- Install the washing machine, Microwave Oven, Juicer-Mixer-Grinder and Water Purifier
- Diagnose faults in the Washing Machine, Microwave Oven, Juicer-Mixer-Grinder & Water purifier.
- Carry out fault rectification
- Interact with the customer, management effectively
- Be able to log call reporting

Expected Job Roles:

The pass out would be competent to:

- Understand the basic terminology and handling of tools and instruments.
- Learn to have effective interaction with customer for Servicing, Installation and Troubleshooting of Washing Machine, Microwave Oven, Juicer-Mixer-Grinder & Water purifier in addition to the product operating guidelines for customer.
- Able to take decision to go for repair work by different case analysis and discussion with colleague.
- Understand the type, model, rating and accessories of Washing Machines, Microwave Oven, Juicer-Mixer-Grinder & Water purifier.
- Installation, fault identification and servicing of Washing Machines, Microwave Oven, Juicer-Mixer-Grinder & Water purifier

Duration of the Course (in hours)	350 Hours

Minimum Eligibility Criteria and pre-requisites, if any	10^{th} + ITI, 12^{th} pass, non-science graduates.

Professional Knowledge:

The individual on the job needs to know and understand:

PK1. Knowledge of Electronic and Electrical Components
PK2. Resistors, Capacitors and Inductors, their identification, types and application
PK3. Protection equipment (anti-static wrist bands, shoes, dress, packaging, and other appropriate insulations) that are required to be used
PK4. First aid requirements in case of electrical shocks, cuts and other common injuries
PK5. Soldering and De-Soldering Techniques
PK5. Basic functionality/working of washing machine/ microwave oven/juicer-mixer-grinder, water purifier.
PK6. Installation/Handling instruction of these devices.
PK7. Fault identification, repair and maintenance of washing machine/ microwave oven/juicer-mixer-grinder, water purifier.
PK8. Component testing methods
PK9. Troubleshooting through circuit diagram
PK10. Removal and Replacement of faulty Component

Professional Skill:

The individual on the job needs to know and understand:

	Electrical and Electronic Component Identification and Use Skills
PS1.	Understand use of Electrical Component such as cable, switches, transformers, etc.
	Understand use of Electronics Component such as Diodes, Transistors, ICs etc.
PS2.	Use of Test and Measurement Equipment
PS3.	**Soldering skills**
	Understand Soldering Requirements
PS4.	Operation of Equipment required for Soldering
PS5.	Use of Desoldering Pump
PS6.	**Basic functionality and Installation**
	washing machine, Microwave oven, Juicer-Mixer-Grinder, Water Purifier
PS7.	**Fault identification, Repair and Maintenance**
	washing machine, Microwave oven, Juicer-Mixer-Grinder, Water Purifier
PS8.	**Troubleshooting Skills**
	How to approach a defect
PS9.	Make use of standard OEM specified troubleshooting steps
PS10.	Interpret intermediate results and progress fault rectification accordingly
PS11.	Utilize appropriate tools to rectify faults
PS12.	

Core Skill:

The individual on the job needs to know and understand how to:

	Reading skills
CS1.	Read and understand technical manuals, work orders and reports
CS2.	Read and understand organizational health and safety instructions
	Writing Skills
CS3.	Fill up record sheets clearly, concisely and accurately as per company procedures
	Communication Skills
CS4.	Clearly communicate relevant information to supervisors
CS5.	Respond appropriately to queries
CS6.	Communicate with customer/customer facing teams to understand handset performance issues
CS7.	Communicate in the local language
CS8.	Convey proposed solution to the customers
	Time Management Skills
CS9.	Prioritize and execute tasks in a high-pressure environment
CS10.	Use and maintain resources efficiently and effectively
	Analytical Skills
CS11.	Analyse (and understand) customer complaints
CS12.	Interpret reports, readings and numerical data
CS13.	Keep up to date with new technology and performance issues
	Other Skills
CS14.	Create and maintain effective working relationships and team environment through collaboration
CS15.	Take initiatives and progressively assume increased responsibilities
CS16.	Share knowledge with other team members and colleagues

Detailed Syllabus of Course

Sl. No.	Modules	Min: No. of Hours Theory/ Practical
1.	**Introduction to Electricity** • Electric Charge, Voltage, Electric Current • Ohm's Law, Electric Potential, Cell • Serial and Parallel Circuit, their effect on Voltage and Current • Transformer, Use and Operation	5 / 5
2.	**Electronic and Electrical components** • Active and Passive Components • Resistors, Capacitors and Inductors, their identification, types and application • Semiconducting Devices: Diodes, its type, characteristics and applications • Transistors, Integrated Circuits • Study of a transistor, use of a transistor as an amplifier and as a switch. • Analog ICs, 555 timer, IC741, characteristics of 741 • Digital ICs, ICs for logic gates, Truth table verification of logic gates • Connectors • Fuse, types, Use of Fuses and its rating • Relays and Switches • Panel Components • Digital electronics – gates and its application, multiplexers, de-multiplexers, counter	15 / 15
3.	**Soldering/ de- soldering techniques** • Soldering Iron, Soldering wire, Soldering Flux, Soldering method, Zero defect soldering • Desoldering pump, Temperature controlled soldering station, • Hands-on-practices of Soldering	10 / 10
4.	**Tools and equipment use for Repairing and maintenance of Electrical Equipment** • Screw Driver Set • Tweezers, Different Types of Tweezers, Nose Pliers, Wire Cutter • Hot air gun • Liquid solder pest, Magnifying Lamp and Measuring Tools • Brush, CRO, Nipper • Test and Measurement Equipment, Multimeter Operation etc.	10 / 10
5.	**Basic functionality and Installation of washing machine** • Different type of washing machines & working principle, • Basic hand wash process, Different types of technologies being used in Washing machines – Pulsator, Agitator, Agipellar, Tumble wash, • Main parts of washing machines and their functionalities etc. • Opening the packed Washing machine, Selection of the suitable place for	15/20

	washing machine, • Installation of washing machine, • Demonstration of various functionality of washing machine	
6.	**Fault identification, Repair and Maintenance of Washing machine** • Testing & identification of the faulty block on the basis of symptom, rectifying common faults by replacing the damage components, • Testing of the damage block after repair, • Step by step re-assembly of the washing machine panel.	15/20
7.	**Basic functionality and Installation of Microwave oven** • Basic working principle of circuit and block description of Microwave Oven • identification of parts and their working • MWO heating/cooking, MWO safe utensils, Tips & Safety precautions for MW • Opening the packaged Microwave Oven • Selection of the electric power socket • switch rating and place for microwave oven installation • Install the microwave oven with the help of step by step instruction. • Demonstration of various functionality of Microwave Oven.	10/15
8.	**Fault identification, Repair and Maintenance of Microwave oven** • Identify the problem based on customer's information, possible solutions and repair costs involved, • Common occurring faults with the Microwave Oven their identification and repair. • Maintenance of Microwave Oven.	10/20
9.	**Basic functionality and Installation of Mixer/Juicer/Grinder** • Working principle of mixer/juicer/grinder, • Identification of various parts and their functionalities. • functioning of motor and circuit breaker, • Opening the packaged Mixer/Juicer/Grinder, assembly of component, • Selection of the power socket, switch rating and place for installation, • Steps to Install the Mixer/Juicer/Grinder. Demonstration of various functionalities of Mixer/Juicer/Grinder	10/15
10.	**Fault identification, Repair and Maintenance of Mixer/Juicer/Grinder** • Common occurring faults, identification and repair, • maintenance of Mixer/Juicer/Grinder	10/20
11.	**Basic functionality and Installation of Water purifier** • Working principle /functionality of different types of water purifiers, part identification and their working, • unpacking of Water purifier, Selection of the place for installation, • Steps to Install the water purifier.	10/15
12.	**Fault identification, Repair and Maintenance of Water purifier** •	10/15

	dentification of problem, possible causes and solution • eplacement of parts • Water Filter Maintenance	
13.	**Safety and Security Procedures** • Reporting incidents, system failures, power failures etc., protection equipment • First aid requirement in case of electrical shocks and other injuries	5 / 5
14.	**Reading, Writing and Communication Skills** • Understanding Technical Manuals, Reports, Work orders etc. • Understanding Organizational health and safety instructions • Types of documentation in organization, their importance, Company guidelines and norms, activities after maintenance process • Spare management, Service Level Agreements (SLAs) • Fill-up forms, record sheets, log book etc. as per company procedures • Customer Communication, Convey proposed solution to the customer, responding queries • Communication with supervisor, Report for unresolved problems • Time Management and Team Skills	15 /15

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

Recommended Hardware:

- Semi-Automatic Washing Machine
- Microwave Oven
- Juicer-Mixer-Grinder& Water Purifier
- Multimeter, Soldering Iron, screw driver set, Wire cutter & plier etc

Recommended Software:

NIL

Text Books:

Course Material Prepared by NIELIT, Chandigarh

Modern Washing Machine Servicing by Lotia(Author) BPB (Publisher)

Reference Books:

Level Code:	L4	Vertical Name:	Consumer Electronics

Course Code:	EL/S/L4/C049	Course Name:	2.1.5 Mobile Phone hardware Repair Technician (ESSCI)

Objective of the Course:

Mobile Phone Hardware Repair Technician: The Smartphone Repair Technician diagnoses problems and repairs the faulty module of the smartphone.

Brief Job Description: The individual at work is responsible for rectifying faults in the smartphone brought in by the customer. The individual receives the faulty smartphone, diagnoses the problems, performs front end or hardware level repair as required, resolves software issues and ensures effective functioning before delivering back to customer.

Personal Attributes: The job requires the individual to have: attention to details, patience, ability to listen, steady hands, logical thinking and customer orientation. The individual must work on desk with different types of equipment.

Learning Outcomes:

NOS # ELE/N8106 Interact with customer and perform front end repair

1. Engage with the customer
2. Understand the complaint
3. Check for terms and conditions of using system
4. Perform front end repair
5. Interact with supervisor or superior and achieve targets

NOS # ELE/N8107 Repair and rectify the faults in smartphone

1. Follow standard repair procedures and avoid damage
2. Diagnose the problem in the smartphone
3. Decide on the type of repairs to be performed
4. Assemble or disassemble the smartphone as per repair required
5. Replace or repair the faulty module
6. Fix the software malfunction
7. Document the repair process
8. Seek assistance from superior as necessary
9. Report and document work status and achieve productivity target

NOS # ELE/N9951 Interact with other employees

10. 1 Interact with supervisor or superior
11. 2 Coordinate with colleagues

NOS # ELE/N9910 Maintain safe and secure work environment

1. Follow standard safety procedures while handling an equipment
2. Participate in company's safety drills and workshops

Expected Job Roles:

Mobile Phone Hardware Repair Technician

Duration of the Course (in hours)	350 Hrs.
Minimum Eligibility Criteria and pre-requisites, if any	ITI/12th Pass

Professional Knowledge:

NOS # ELE/N5901 Check site conditions, collect tools and raw materials

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. company's sales and after sales support policy
KA3. importance of the individual's role in the workflow
KA4. reporting structure
KA5. company's policy on product's warranty and other terms and conditions
KA6. company's line of business and product portfolio
KA7. company's service level agreement (SLA) with the brand

KB1. basic electronics involved in the hardware
KB2. operate various models of smartphone
KB3. features of smartphone and their purpose
KB4. different types of smartphone and their model specifications
KB5. how to document the spares movement note and capture all the action performed
KB6. different accessories available for smartphones and their purpose
KB7. software and applications related to smartphone
KB8. procedures of replacing accessories such as battery, SD card
KB9. software and applications available in the smartphone market ,their usage and purpose
KB10. licensed and authorised software compatable for smartphones and the downloading procedure
KB11. specifications of accessories such as chargers, battery
KB12. service level agreement with the brand on parameters such as turn around time (TAT), repair procedure, warranty
KB13. company's ERP system and operational procedure
KB14. safety rules, policies and procedures
KB15. quality standards to be followed

NOS # ELE/N8107 Repair and rectify the faults in smartphone

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. company's after sales support policy
KA3. importance of the individual's role in the workflow
KA4. reporting structure
KA5. company's policy on product's warranty and other terms and conditions
KA6. company's line of business and product portfolio
KA7. company's repair and stores policy
KA8. documentation procedure followed in the company
KA9. company's policy on repair time, turnaround time, production targets, working hours

KB1. basic electronics involved in the hardware
KB2. operations of different models of smartphone
KB3. features of smartphone and their purpose
KB4. different types of smartphone and their model specifications
KB5. new product specifications and their spares and repair details
KB6. how to document the spares movement note and capture activity performed
KB7. software and applications related to smartphone
KB8. assembling and disassembling smartphone

KB9. handling procedure of display systems in smartphone (LCD and LED)
KB10. frequently encountered problems in smartphone and their repair procedures
KB11. terminologies and procedures mentioned in repair manual
KB12. softwares and operating system related to smartphone
KB13. applications including games that can be installed in smartphone and the authentic source to download them
KB14. licensed versions of software and application, its terms and conditions associated with it
KB15. different types of soldering techniques such as surface mount, through hole
KB16. basic electronic repairing and reworking such as desoldering, soldering, removal and fixing components
KB17. usage of tools such as electric screwdrivers, multimeter, soldering station, hot air blower, BGA workstation
KB18. estimate cost of repair and verify Beyond Economic Repair (BER) value
KB19. service level agreement (SLA) and conditions associated with it
KB20. Electrostatic Discharge (ESD), its purpose and precautionary measures to be taken
KB21. process system such as 5S
KB22. documentation procedure to record customer, smartphone and repair details
KB23. check and test various electronic components on their functionality
KB24. quality standards to be followed
KB25. implementation process for Engineering Change Order (ECO)

ELE/N9952 Coordinate with colleagues at work

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. importance of the individual's role in the workflow
KA3. reporting structure

KB1. how to communicate effectively
KB2. how to build team coordination

ELE/N9953 Ensure safety at workplace

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. company occupational safety and health policy followed
KA3. company emergency evacuation procedure
KA4. company's medical policy

KB1. how to maintain the work area safe and secure
KB2. how to handle hazardous material
KB3. how to operate hazardous tools and equipment
KB4. emergency procedures to be followed such as fire accidents, etc.

Professional Skill:

i. **Interpersonal skills**
ii. **Behavioural skills**
iii. **Reflective thinking**
iv. Critical Thinking
v. **Decision Making**
vi. **Using tools and machines**

Core Skill:

1. Using tools and machines
2. Reading, writing and computer skills
3. Teamwork and multitasking
4. Communication skills

Detailed Syllabus of Course

S.No.	Module. Name	Duration
1	• Interact with customer and perform front end repair	
2	• Repair and rectify the faults in smartphone	
3	• Interact with other employees	
4	• Maintain safe and secure work environment	
	Total Theory/Lecture	150 Hrs
	Total Practical / Tutorial Hours:	200 Hrs
	Total Hours:	350 Hrs

Recommended Hardware:

Recommended Software:

Text Books:

Reference Books:

ESDM Courses

Level Code:	II	**Vertical Name:**	Communications Electronics

Course Code:	EL/S/L2/C001 TL/S/L2/C022	**Course Name:**	2.2.1 DTH Set-top-box Installer and Service Technician (ESSCI/TSSC)

Objective of the Course:

To train the person who installs the set-top box at customer's premises; addresses the field serviceable complaints and coordinates with the technical team for activation of new connections

Learning Outcomes:

NOS # ELE/N8105 - Install and repair DTH set-top box

1. Collect the customer's site details and carry necessary equipment and products
2. Install the set top box (DTH) at customer's site
3. Provide field service and resolve faults in case of complaint
4. Collect documents and forms filled by customer as per company's policy
5. Achieve productivity and quality targets as prescribed by company

NOS # ELE/N8102 - Comprehend customer's requirement

1. Interact with the customer prior to visit
2. Interact with customer at their premises
3. Suggest possible solutions to customer
4. Achieve productivity and quality as per company's norms

NOS # ELE/N9951 - Interact with other employees

1. Interact with supervisor or superior
2. Coordinate with colleagues

Expected Job Roles:

DTH Setp-top Box Installer and Service Technician

Duration of the Course (in hours)	200 hours

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

Professional Knowledge:

NOS # ELE/N8101 - Install and repair DTH set-top box

KB1. basics of Geo stationery satellite and Other Communication Satellite
KB2. azimuth, elevation and polarisation
KB3. spectrum utilization
KB4. optimum signal strength/ signal quality for good reception
KB5. basics of input/output functions and block diagram of the set top box
KB6. functions of the set top box and remote control
KB7. structure of cable, parameters and the implications on signal
KB8. basic functioning of tuners
KB9. functioning of Low Noise Block Down Convertor (LNBC)
KB10. basics of digital signals and difference in analogue and digital
KB11. transmission of television signals and functioning of television sets
KB12. specifications of different kind of inputs available on TV sets such as RF, AV, RGB, VGA, USB and HDMI
KB13. digital signal processing chain including CAS and SMS

NOS # ELE/N8102 - Comprehend customer's requirement

KA1. company's policies on: customer care
KA2. company's code of conduct
KA3. organisation culture and typical customer profile
KA4. company's reporting structure
KA5. company's documentation policy

KB1. company's products and recurring problems reported in consumer appliances
KB2. how to communicate with customers in order to put them at ease
KB3. basic electrical and mechanical modules of various products
KB4. electronics involved in the type of product
KB5. models of different appliances and their common and distinguishing features
KB6. etiquette to be followed at customer's premises
KB7. precautions to be taken while handling field calls and dealing with customers
KB8. relevant reference sheets, manuals and documents to carry in the field

NOS # ELE/N9951 - Interact with other employees

KB1. how to communicate effectively
KB2. how to build team coordination

Professional Skill:

i. **Interpersonal skills**
ii. **Communication skills**
iii. **Behavioural skills**
iv. **Reading, writing and computer skills**
v. **Teamwork and multitasking**
vi. Documentation Skills
vii. **Reflective thinking**
viii. Critical Thinking
ix. **Decision Making**

Core Skill:

1. **Installation and Repair Skills**
2. **Using tools and machines**

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
	As per the NOSs listed in the Qualification pack	
	Total Theory / Lecture Hours:	80
	Total Practical / Tutorial Hours:	120
	Total Hours:	200

Recommended Hardware:

1. Set top box
2. Dish
3. Television
4. Drilling machine, satellite meter, multi-meter, Angle meter
5. Lead tester, spanner, cutter
6. RF strength meter, QAM meter

Recommended Software:	NA
Text Books:	NA
Reference Books:	NA

ESDM Courses

Level Code:	II	**Vertical Name:**	Communication Electronics

Course Code:	EL/S/L2/C002 TL/S/L2/C023	**Course Name:**	2.2.2 DAS Set-top-box Installer and Service Technician (ESSCI/TSSC)

Objective of the Course:

To train the person who installs the set-top box at customer's premises; addresses the field serviceable complaints and coordinates with the technical team for activation of new connections

Learning Outcomes:

NOS # ELE/N8101 - Install and repair DAS set-top box

1. Collect the customer's site details and carry necessary equipment and products
2. Install the set top box (DAS) at customer's site
3. Provide field service and resolve faults in case of complaint
4. Collect documents and forms filled by customer as per company's policy
5. Achieve productivity and quality targets as prescribed by company

NOS # ELE/N8102 - Comprehend customer's requirement

1. Interact with the customer prior to visit
2. Interact with customer at their premises
3. Suggest possible solutions to customer
4. Achieve productivity and quality as per company's norms

NOS # ELE/N9951 - Interact with other employees

1. Interact with supervisor or superior
2. Coordinate with colleagues

Expected Job Roles:

DAS Setp-top Box Installer and Service Technician

Duration of the Course (in hours)	200 hours

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

Professional Knowledge:

NOS # ELE/N8101 - Install and repair DAS set-top box

KB1. optimum signal strength/ signal quality for good reception
KB2. basics of input/output functions and block diagram of the set top box
KB3. functions of the set top box and remote control
KB4. structure of cable, parameters and the implications on signal
KB5. basic functioning of tuners
KB6. basics of digital signals and difference in analogue and digital
KB7. transmission of television signals and functioning of television sets
KB8. specifications of different kind of inputs available on TV sets such as RF, AV, RGB, VGA, USB and HDMI
KB9. digital signal processing chain including CAS and SMS
KB10. basics of Digital TV signal distribution through HFC network including elements of fibre, coaxial chain and devices such as nodes, amplifier, taps, splitter, etc., from head ends to input point of consumer premises for DAS
KB11. concepts of modulation, demodulation, encryption, decryption, decoding, signal ingress, cross modulation, tuning, amplifying, coupling, attenuation, equalisation, digitising, etc., and their purposes
KB12. commonly used terms and their meanings such as ECM, EMM, EPG-SDT, MPEG

NOS # ELE/N8102 - Comprehend customer's requirement

KA1. company's policies on: customer care
KA2. company's code of conduct
KA3. organisation culture and typical customer profile
KA4. company's reporting structure
KA5. company's documentation policy

KB1. company's products and recurring problems reported in consumer appliances
KB2. how to communicate with customers in order to put them at ease
KB3. basic electrical and mechanical modules of various products
KB4. electronics involved in the type of product
KB5. models of different appliances and their common and distinguishing features
KB6. etiquette to be followed at customer's premises
KB7. precautions to be taken while handling field calls and dealing with customers
KB8. relevant reference sheets, manuals and documents to carry in the field

NOS # ELE/N9951 - Interact with other employees

KB1. how to communicate effectively
KB2. how to build team coordination

Professional Skill:

i. **Interpersonal skills**
ii. **Communication skills**
iii. **Behavioural skills**
iv. **Reading, writing and computer skills**
v. **Teamwork and multitasking**
vi. Documentation Skills
vii. **Reflective thinking**
viii. Critical Thinking
ix. **Decision Making**

Core Skill:

1. **Installation and Repair Skills**
2. **Using tools and machines**

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
	As per the NOSs listed in the Qualification pack	
	Total Theory / Lecture Hours:	80
	Total Practical / Tutorial Hours:	120
	Total Hours:	200

Recommended Hardware:

1. Set top box
2. Television
3. Drilling machine, satellite meter, multi-meter
4. Lead tester, spanner, cutter
5. RF strength meter, QAM meter

Recommended Software:

NA

Text Books:	NA
Reference Books:	NA

ESDM Courses

Level Code:	IV	**Vertical Name:**	Communication Electronics
Course Code:	EL/S/L4/C046	**Course Name:**	2.2.3 Digital Cable TV Technician (ESSCI)

Objective of the Course:

Data Networking and Cable Technician: The main job responsibility of this job role is to carry out LAN communication cabling using appropriate techniques, tools and cabling standards in a given work site.

Brief Job Description: A data networking and cable technician is responsible for laying cables (optical fibre or copper cables) for LAN communication in offices and commercial buildings. The candidate must be capable of carrying out the given tasks as per relevant cabling standards and safety parameters. He/She should have the knowledge of the various kinds of cables and their uses in LAN connectivity. The individual is expected to perform job responsibilities in a given work site with minimum supervision and ensure that customer's requirements are met.

Personal Attributes: Must exhibit good customer service attributes—courteous, solution oriented, polite, reliable, good decision-making skills, etc. Must be focused on quality outcomes. Possess an alert mind and a physically active body. Should be responsible for own outcomes and work in a team.

Learning Outcomes:

NOS # ELE/N: (Laying fibre optic and/or copper cables for LAN connection)

- Customer handling
- Working safely
- Preparing work area for LAN cabling
- Laying cable for LAN communication
- Terminating communication cables
- Testing cable
- Troubleshooting faults
- Post installation activities

ELE/ N 1001: (Use basic health and safety practices in electrical and electronics work)

- Health and safety
- Fire safety
- Emergencies, rescue and first-aid procedures

CSC/ N 1336: (Work effectively in team)

- Working in a team

Entrepreneurship Module

Expected Job Roles:

Data Networking and Cable Technician

Duration of the Course (in hours)	350 Hrs
Minimum Eligibility Criteria and pre-requisites, if any	ITI / 12th Pass

Professional Knowledge:

NOS # ELE/N: (Laying fibre optic and/or copper cables for LAN connection)

KA1. relevant legislation, standards, policies, and procedures followed in the company relevant to own employment and performance conditions
KA2. relevant health and safety requirements applicable in the work place
KA3. own job role and responsibilities and sources for information pertaining to employment terms, entitlements, job role and responsibilities
KA4. reporting structure, inter-dependent functions, lines and procedures in the work area
KA5. how to engage with specialists for support in order to resolve incidents and service requests
KA6. importance of working in clean and safe environment practices and procedures
KA7. relevant people and their responsibilities within the work area
KA8. escalation matrix and procedures for reporting work and employment related issues

KB1. importance of using personal protective equipment and safeguarding self and others from injury
KB2. hazards and risks associated with electronic embedded product designing work
Hazards: faulty electrical components, exposure to live conductors, misuse of tools, etc.
KB3. use and interpret information from resources and job specification documents
Resources: drawings, circuit and physical layouts, charts, customer's specifications, graphical electronic/electrical symbols and standard soldering regulations
KB4. basic principles of communications systems
Communications systems: transmitter, receiver, communication channel
KB5. different kinds of information transmitted through communication systems
Information: sound, video, picture or data
KB6. basic principles of data communication
KB7. differences between analog and digital signals
KB8. approved techniques used to convert analog to digital and vice versa
KB9. concept of bandwidth and applications
KB10. various kinds of communication methods used over channel
Methods: simplex (one way), duplex (two way), half/semi-duplex (two way but one at a time), broadcast, serial, parallel
KB11. basic concepts of electrical theory and current
KB12. difference between AC and DC
KB13. main category of cables used in communication systems
Category: fibre optic and copper cable
KB14. range of connectors and their uses
KB15. various possible causes of common faults in termination
Common faults: chip, crack, scratch, pitting, concentricity error, etc.
KB16. range of fibre optic cables used in data communication
KB17. characteristics of copper cable and effects on signal
KB18. approved tests used to prevent fibre optic link error

Tests: calibration, launch stability, test lead connection, spatial resolution, elimination of ghosting, fibre mismatch, minimization of dead zone, etc.
KB19. important features and specifications of fibre optic cable
Features: cladding diameters, secondary and primary coating diameters, refractive index, numerical aperture, attenuation, operational wavelengths
KB20. fundamentals of data networking
KB21. application methods of serial and parallel data networking
KB22. differences between LAN and WAN and their uses
KB23. component parts of cable used in communication systems
KB24. various kinds of optical fibres
Kinds: single-mode, multimode, graded index, stepped index
KB25. interpreting cable labeling and colour coding
KB26. common problems in copper and optical fibre cabling
KB27. troubleshooting techniques used in cabling
KB28. cabling transmission performance and tests requirements
KB29. appropriate installation points for connecting hardware
Installation points: main cross connect, intermediate cross connect, horizontal cross connect, horizontal cabling transition points, consolidation points, telecommunications outlets
KB30. basic topologies used in data networking
Topologies: star, bus, ring, grid, mesh, point to point, branching tree, etc.
KB31. manufacturer's standard operating procedures (SOP) and their applications
KB32. importance of correct labeling of components and peripherals
KB33. range of IP address and categorization of class
KB34. use of appropriate cable length in LAN connection
KB35. safe disposal of waste materials
KB36. documenting required information of work fully and accurately in appropriate respective service logbook, report sheets, etc.
KB37. SI units and symbols used in measurement
Units: e.g. metre (m), kilogram (kg), second(s), ampere (A), tera (A), giga (G),
mega (M), nano (N), etc.
KB38. use of terminology, jargons, unit, graphical representation, signs and symbols related to data communication systems

ELE/N 1001: Use basic health and safety practices in electrical and electronics work

KA1. names (and job titles if applicable), and where to find, all the people responsible for health and safety in a workplace.
KA2. names and location of documents that refer to health and safety in the workplace
KB1. meaning of "hazards" and "risks"
KB2. health and safety hazards commonly present in the work environment and related precautions
KB3. possible causes of risk, hazard or accident in the workplace and why risk and/or accidents are possible
KB4. possible causes of risk and accident
Possible causes of risk and accident: physical actions; not following instructions; inattention; sickness and incapacity (such as drunkenness); health hazards (such as untreated injuries and contagious illness); not taking safety precautions
KB5. methods of accident prevention
Methods of accident prevention: training in health and safety procedures; using health and safety procedures; use of equipment and working practices (such as safe carrying procedures); safety notices, advice; instruction from colleagues and supervisors

KB6. safe working practices when working with tools and equipment
KB7. safe working practices while working at various hazardous sites
KB8. where to find all the general health and safety equipment in the workplace
KB9. various dangers associated with the use of electrical equipment
KB10. positive isolation of electrical equipment and system

KB11. safe handling and disposal of hazardous wastes
KB12. risks of electric shock while using electrical equipment
KB13. various safety procedures and equipment used to work at heights, trenches and confined places
KB14. safe methods used to repair building surfaces
KB15. preventative and remedial actions to be taken in the case of exposure to toxic materials
Exposure: ingested, contact with skin, inhaled
Preventative action: ventilation, masks, protective clothing/ equipment);
Remedial action: immediate first aid, report to supervisor
Toxic materials: solvents, flux, lead
KB16. importance of using protective clothing/equipment and other insulated work gear while handling electrical system and equipment
KB17. precautionary activities taken to prevent fire accident
KB18. various causes of fire
Causes of fires: heating of metal; spontaneous ignition; sparking; electrical heating; loose fires (smoking, welding, etc.); chemical fires; etc.
KB19. techniques of using the different fire extinguishers
KB20. different methods of extinguishing fire
KB21. different materials used for extinguishing fire
Materials: sand, water, foam, CO_2, dry powder
KB22. building fire safety regulations
KB23. emergency rescue techniques applied during a fire hazard
KB24. various types of safety signs and what they mean
KB25. appropriate basic first aid treatment relevant to the condition e.g. shock, electrical shock, bleeding, breaks to bones, minor burns, resuscitation, poisoning, eye injuries
KB26. content of written accident report
KB27. potential injuries and ill health associated with incorrect manual handing
KB28. safe lifting, carrying and transporting practices
KB29. personal safety, health and dignity issues relating to the movement of a person by others
KB30. potential impact to a person who is moved incorrectly

CSC/ N 1336: (Work effectively in team)

KA1. legislation, standards, policies, and procedures followed in the company relevant to own employment and performance conditions
KA2. reporting structure, inter-dependent functions, lines and procedures in the work area
KA3. relevant people and their responsibilities within the work area
KA4. escalation matrix and procedures for reporting work and employment related issues

KB1. various categories of people that one is required to communicate and co-ordinate with in the organization
KB2. importance of effective communication in the workplace
KB3. importance of teamwork in organizational and individual success
KB4. various components of effective communication
KB5. key elements of active listening
KB6. value and importance of active listening and assertive communication
KB7. barriers to effective communication
KB8. importance of tone and pitch in effective communication
KB9. importance of avoiding casual expletives and unpleasant terms while communicating professional circles
KB10. how poor communication practices can disturb people, environment and cause problems for the employee, the employer and the customer
KB11. importance of ethics for professional success
KB12. importance of discipline for professional success
KB13. what constitutes disciplined behavior for a working professional
KB14. common reasons for interpersonal conflict

KB15. importance of developing effective working relationships for professional success
KB16. expressing and addressing grievances appropriately and effectively
KB17. importance and ways of managing interpersonal conflict effectively

Professional Skill:

i. **Interpersonal skills**
ii. **Behavioural skills**
iii. **Reflective thinking**
iv. Critical Thinking
v. **Decision Making**
vi. **Using tools and machines**

Core Skill:

1. Using tools and machines
2. Assembling Skills
3. Reading, writing and computer skills
4. Teamwork and multitasking
5. Communication skills

Detailed Syllabus of Course

S. No.	Module. Name	Duration
1	Laying fibre optic and/or copper cables for LAN connection	
2	Use basic health and safety practices in electrical and electronics work	
3	Work effectively in team	
	Total Theory/Lecture	140 Hrs
	Total Practical / Tutorial Hours:	210 Hrs
	Total Hours:	350 Hrs

Recommended Hardware:

Recommended Software:	
Text Books:	
Reference Books:	

ESDM Courses

Level Code:	III	**Vertical Name:**	IT Hardware

Course Code:	EL/S/L3/C004 TL/S/L3/C024	**Course Name:**	2.3.1 Installation Technician – Computing and Peripherals (ESSCI/TSSC)

Objective of the Course:

To train the person whois responsible for installing newly purchased products, troubleshooting system problems and, configuring peripherals such as printers, scanners and network devices

Learning Outcomes:

NOS # ELE/N4601 - Engage with customer

1. Interact with the customer prior to visit
2. Understand customer's requirements on visit or prior to visit
3. Suggest possible solutions
4. Complete the documentation
5. Achieve productivity and quality as per company's norms

NOS # ELE/N4602 - Install, configure and setup the system

1. Understand the installation requirement and install the hardware
2. Configure and install the peripherals
3. Check system functionality
4. Set up the software
5. Complete the installation task and report
6. Interact with customer
7. Interact with superior
8. Achieve productivity and quality as per company's norms

NOS # ELE/N9909 - Coordinate with colleagues and co-workers

1. Interact with supervisor or superior
2. Coordinate with colleagues

Entrepreneurship

Expected Job Roles:

Installation Technician - Computing and Peripherals

Duration of the Course (in hours)	350 hours
Minimum Eligibility Criteria and pre-requisites, if any	10th Pass

Professional Knowledge:

NOS # ELE/N4601 - Engage with customer

KB1. company's products and recurring problems reported
KB2. how to communicate with customers in order to put them at ease
KB3. basic electronics of system hardware
KB4. hardware maintenance
KB5. functions of electrical and mechanical parts/ modules
KB6. behavioural aspects and etiquette to be followed at customer's premises
KB7. precautions to be taken while handling field calls and dealing with customers
KB8. Relevant reference sheets, manuals and documents to carry in the field

NOS # ELE/N4602 - Install, configure and setup the system

KA6. company's line of business and product portfolio

KB1. basic electronics involved in the hardware
KB2. different types of IT hardware products and functionalities
KB3. functions of electrical and mechanical parts/ modules
KB4. typical customer profile
KB5. company's portfolio of products and that of competitors
KB6. installation procedures given in the manuals
KB7. different types of equipment assembled in a pack (one system)
KB8. different types of peripherals and their standard installation procedure
KB9. specification and the procedures to be followed for setting up the system
KB10. voltage and power requirement for different hardware devices
KB11. memory, input, output and storage devices
KB12. different modules in system such as SMPS, drivers, hard disk, battery, mother board
KB13. different module in the peripheral and their functions
KB14. how to operate the system and other hardware peripherals

NOS # ELE/N9909 - Coordinate with colleagues and co-workers

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. importance of the individual's role in the workflow
KA3. reporting structure

KB1. how to communicate effectively
KB2. how to build team coordination

Professional Skill:

i. **Interpersonal skills**
ii. **Communication skills**
iii. **Behavioural skills**
iv. **Reading, writing and computer skills**
v. **Teamwork and multitasking**
vi. Documentation Skills
vii. **Reflective thinking**
viii. Critical Thinking
ix. **Decision Making**

Core Skill:

1. **Installation and Repair Skills**
2. **Hardware and Software operation skills**
3. **Computer system and peripheral hardware related skills**
4. **Using tools and machines**

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
	As per the NOSs listed in the Qualification pack	
	Total Theory / Lecture Hours:	150
	Total Practical / Tutorial Hours:	200
	Total Hours:	350

Recommended Hardware:

1. Computer, Laptop
2. Soldering iron, multimeter, POST cards
3. Printer, Scanner

Recommended Software:	NA
Text Books:	NA
Reference Books:	NA

ESDM Courses

Level Code:	IV	**Vertical Name:**	IT Hardware

Course Code:	EL/S/L4/C006	**Course Name:**	2.3.2 Field Technician – Computing and Peripherals (ESSCI)

Objective of the Course:

To train the person whois responsible for attending to customer complaints, installing newly purchased products, troubleshooting system problems and, configuring peripherals such as printers, scanners and network devices.

Learning Outcomes:

NOS # ELE/N4601 - Engage with customer

1. Interact with the customer prior to visit
2. Understand customer's requirements on visit or prior to visit
3. Suggest possible solutions
4. Complete the documentation
5. Achieve productivity and quality as per company's norms

NOS # ELE/N4602 - Install, configure and setup the system

1. Understand the installation requirement and install the hardware
2. Configure and install the peripherals
3. Check system functionality
4. Set up the software
5. Complete the installation task and report
6. Interact with customer
7. Interact with superior
8. Achieve productivity and quality as per company's norms

NOS # ELE/N4603 - Troubleshoot and replace faulty module

1. Receive and understand the customer complaint registered at customer care
2. Identify system problems on firld visit
3. Replace faulty module after diagnosis
4. Interact with customer
5. Report to Superior

NOS # ELE/N9909 - Coordinate with colleagues and co-workers

1. Interact with supervisor or superior
2. Coordinate with colleagues

Entrepreneurship

Expected Job Roles:

Field Technician - Computing and Peripherals

Duration of the Course (in hours)	350 hours
Minimum Eligibility Criteria and pre-requisites, if any	12th pass

Professional Knowledge:

NOS # ELE/N4601 - Engage with customer

KB1. company's products and recurring problems reported
KB2. how to communicate with customers in order to put them at ease
KB3. basic electronics of system hardware
KB4. hardware maintenance
KB5. functions of electrical and mechanical parts/ modules
KB6. behavioural aspects and etiquette to be followed at customer's premises
KB7. precautions to be taken while handling field calls and dealing with customers
KB8. Relevant reference sheets, manuals and documents to carry in the field

NOS # ELE/N4602 - Install, configure and setup the system

KB1. basic electronics involved in the hardware
KB2. different types of IT hardware products and functionalities
KB3. functions of electrical and mechanical parts/ modules
KB4. typical customer profile
KB5. company's portfolio of products and that of competitors
KB6. installation procedures given in the manuals
KB7. different types of equipment assembled in a pack (one system)
KB8. different types of peripherals and their standard installation procedure
KB9. specification and the procedures to be followed for setting up the system
KB10. voltage and power requirement for different hardware devices
KB11. memory, input, output and storage devices
KB12. different modules in system such as SMPS, drivers, hard disk, battery, mother board
KB13. different module in the peripheral and their functions
KB14. how to operate the system and other hardware peripherals

NOS # ELE/N4603 - Troubleshoot and replace faulty module

KB1. company's portfolio of products
KB2. different types of IT hardware products and functionalities
KB3. different electrical and mechanical modules in the product
KB4. basic electronics of the hardware
KB5. different models of devices and their repair procedures
KB6. different equipments assembled in a pack (one system)
KB7. peripherals and their standard operating procedure for disassembling and re-assembling
KB8. procedures to be followed for trouble shooting and standards to follow

KB9. voltage and power requirement for different hardware devices
KB10. memory, input, output and storage devices

NOS # ELE/N9909 - Coordinate with colleagues and co-workers

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. importance of the individual's role in the workflow
KA3. reporting structure

KB1. how to communicate effectively
KB2. how to build team coordination

Professional Skill:

i. **Interpersonal skills**
ii. **Communication skills**
iii. **Behavioural skills**
iv. **Reading, writing and computer skills**
v. **Teamwork and multitasking**
vi. Documentation Skills
vii. **Reflective thinking**
viii. Critical Thinking
ix. **Decision Making**

Core Skill:

1. **Installation and Repair Skills**
2. **Hardware and Software operation skills**
3. **Computer system and peripheral hardware related skills**
4. **Using tools and machines**

Detailed Syllabus of Course

Module. No	**Module. Name**	**Minimum No. of Hours**
	As per the NOSs listed in the Qualification pack	
	Total Theory / Lecture Hours:	150

Total Practical / Tutorial Hours:	200
Total Hours:	350

Recommended Hardware:	1. Computer, Laptop 2. Soldering iron, multimeter, POST cards 3. Printer, Scanner
Recommended Software:	NA
Text Books:	NA
Reference Books:	NA

ESDM Courses

Level Code:	V	**Vertical Name:**	IT Hardware

Course Code:	EL/S/L5/C009 TL/S/L5/C027	**Course Name:**	2.3.3 Field Technician – Networking and Storage (ESSCI/TSSC)

Objective of the Course:

To train the person who responsible for attending to customer complaints, installing newly purchased products, troubleshooting system problems and, configuring hardware equipment such as servers, storage and other related networking devices

Learning Outcomes:

NOS # ELE/N4601 - Engage with customer

1. Interact with the customer prior to visit
2. Understand customer's requirements on visit or prior to visit
3. Suggest possible solutions
4. Complete the documentation
5. Achieve productivity and quality as per company's norms

ELE/N4612 Install, configure and setup the networking and storage system

1. Understand the installation requirement and install the hardware
2. Configure and setup the network, servers and storage system
3. Check system functionality
4. Set up the software
5. Complete the installation task and report
6. Interact with customer
7. Interact with superior
8. Achieve productivity and quality as per company's norms

ELE/N4613 Troubleshoot and fix equipment

1. Receive and understand the customer complaint registered at customer care
2. Identify system problems on field visit
3. Replace faulty module after diagnosis
4. Coordinate with Remote Technical Helpdesk for assistance
5. Interact with customer
6. Report to Superior

NOS # ELE/N9909 - Coordinate with colleagues and co-workers

1. Interact with supervisor or superior
2. Coordinate with colleagues

Expected Job Roles:

Field Technician – Networking and Storage

Duration of the Course (in hours)	400 hours
Minimum Eligibility Criteria and pre-requisites, if any	Diploma

Professional Knowledge:

NOS # ELE/N4601 - Engage with customer

KB1. company's products and recurring problems reported
KB2. how to communicate with customers in order to put them at ease
KB3. basic electronics of system hardware
KB4. hardware maintenance
KB5. functions of electrical and mechanical parts/ modules
KB6. behavioural aspects and etiquette to be followed at customer's premises
KB7. precautions to be taken while handling field calls and dealing with customers
KB8. Relevant reference sheets, manuals and documents to carry in the field

ELE/N4612 Install, configure and setup the networking and storage system

KB1. basic electronics involved in the hardware
KB2. different types of IT hardware products and functionalities
KB3. functions of electrical and mechanical parts/ modules
KB4. typical customer profile
KB5. company's portfolio of products and that of competitors
KB6. installation procedures given in the manuals
KB7. different types of servers, storage, networking devices offered by the company
KB8. different types of servers and storage hardware equipment and their standard installation procedure
KB9. specification and the procedures to be followed for configuration and setting up the server system
KB10. design architecture for system configuration
KB11. networking of devices
KB12. different types of networking devices, their functionality
KB13. operate and load networking drivers

ELE/N4613 Troubleshoot and fix equipment

KB1. company's portfolio of products
KB2. different types of IT hardware products and functionalities
KB3. different electrical and mechanical modules in the product
KB4. basic electronics of the hardware
KB5. different models of devices and their repair procedures
KB6. standard operating procedure for disassembling and re-assembling of hardware equipment
KB7. procedures to be followed for trouble shooting and standards to follow
KB8. voltage and power requirement for different hardware devices
KB9. servers, storage and network devices

KB10. ERP software application and its installation procedure

NOS # ELE/N9909 - Coordinate with colleagues and co-workers

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. importance of the individual's role in the workflow
KA3. reporting structure

KB1. how to communicate effectively
KB2. how to build team coordination

Professional Skill:

vii. **Interpersonal skills**
viii. **Communication skills**
ix. **Behavioural skills**
x. **Reading, writing and computer skills**
xi. **Teamwork and multitasking**
xii. Documentation Skills
xiii. **Reflective thinking**
xiv. Critical Thinking
xv. **Decision Making**

Core Skill:

5. **Installation and Repair Skills**
6. **Hardware and Software operation skills**
7. **Networking, Servers and storage hardware related skills**
8. **Using tools and machines**

Detailed Syllabus of Course

Module. No	**Module. Name**	**Minimum No. of Hours**
	As per the NOSs listed in the Qualification pack	
	Total Theory / Lecture Hours:	
	Total Practical / Tutorial Hours:	
	Total Hours:	400

Recommended Hardware:	1. Computer, Laptop, networking devices 2. Soldering iron, multimeter, POST cards 3. Servers
Recommended Software:	NA
Text Books:	NA
Reference Books:	NA

ESDM Courses

Level Code:	III	**Vertical Name:**	IT Hardware

Course Code:	EL/S/L3/C014 TL/S/L3/C031	**Course Name:**	2.3.4 CCTV Installation technician (ESSCI/TSSC)

Objective of the Course:

CCTV Installation Technician: Also called 'CCTV Installer', the CCTV installation Technician provides after sale support services to customers, typically, at their premises

Brief Job Description: The individual at work is responsible for installing the CCTV system in the customer premises. The individual understand the customer and site requirement, installs the camera and integrates the hardware for effective CCTV surveillance system functioning.

Personal Attributes: The job requires the individual to have: ability to build interpersonal relationships, patience, listening skills and critical thinking. The individual must be willing to travel to client premises in order to install equipment at different locations.

Learning Outcomes:

NOS # ELE/N4609- Visit site and understand customer requirement

1. Interact with the customer
2. Understand their requirements
3. Visit the site
4. Understand the site condition and requirement
5. Suggest possible solutions
6. Decide on the CCTV system to be installed
7. Achieve productivity and quality standards

ELE/N4610Install the CCTV camera

1. Procure the hardware required for installation
2. Test the hardware before installation
3. Connect the cables
4. Install and setup the camera
5. Use appropriate tools and equipments for installation
6. Achieve productivity and quality standards

ELE/N4611 Setup the CCTV surveillance system

1. Connect CCTV camera and DVR with system
2. Set up CCTV system
3. Ensure system functioning, perform demo
4. Complete installation, report
5. Interact with customer

6. Interact with Supervisor
7. Achieve productivity and quality as per company's norms

NOS # ELE/N9909 - Coordinate with colleagues and co-workers

1. Interact with supervisor or superior
2. Report potential areas of disruptions to work process
3. Spot process disruptions and delays
4. Coordinate with colleagues

Expected Job Roles:

CCTV Installation technician

Duration of the Course (in hours)	350 hours
Minimum Eligibility Criteria and pre-requisites, if any	10th Passed

Professional Knowledge:

NOS # ELE/N4609- Visit site and understand customer requirement

KA1. company's policies on: customer care, warranties, products
KA2. company's code of conduct
KA3. organization culture and typical customer profile
KA4. company's reporting structure
KA5. company's documentation policy
KA6. company's service level agreements and policies

KB1. CCTV camera installation requirement in terms of equipment, system , tools, applications appropriate for a particular site
KB2. preparation of field and site for camera installation
KB3. design criteria for CCTV camera installation
KB4. location criteria for CCTV camera installation
KB5. different types of CCTV equipment in the market, their specifications and prices
KB6. different types of CCTV camera and associated systems
KB7. different types of DVR and their purposes
KB8. tools and equipment to carry for installations
KB9. precautions to be taken while handling field calls and dealing with customers
KB10. relevant reference sheets, manuals and documents to carry in the field

ELE/N4610Install the CCTV Camera

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. company's sales and after sales support policy
KA3. importance of the individual's role in the workflow
KA4. reporting structure
KA5. company's policy on product's warranty and other terms and conditions
KA6. company's line of business and product portfolio
KA7. company's customer support and service policy

KB1. basic electronics involved in the hardware
KB2. basic electrical and wiring
KB3. different types of electronic surveillance products and functionalities
KB4. functions of electrical and mechanical parts or modules
KB5. typical customer profile
KB6. elements of CCTV systems such as camera, DVR, monitor
KB7. company's portfolio of products and that of competitors
KB8. installation procedures given in the manuals
KB9. specification and the procedures to be followed for setting up the system
KB10. different type of cables used for data transmission and power transmission
KB11. power requirement of different CCTV related equipment
KB12. video recording of footage – analog and digital
KB13. different types of camera available in the market
KB14. camera specifications such as focus, lens type, zoom
KB15. controls of different options in camera such as rotation, speed of movement in pan / tilt camera
KB16. voltage and power requirement for different hardware devices
KB17. how to operate the system and other hardware
KB18. safety rules, policies and procedures
KB19. quality standards to be followed

ELE/N4611 Setup the CCTV surveillance system

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. company's sales and after sales support policy
KA3. importance of the individual's role in the workflow
KA4. reporting structure
KA5. company's policy on product's warranty and other terms and conditions
KA6. company's line of business and product portfolio

KB1. different types of electronic surveillance products and functionalities
KB2. functions of electrical and mechanical parts/ modules
KB3. specification and the procedures to be followed for setting up the system
KB4. different type of cables used for data transmission and power transmission
KB5. power requirement of different CCTV related equipment
KB6. video recording of footage – analog and digital
KB7. different types of camera available in the market
KB8. camera specifications such as focus, lens type, zoom
KB9. controls of different options in camera such as rotation, speed of movement
KB10. voltage and power requirement for different hardware devices
KB11. integration of hardware to setup the system
KB12. parameters and specification for different types of system integration
KB13. accessing image from remote locations
KB14. CCTV monitoring and control over IP network / Internet
KB15. IP technology and networking principles

KB16. basics of networking
KB17. video recording technologies
KB18. controls in digital video recorder and their usage
KB19. how to operate the system and other hardware
KB20. safety rules, policies and procedures
KB21. quality standards to be followed

NOS # ELE/N9909 - Coordinate with colleagues and co-workers

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. importance of the individual's role in the workflow
KA3. reporting structure

KB1. how to communicate effectively
KB2. how to build team coordination

Entrepreneurship

Professional Skill:

xvi. **Interpersonal skills**
xvii. **Communication skills**
xviii. **Behavioural skills**
xix. **Reading, writing and computer skills**
xx. **Teamwork and multitasking**
xxi. **Reflective thinking**
xxii. Critical Thinking
xxiii. **Decision Making**

Core Skill:

9. **Installation and Repair Skills**
10. **Hardware and Software operation skills**
11. **Networking, Servers and storage hardware related skills**
12. **Using tools and machines**

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
	Visit site and understand customer requirement	
	Install the CCTV Camera	
	Setup the CCTV surveillance system	
	Coordinate with colleagues and co-workers	

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

Recommended Hardware:

1. Different types of CCTV Camera
2. DVR, Monitor, Key board mouse & their hardware
3. Storage device
4. Diagonal cutters, screwdrivers, crimp tools, knife for cabling and camera mounting

Recommended Software:

NA

Text Books:

NA

Reference Books:

NA

ESDM Courses

Level Code:	III	**Vertical Name:**	IT Hardware

Course Code:	EL/S/L3/C015	**Course Name:**	2.3.5 Access Controls Installation Technician (ESSCI)

Objective of the Course:

Access Controls Installation Technician: Also called 'Access Control Device Installer', the Access Control Installation Technician provides after sale support services for access control devices and systems such as point of sale scanners, finger print or iris scan.

Brief Job Description: The individual at work is responsible for installing the access control system at the customer's premises. The individual undertakes site assessment, installs the hardware and integrates the system to meet customer's requirement.

Personal Attributes: The job requires the individual to have: ability to build interpersonal relationships, patience, listening skills and critical thinking. The individual must be willing to travel to client premises in order to install equipment at different locations.

Learning Outcomes:

NOS #ELE/N4616 - Engage with customer for installation

1. Interact with customer to assess their requirement
2. Visit site to understand infrastructure required
3. Suggest possible solutions

ELE /N4617 Install and setup the access control system both Hardware and Software

1. Procure the hardware required for installation
2. Test the access control hardware before installation
3. Install the wiring
4. Install and setup the access controls
5. Setup the system
6. Use appropriate tools and equipment for installation

ELE/N9909 Coordinate with colleagues and co-workers

1. Interact with supervisor or superior
2. Coordinate with colleagues

Expected Job Roles:

Access Controls Installation Technician

Duration of the Course (in hours)	350 hours
Minimum Eligibility Criteria and pre-requisites, if any	10th Passed

Professional Knowledge:

NOS # ELE/N4616 - Engage with customer for installation

KA1. company's policies on: customer care, warranties, products
KA2. company's code of conduct
KA3. organization culture and typical customer profile
KA4. company's reporting structure
KA5. company's documentation policy
KA6. company's service level agreements and policies

KB1. access control device system and their applications
KB2. basic concepts operating different types of scanners
KB3. field and site assessment for access control equipment installation
KB4. design for access control system installation
KB5. different types of access control equipment in the market, their specifications and price
KB6. different types of data information storage device and their purpose
KB7. safety precautions to be taken while installing
KB8. reference sheets, manuals and documents to carry in the field

NOS# ELE/N4617Install and setup the access control system

KB1. basic electronics involved in the hardware
KB2. basic electrical and wiring techniques
KB3. different types of access control products and functionalities
KB4. functions of electrical and mechanical parts/ modules
KB5. typical customer profile
KB6. dismantling and assembling of hardware equipment
KB7. access control system concepts such as for master controller, card reader, door control units, smart-hub, etc.
KB8. company's portfolio of products and that of competitors
KB9. installation procedures given in the manuals
KB10. specification and the procedures to be followed for setting up the system
KB11. different type of cables used for data transmission and power transmission
KB12. power requirement of hardware
KB13. different types of access controls hardware available in the market
KB14. software requirement associated with access controls

KB15. computing system and operating system requirements for access control system installation
KB16. voltage and power requirement for different hardware devices
KB17. how to operate the system and other hardware
KB18. all safety rules, policies and procedures
KB19. quality standards to be followed

NOS # ELE/N9909 - Coordinate with colleagues and co-workers

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. importance of the individual's role in the workflow
KA3. reporting structure

KB1. how to communicate effectively
KB2. how to build team coordination

Entrepreneurship Module

Professional Skill:

i. **Interpersonal skills**
ii. **Communication skills**
iii. **Behavioural skills**
iv. **Reading, writing and computer skills**
v. **Hardware and electrical skills**
vi. **Reflective thinking**
vii. Critical Thinking
viii. **Decision Making**
ix. Using tools and equipment

Core Skill:

1. **Reading and writing skills**
2. **Teamwork and multitasking**

Detailed Syllabus of Course

Module. No	**Module. Name**	**Minimum No. of Hours**
	Engage with customer for installation	
	Install and setup the access control system	
	Coordinate with colleagues and co-workers	
		150

Total Practical / Tutorial Hours:	200
Total Hours:	350

Recommended Hardware:	
Recommended Software:	NA
Text Books:	NA
Reference Books:	NA

ESDM Courses

Level Code:	IV	**Vertical Name:**	IT Hardware

Course Code:	EL/S/L4/C045	**Course Name:**	2.3.6 Electronic Security System Technician (ESSCI)

Objective of the Course:

Brief Job Description: Understanding the customer's requirements for installing the various types of electronic security systems and configuring the system for security functions

Learning Outcomes:

NOS # ELE/N4616 Engage with customer for installation

- Interact with the customer
- Understand their requirements
- Visit the site
- Understand the site condition and requirement
- Suggest possible solutions
- Decide on the system to be installed
- Achieve productivity and quality standards

NOS # ELE/N4617 Install and setup the access control system

- Procure the hardware required for installation
- Test the access control hardware before installation
- Install the wiring
- Install and setup the access controls
- Setup the system
- Use appropriate tools and equipment for installation

NOS # ELE/N4610IDS Install Intrusion Detection System

- Procure the hardware required for installation.
- Test the hardware before installation.
- Connect the cables.
- Install and setup the IDS.
- Use appropriate tools and equipments for installation.
- Achieve productivity and quality standards.

NOS # ELE/N4611IDS Setup IDS

- Procure the hardware required for installation.
- Test the hardware before installation.

- Connect the cables.
- Install and setup the IDS.
- Use appropriate tools and equipments for installation.
- Achieve productivity and quality standards.

NOS # ELE/N4610 Install CCTV camera

- Procure the hardware required for installation
- Test the hardware before installation
- Connect the cables
- Install and setup the camera
- Use appropriate tools and equipments for installation
- Achieve productivity and quality standards

NOS# ELE/N4611 Setup CCTV surveillance system

- Connect CCTV camera and DVR with the system
- Setup the CCTV system
- Ensure system functioning and perform a demo
- Complete the installation task and report
- Interact with customer
- Interact with superior
- Achieve productivity and quality as per company's norms

NOS# ELE/N4610FAS Install FAS detector

- Procure the hardware required for installation.
- Test the hardware before installation.
- Connect the cables.
- Install and setup the detectors, devices & Control Panels.
- Use appropriate tools and equipments for installation.
- Achieve productivity and quality standards.

NOS #ELE/N4611FAS Setup FAS

- Connect FAS detectors and devices with the Fire Alarm Control Panel.
- Setup the Fire Alarm System.
- Ensure system functioning and perform a demo.
- Complete the installation task and report.
- Interact with customer.
- Interact with superior.
- Achieve productivity and quality as per company's norms.

NOS # ELE/N4610 Install VDP Outdoor Unit and lock

- Procure the hardware required for installation
- Test the hardware before installation
- Connect the cables
- Install and setup the indoor and outdoor units.
- Use appropriate tools and equipments for installation
- Achieve productivity and quality standards

NOS # ELE/N4611 Setup VDP Indoor system

- Connect outdoor units and lock with the Indoor unit
- Setup the Video Door Phone system
- Ensure system functioning and perform a demo
- Complete the installation task and report
- Interact with customer
- Interact with superior
- Achieve productivity and quality as per company's norms

NOS # ELE/N0009 Coordinate with colleagues

- Interact with supervisor or superior
- Coordinate with colleagues

Expected Job Roles:

Installation technician of Electronic Security Systems

Duration of the Course (in hours)	350 Hrs
Minimum Eligibility Criteria and pre-requisites, if any	ITI / 12th Pass.

Professional Knowledge:

NOS # ELE/N4616 Engage with customer for installation

KA1. company's policies on: customer care, warranties, products
KA2. company's code of conduct
KA3. organisation culture and typical customer profile
KA4. company's reporting structure
KA5. company's documentation policy
KA6. company's service level agreements and policies
KB1. Installation requirement in terms of equipment, system , tools, applications appropriate for a particular site
KB2. preparation of field and site for installation
KB3. design criteria for installation
KB4. location criteria for installation
KB5. different types of equipment's in the market, their specifications and prices
KB6. different types of and associated systems
KB7. different types of and their purposes
KB8. tools and equipment to carry for installations
KB9. precautions to be taken while handling field calls and dealing with customers
KB10. relevant reference sheets, manuals and documents to carry in the field

NOS # ELE/N4617 Install and setup the access control system

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. company's sales and after sales support policy
KA3. importance of the individual's role in the workflow
KA4. reporting structure
KA5. company's policy on product's warranty and other terms and conditions
KA6. company's line of business and product portfolio

KA7. company's customer support and service policy
KB1. basic electronics involved in the hardware
KB2. basic electrical and wiring techniques
KB3. different types of access control products and functionalities
KB4. functions of electrical and mechanical parts/ modules
KB5. typical customer profile
KB6. dismantling and assembling of hardware equipment
KB7. access control system concepts such as for master controller, card reader, door control units, smart-hub, etc.
KB8. company's portfolio of products and that of competitors
KB9. installation procedures given in the manuals
KB10. specification and the procedures to be followed for setting up the system
KB11. different type of cables used for data transmission and power transmission
KB12. power requirement of hardware
KB13. different types of access controls hardware available in the market
KB14. software requirement associated with acces controls
KB15. computing system and operating system requirements for access control system installation
KB16. voltage and power requirement for different hardware devices
KB17. how to operate the system and other hardware
KB18. all safety rules, policies and procedures
KB19. quality standards to be followed

NOS # ELE/N4610IDS Install Intrusion Detection System

KA1. company's policies on: incentives, delivery standards, and personnel Management.
KA2. company's sales and after sales support policy.
KA3. importance of the individual's role in the workflow.
KA4. reporting structure.
KA5. company's policy on product's warranty and other terms and conditions.
KA6. company's line of business and product portfolio.
KA7. company's customer support and service policy.
KB1. basic electronics involved in the hardware.
KB2. basic electrical and wiring.
KB3. different types of electronic Intrusion Detection and Alarm products and their Functionalities.
KB4. functions of electrical and mechanical parts or modules.
KB5. typical customer profile.
KB6. elements of IDS systems such as IDS sensors, IDS panel. Kb 7 company's portfolio of products and that of competitors.
KB8. installation procedures given in the manuals.
KB9. specification and the procedures to be followed for setting up the system. KB10. different type of cables used for data transmission and power transmission for a wired system.
KB11. power requirement of different IDS related equipment.
KB12. different types of IDS sensors available in the market.
KB13. IDS sensor specifications such as sensitivity, threshold, etc.
KB14. controls of different options in IDS sensors such as NO, NC Sensors.
KB15. voltage and power requirement for different hardware devices.
KB16. how to operate the system and other hardware.
KB17. safety rules, policies and procedures
KB18. quality standards to be followed

NOS # ELE/N4611IDS Setup IDS

KA1. company's policies on: incentives, delivery standards, and personnel management.
KA2. company's sales and after sales support policy.
KA3. importance of the individual's role in the workflow.
KA4. reporting structure.

KA5. company's policy on product's warranty and other terms and conditions.
KA6. company's line of business and product portfolio
KB1. different types of electronic IDS products and functionalities.
KB2. functions of electrical and mechanical parts/ modules.
KB3. specification and the procedures to be followed for setting up the system. KB4. different type of cables used for data transmission and power transmission.
KB5. different types IDS related equipment, different types of IDS Sensor, and Panels available in the market
KB6. IDS Sensor and Panels Specifications, such as, Sensitivity, Area of Coverage, etc.
KB7. controls of different options in IDS Panels.
KB8. voltage and power requirement for different hardware devices.
KB9. integration of hardware to setup the system.
KB10. parameters and specification for different types of system integration.
KB11. accessing IDS from remote locations.
KB12. IDS monitoring and control.
KB13. technology and networking principles.
KB14. basics of wireless Technology.
KB15. controls in IDS Panel and their usage.
KB16. how to operate the system and other hardware. KB17. safety rules, policies and procedures.
KB18. quality standards to be followed.

NOS # ELE/N4610 Install CCTV camera

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. company's sales and after sales support policy
KA3. importance of the individual's role in the workflow
KA4. reporting structure
KA5. company's policy on product's warranty and other terms and conditions
KA6. company's line of business and product portfolio
KA7. company's customer support and service policy
KB1. basic electronics involved in the hardware
KB2. basic electrical and wiring
KB3. different types of electronic surveillance products and functionalities
KB4. functions of electrical and mechanical parts or modules
KB5. typical customer profile
KB6. elements of CCTV systems such as camera, DVR, monitor
KB7. company's portfolio of products and that of competitors
KB8. installation procedures given in the manuals
KB9. specification and the procedures to be followed for setting up the system
KB10. different type of cables used for data transmission and power transmission
KB11. power requirement of different CCTV related equipment
KB12. video recording of footage – analog and digital
KB13. different types of camera available in the market
KB14. camera specifications such as focus, lens type, zoom
KB15. controls of different options in camera such as rotation, speed of movement in pan / tilt camera
KB16. voltage and power requirement for different hardware
KB17. how to operate the system and other hardware
KB18. safety rules, policies and procedures
KB19. quality standards to be followed

NOS # ELE/N4611 Setup CCTV surveillance system

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. company's sales and after sales support policy
KA3. importance of the individual's role in the workflow
KA4. reporting structure

KA5. company's policy on product's warranty and other terms and conditions
KA6. company's line of business and product portfolio
KB1. different types of electronic surveillance products and functionalities
KB2. functions of electrical and mechanical parts/ modules
KB3. specification and the procedures to be followed for setting up the system
KB4. different type of cables used for data transmission and power transmission
KB5. power requirement of different CCTV related equipment
KB6. video recording of footage – analog and digital
KB7. different types of camera available in the market
KB8. camera specifications such as focus, lens type, zoom
KB9. controls of different options in camera such as rotation, speed of movement in pan / tilt camera
KB10. voltage and power requirement for different hardware devices
KB11. integration of hardware to setup the system
KB12. parameters and specification for different types of system integration
KB13. accessing image from remote locations
KB14. CCTV monitoring and control over IP network / Internet
KB15. IP technology and networking principles
KB16. basics of networking
KB17. video recording technologies
KB18. controls in digital video recorder and their usage
KB19. how to operate the system and other hardware
KB20. safety rules, policies and procedures
KB21. quality standards to be followed

NOS # ELE/N4610FAS Install FAS detector

KA1. company's policies on: incentives, delivery standards, and personnel Management.
KA2. company's sales and after sales support policy.
KA3. importance of the individual's role in the workflow.
KA4. reporting structure.
KA5. company's policy on product's warranty and other terms and conditions.
KA6. company's line of business and product portfolio.
KA7. company's customer support and service policy
KB1. basic electronics involved in the FAS hardware.
KB2. basic electrical and wiring.
KB 3. Functioning of Fire Alarm System.
KB4. different types of electronic detection equipment and their functionalities.
KB5. Conventional and Addressable Fire Alarm Systems.
KB6. Elements of FAS systems such as Detector, Fire Panel, Sounder, Control Module, Monitor Module, etc.
KB7. company's portfolio of products and that of competitors. KB8. installation procedures given in the manuals.
KB9. specification and the procedures to be followed for setting up the system. KB10. different type of cables used for FAS.
KB11. power requirement of FAS Equipment.
KB12. different types of detectors and devices available in the market.
KB13. detector specifications such as smoke, heat, Rate of-rise or flame detector.
KB14. Installation of detectors & devices and assigning addresses to them.
KB15. how to operate hardware and the complete system.
KB16. safety rules, policies and procedures.
KB17. Various Quality Standards and Certifications, such as, UL, FM, NFPA, etc.
KB18. Integration with other Systems

NOS # ELE/N4611FAS Setup FAS

KB11. power requirement of FAS Equipment.
KB12. different types of detectors and devices available in the market.
KB13. detector specifications such as smoke, heat, Rate of-rise or flame detector.
KB14. Installation of detectors & devices and assigning addresses to them.
KB15. how to operate hardware and the complete system.
KB16. safety rules, policies and procedures.
KB17. Various Quality Standards and Certifications, such as, UL, FM, NFPA, etc.
KB18. Integration with other Systems.

NOS # ELE/N4610 Install VDP Outdoor Unit and lock

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. company's sales and after sales support policy
KA3. importance of the individual's role in the workflow
KA4. reporting structure
KA5. company's policy on product's warranty and other terms and conditions
KA6. company's line of business and product portfolio
KA7. company's customer support and service policy
KB1. basic electronics involved in the hardware
KB2. basic electrical and wiring
KB3. different types of electronic surveillance products and functionalities
KB4. functions of electrical and mechanical parts or modules
KB5. typical customer profile
KB6. Elements of VDP systems such as indoor units, outdoor units, locks
KB7. company's portfolio of products and that of competitors KB8. installation procedures given in the manuals
KB9. specification and the procedures to be followed for setting up the system KB10. different type of cables used for data transmission and power transmission KB11. power requirement of different VDP related equipment
KB12. VDP system– coloured and monochrome
KB13. different types of VDP systems available in the market
KB14. VDP specifications such number of indoor systems and outdoor systems
KB15. options in connection of locks , number of indoor
KB16. voltage and power requirement for different hardware devices
KB17. how to operate the system and other hardware
KB18. safety rules, policies and procedures
KB19. quality standards to be followed

NOS # ELE/N4611 Setup VDP Indoor system

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. company's sales and after sales support policy
KA3. importance of the individual's role in the workflow
KA4. reporting structure
KA5. company's policy on product's warranty and other terms and conditions
KA6. company's line of business and product portfolio
KB1. different types of electronic surveillance products and functionalities

KB2. functions of electrical and mechanical parts/ modules
KB3. specification and the procedures to be followed for setting up the system KB4. different type of cables used for data transmission and power transmission KB5. power requirement of different VDP related equipment
KB6. VDP system – colour or monochrome system.
KB7. different types of VDP systems available in the market
KB8. specifications such as light condition, vandal proof, IR
KB9. different options in outdoor units like IR, hard plastic, tamper proof
KB10. voltage and power requirement for different hardware devices
KB11. integration of hardware to setup the system
KB12. parameters and specification for different types of system integration
KB13. accessing input or output from remote locations
KB14. VDP and control from indoor unit
KB15. Technologies used in VDP
KB16. how to operate the system and other hardware
KB17. safety rules, policies and procedures
KB18. quality standards to be followed

NOS # ELE/N0009 Coordinate with colleagues

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. importance of the individual's role in the workflow
KA3. reporting structure
KB1. how to communicate effectively
KB2. how to build team coordination

Professional Skill:

xxiv. **Interpersonal skills**
xxv. **Behavioural skills**
xxvi. **Reflective thinking**
xxvii. Critical Thinking
xxviii. **Decision Making**
xxix. **Using tools and machines**

Core Skill:

13. Using tools and machines
14. Reading, writing and computer skills
15. Teamwork and multitasking
16. Communication skills

Detailed Syllabus of Course

S.No.	Module. Name	Duration
1	• Engage with customer for installation	
2	• Install and setup the access control system	
3	• Install Intrusion Detection System	
4	• IDS Setup IDS	
5	• Install CCTV camera	
6	• Setup CCTV surveillance system	
7	• FAS Install FAS detector	
8	• FAS Setup FAS	
9	• Install VDP Outdoor Unit and lock	
10	• Setup VDP Indoor system	
11	• Coordinate with colleagues	
	Total Theory/Lecture	150 Hrs
	Total Practical / Tutorial Hours:	200 Hrs
	Total Hours:	350 Hrs

Recommended Hardware:	
Recommended Software:	
Text Books:	
Reference Books:	

ESDM Courses

Level Code:	L4	**Vertical Name:**	Solar Electronics

Course Code:	EL/S/L4/C007 TL/S/L4/C025	**Course Name:**	2.4.1 Solar Panel Installation Technician (ESSCI/TSSC)

Objective of the Course:

To train the person, who checks the installation site, understands the layout requirement as per design, assesses precautionary measures to be taken, installs the solar panel as per customer's requirement and ensures effective functioning of the system post installation.

Learning Outcomes:

NOS # ELE/N5901 Check site conditions, collect tools and raw materials

1. Understand the work requirement
2. Check out and assess the site condition
3. Understand the installation requirement
4. Collect materials required for installation
5. Ensure quality material usage and appropriate handling mechanism

NOS # ELE/N5902 Install the solar panel

1. Understand the installation and material usage procedure
2. Assess mounting requirements
3. Install the solar panel
4. Connect the system and check for functioning
5. Report and document completion of work
6. Follow quality and safety procedures

NOS # ELE/N9952 Coordinate colleagues at work

1. Interact with supervisor or superior
2. Coordinate with colleagues

NOS # ELE/N9953 Ensure safety at workplace

Follow standard safety procedures while handling an equipment

Participate in company's safety drills and workshops

Expected Job Roles:

Solar Panel Installation Technician

Duration of the Course (in hours)	350 hours
Minimum Eligibility Criteria and pre-requisites, if any	12th passed

Professional Knowledge:

NOS # ELE/N5901 Check site conditions, collect tools and raw materials

KB1. basics on solar energy and power generation systems
KB2. use and handling procedure of solar panels
KB3. energy storage, control and conversion
KB4. basic electrical system and functioning
KB5. mechanical equipment and its functioning
KB6. maintenance procedure of equipment
KB7. site survey, design and evaluation of various parameters
KB8. tools involved in installation of system
KB9. quality and process standards
KB10. occupational health and safety standards

NOS # ELE/N5902 Install the solar panel

KB2. solar energy system components such as panels, batteries, charge controllers, inverters
KB3. significance of volts, amps and watts: series and parallel connection
KB9. voltage requirement of various equipment
KB10. panel mounting and inclination and angle of tilt
KB11. placement of solar panel mounting
KB12. sunlight and direction assessment
KB13. site surveying methods and evaluation parameters
KB14. tools involved in installation of system

NOS # ELE/N9952 Coordinate colleagues at work

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. importance of the individual's role in the workflow
KA3. reporting structure

KB1. how to communicate effectively
KB2. how to build team coordination

NOS # ELE/N9953 Ensure safety at workplace

KB1. how to maintain the work area safe and secure
KB2. how to handle hazardous material
KB3. how to operate hazardous tools and equipment

KB4. emergency procedures to be followed such as fire accidents, etc.

Professional Skill:

i. **Communication skills** ii. **Reading, writing and computer skills** iii. **Teamwork and multitasking** iv. **Reflective thinking** v. **Analytical thinking** **vi. Critical Thinking** vii. **Decision Making**

Core Skill:

1. **Panel Installation Skills** 2. **Using Tools and Machines** 3. **Handling Safety Equipment**

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
	As per the NOSs listed in the Qualification pack	
	Total Theory / Lecture Hours:	48

Total Practical / Tutorial Hours:	72
Total Hours:	120

Recommended Hardware:	1. Different types of Solar panels 2. Screw driver, inspection fixtures, wire cutter, pliers, tester, spanner 3. Different types of Battery
Recommended Software:	NA
Text Books:	NA
Reference Books:	NA

ESDM Courses

Level Code:	4	**Vertical Name:**	Solar Electronics
Course Code:	EL/S/L4/C020	**Course Name:**	2.4.2 Tech Support (ESSCI)

Objective of the Course:

Tech Support: Responsible for collecting Customer requirements by visiting the site and suggest for suitable Solar and LED products model. Also suggest new design to Design team as per Customer's new requirement.

Brief Job Description: The individual at work evaluates the installation site, helps in designs the Solar system and support in Design, plans arranges for materials and ensures smooth installation process.

Personal Attributes: The individual must have: attention to detail, good eye sight, logical thinking, analytical ability and good interpersonal skills.

Learning Outcomes:

NOS # ELE/N5907 Customer interaction

1 Understand the work requirement
2 Engage with customers to understand their requirement
3 Visit and evaluate the site for installation
4 Suggest suitable model of Solar and LED system
5 Support to design new model is the Customer
6 Collect the required material for installation
7 Support in Install the Solar and LED products as per Customer requirement
8 Ensure quality, standards and regulatory requirement are adhered

ELE/N5601 Develop product and market understanding

a. Understand the work requirement
b. Understand about the product
c. Study and research about the market
d. Coordinate with channel partners
e. Initiate meeting with the prospective client
f. Interact and understand the client requirement
g. Record the client details and document the visit
h. Achieve productivity targets set by the company

ELE/N5602 Sell the products and services

a. Offer possible solutions to customers

b. Close the sales
c. Coordinate with channel partners and offer suggestions to improve sales
d. Offer proper documentation and understand post purchase requirements
e. Assist client with installation service
f. Maintain relationship with client
g. Achieve productivity targets set by the company

NOS # ELE/N9953 Ensure safety at workplace

1. Follow standard safety procedures while handling an equipment
2. Participate in company's safety drills and workshops

Entrepreneurship Module

Expected Job Roles:

Solar & LED Technician

Duration of the Course (in hours)	350 Hrs
Minimum Eligibility Criteria and pre-requisites, if any	ITI / Diploma / Graduates

Professional Knowledge:

Professional Skill:

vii. **Interpersonal skills**
viii. **Behavioural skills**
ix. **Reflective thinking**
x. Critical Thinking
xi. **Decision Making**
xii. **Using tools and machines**

Core Skill:

6. Using tools and machines
7. Assembling Skills
8. Reading, writing and computer skills
9. Teamwork and multitasking
10. Communication skills

Detailed Syllabus of Course:

S. No.	Module. Name	Duration
1	Customer interaction	
2	Develop product and market understanding	
3	Sell the products and services	
4	Ensure safety at workplace	
	Total Theory/Lecture	140 Hrs
	Total Practical / Tutorial Hours:	210 Hrs
	Total Hours:	350 Hrs

Recommended Hardware:	Different types of Solar home lighting system, DC system, Different types of Solar panels, Different types of LED lights, Solar lanterns, Multimeter, Mechanical fixtures,
Recommended Software:	
Text Books:	
Reference Books:	

ESDM Courses

Level Code:	L1	**Vertical Name:**	Photovoltaic Segment (Solar Panel)
Course Code:	EL/S/L1/C010	**Course Name:**	2.4.3 Testing of Emergency Light & Solar Lantern (ESSCI)

Objective of the Course:

This Course has been design to provide an introduction to use of Solar Appliances, their assembly, repair and maintenance and installation.

Learning Outcomes:

At the end of the course the learners will be able:

- To assemble the solar lantern and emergency light
- To install solar panels and solar system
- To know the detail operation of solar appliances
- Repair and maintenance of solar lantern, solar panel and emergency light.

Expected Job Roles:

This course will contribute the job potential in the following field:

- Repairing and service centre
- Solar equipments assembling industries
- Different Government Agencies responsible for dissemination/installation of solar equipments as UREDA Uttarakhand
- Different Electronics Industries

Duration of the Course (in hours)	200 Hrs.
Minimum Eligibility Criteria and pre-requisites, if any	8th Pass having Knowledge of Basic Science

Professional Knowledge:

By completing the course the students is supposed to have the following profession knowledge:

- Basics of Electronics
- Working principle and operation of emergency light, solar lantern, battery and solar panels
- Maintenance of Solar appliances

Professional Skill:

- Trouble shooting of Emergency light, Solar lantern
- Preventive and corrective maintenance of solar appliances
- Charging/Discharging and reconditioning of battery

Core Skill:

The following core Skill is to be supposed for the learners

- Basics of Electronics Principles
- Different Electronic and Electrical active and passive components
- Idea of Electronic Circuits
- Application and operation of different Electronic Equipments as multimeter, CRO etc.
- Core efficiencies in soldering practices and use of different related tools
- Knowledge of solar panels and battery
- Preventive and corrective maintenance of related appliances

Detailed Syllabus of Course

S.No.	Topic	Hours	
		Theory	Practical/ Tutorial
1.	Introduction to Basic Electronics	10	20
2.	Trouble shooting Tools and Equipments	10	20
3.	Working principle of Emergency lights	05	20
4.	Working principle of Solar Lantern	05	20
5.	Battery	10	20
6.	Solar Panels	10	20
7.	Repair and maintenance of Emergency Light and Solar Lantern	10	20
	TOTAL	**60**	**140**

Detailed Syllabus

1. Introduction to Basic Electronics 10 Hrs.

Topic
Introduction to Electronics, Types of Material
Intrinsic Semiconductor, Extrinsic Semiconductor
Semiconductor, N-Type Semiconductor, P-Type Semiconductor, Conductivity of N-Type and P-Type Semiconductor
Charge on N-Type and P-Type Semiconductor, Majority and Minority carrier in Semiconductor
PN-Junction, Properties of PN junction
Applying voltage across PN-junction, Current Flow in PN junction
V-I characteristics of PN- junction
Semiconductor diode, Working of diode, specification of diode
Active and Passive component, Testing, Identification, Properties
Rectifier Circuit, Measurement of Voltage, Current and resistance power supply

2. Trouble shooting Tools and Equipments 10Hrs.

Topic
Introduction to Multimeter, Oscilloscope, Soldering/desoldering station, vaccum cleaner, brush, forceps, screw driver set, cutter, pliers, soldering iron, soldering iron, soldering wire, desoldering pump
Soldering Wire Solution, Soldering flux solution, clearing solution, soldering and Desoldering technique

3. Working principle of Emergency lights 05 Hrs.

Topic
Introduction to Emergency Light, Charger Circuit
Working of Tube Light used in Emergency Light
Inverter circuit used in Emergency Light
Change over circuit, change over time, component used in change over circuit

4. Working principle of Solar Lantern 05Hrs.

Topic
Introduction to Solar, Solar Devices
Introduction Solar Lantern, CFL for Solar Lantern
Control Circuit, Sensor Circuit
Voltage Controller Circuit, Charge Circuit

5. Battery 10 Hrs.

Topic
Introduction to Battery, types of Battery
Principle of Cell, Charge on Cell
Charging and discharging of Battery
Lead-Acid Battery
Maintenance free battery
Preventive maintenance of Battery

6. Solar Panels 10Hrs.

Topic
Element of Solar Light
Working of Solar panel

7. Repair and

maintenance of Emergency Light and Solar Lantern 10 Hrs.

Topic
Troubleshooting techniques
Fault Finding
Precaution during fault finding
Fault diagnosis of Emergency Light
Fault diagnosis of Solar Lantern
Removing faulty component in Emergency Light
Removing faulty component in Solar Lantern
Safety Precaution, Preventive maintenance of emergency light and Solar Lantern

Recommended Hardware:

Particulars	
1.Digital Multimeter	02 No.
2.CRO dual Trace	01 No.
3 Electronic Tool Kits	03 No.
4.Battery Charger	01 No.
5.Emergency Light	02 No
6.Solar Lantern with Solar Panel	02 No.
7.Lead-Acid Battery	02 No.
8 Solar Panel	03 No.

Recommended Software:

NIL

Text Books:

1- Concentrating Solar Power Technologies by Keith Lovegrove and west Stein
2- Crystalline Silicon Solar cells by Armin G. Aberle.
3- Third Generation Photovoltaic by Martin A.Green

Reference Books:

1- Silicon Solar cell by Martin A. Green
2- Solar Electricity Hand Book 2014 Edition by Michael Box Well
3- Solar Power Our Home for Dummles by Rik De Gunther

ESDM Courses

Level Code:	L4	**Vertical Name:**	PCB Assembly

Course Code:	EL/S/L4/C008 TL/S/L4/C026	**Course Name:**	2.5.1 Pick and Place Assembly Operator (ESSCI/TSSC)

Objective of the Course:

To train the person, who programs, operates and maintains the automated pick-and-place machine for placing different types of components on the surface of PCBs for soldering.

Learning Outcomes:

NOS # ELE/N5102 - Operate pick-and-place machine

1. Program and load the pick and place machine
2. Load components and operate the machine for assembling on PCBs
3. Check visually and ensure after assembly cycle is complete
4. Undertake preventive maintenance on the machine
5. Achieve productivity and quality standards

NOS # ELE/N9919 - Work with superiors and colleagues

1. Interact with supervisor or superior
2. Coordinate with colleagues

NOS # ELE/N9920 - Follow safety procedures

1. Understand potential sources of accidents
2. Use safety gear to avoid accidents
3. Understand the safety procedures followed by the company

Expected Job Roles:

Pick and Place Operator

Duration of the Course (in hours)	350 hours
Minimum Eligibility Criteria and pre-requisites, if any Professional Knowledge:	12th Passed

NOS # ELE/N5102 - Operate pick-and-place machine

KB1. basic electronics and component identification
KB2. pick-and-place machine functioning and controls
KB3. basic programming and loading
KB4. setting up, loading pick-and-place machine
KB5. techniques of cleaning stencil
KB6. colour codes and polarity of components
KB7. regulation of operating speed and temperature
KB8. LEDs and special mounting tecnique, junction temperature, types of assembly, metal core PCB, spike correction
KB9. operation of LED mounting machine
KB10. Electro-static discharge (ESD) precautions
KB11. manual soldering and rework of SMT components
KB12. PCB design basics
KB13. commonly ocuring machine defects

NOS # ELE/N9917 - Interact with superiors and colleagues

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. work flow involved in company's process
KA3. importance of the individual's role in the workflow
KA4. reporting structure

KB1. how to communicate effectively
KB2. how to build team coordination

NOS # ELE/N9918 - Follow safety standards

KB1. how to maintain the work area safe and secure
KB2. how to handle hazardous material
KB3. how to follow safety procedures while operating hazardous tools and equipment
KB4. emergency procedures to be followed such as fire accidents and fire safety education
KB5. how to use machines and tools without causing bodily harm
KB6. first aid execution
KB7. disposal of hazardous chemicals, tools and materials by following prescribed environmental norms or as per company policy

Professional Skill:

i. **Communication skills**
ii. **Reading, writing and computer skills**
iii. **Teamwork and multitasking**
iv. **Reflective thinking**
v. Critical Thinking
vi. **Decision Making**

Core Skill:

1. **Operating Machines and Material Handling**
2. **Using Tools and Machines**
3. **Problem Solving & trouble shooting**
4. **Arithmetic and Geometry Skills**
5. **Handling Safety Equipment**

Detailed Syllabus of Course

ModuleNo	Module. Name	Minimum No. of Hours

	As per the NOSs listed in the Qualification pack	

Total Theory / Lecture Hours:	48
Total Practical / Tutorial Hours:	72
Total Hours:	120

Recommended Hardware:

1. Pick and Place system
2. Sample PCB boards
3. Sample components
4. Solder paste and Flux
5. Calipers, microscope, screwdrivers, pliers, cutters, stencils, feeders, supporting pins, and other SMT tools

Recommended Software:

NA

Text Books:

NA

Reference Books:

NA

ESDM Courses

Level Code:	L2	**Vertical Name:**	Industrial Electronics

Course Code:	EL/S/L2/C011 TL/S/L2/C028	**Course Name:**	2.6.1 Wireman – Control Panel (ESSCi/TSSC)

Objective of the Course:

To train the person who is responsible for wiring all components present within the panel as per specifications provided by the design engineering team.

Learning Outcomes:

NOS # ELE/N7302 Wire control panel:

1. Understand work requirement from the supervisor
2. Wire the control panel
3. Report problems to supervisor
4. Achieve productivity, quality and safety standards as per company's norms

NOS # ELE/N9962 - Interact with other employees

1. Interact with supervisor or superior
2. Coordinate with colleagues

ELE/N9963 Maintain safe work surroundings

1. Follow standard safety procedures of the company
2. Participate in company's safety and fire drills
3. Maintain good posture at work for long term health

Expected Job Roles:

Wireman Control panel

Duration of the Course (in hours)	200 hours
Minimum Eligibility Criteria and pre-requisites, if any	8th Pass

Professional Knowledge:

NOS # ELE/N7302- wire control panel

KA1. company's policies on: incentives, delivery standards and personnel management
KA2. reporting and documentation processes
KA3. importance of the individual's role in the workflow
KA4. reporting structure
KB1. electro-mechanical assembly and wiring instructions
KB2. hazards associated with panel assembly and wiring and how to avoid them
KB3. general principles of wiring and assembly
KB4. insulation stripping, securing of cables and wires, cable routing, cable forming or bending, colour coding wires and cables
KB5. types of cables such as single and multi-core fibre optic cables, etc.
KB6. types of components and sub-assemblies used in the panel assembly process
KB7. preparations and precautions to be taken on the components and the panel before assembly process
KB8. basics of automation and electro mechanical control systems
KB9. regulations applicable during selection of wiring/cabling
KB10. methods of attaching labels, warning signs on the panel
KB11. operation of PLCs, relays, contactors, circuit breakers, solenoids, actuators, controllers, etc.
KB12. motors, generators, starters and their controls
KB13. safety norms in handling electrical/electronic components and electrostatic discharge
KB14. customer safety requirements for all projects being implemented and other applicable safety standards
KB15. ISO standards and procedures applicable for assembly activities

KB16. fundamentals of electricity such as Ohms law, difference between AC and DC, series and parallel connections
KB17. components such as diode, transformer, LED, transistor, capacitor, resistor, inductor, thermistor, IC
KB18. how to read values, colour coding, polarity, orientation, tolerance
KB19. specific safety precautions while working in an electronic assembly unit
KB20. protective gear such as goggles, gloves, rubber shoes, etc.
KB21. selection and maintenance of various tools used during the assembly process
KB22. frequently occurring errors, causes and preventive measures
KB23. work place norms such as 5S and Kaizen

ELE/N9962interact with co-workers
KA2. importance of the individual's role in the workflow
KA3. reporting structure
KB1. how to communicate effectively
KB2. how to build team coordination

ELE/N9963Maintain safe work surrounding
KA2. company occupational safety and health policy followed
KA3. company emergency evacuation procedure
KA4. company's medical policy
KB1. how to maintain the work area safe and secure
KB2. how to handle hazardous materials, tools and equipment
KB3. Emergency procedures to be followed such as fire accidents, etc.
KB4. long term value of good posture and use of appropriate handling equipment

Professional Skill:

1. **Interpersonal skills**
2. **Communication skills**
3. **Behavioural skills**
4. **Reading, writing and computer skills**
5. **Teamwork and multitasking**
6. **Documentation Skills**
7. **Reflective thinking**
8. **Critical Thinking**
9. **Decision Making**

Core Skill:

1.**Electro-mechanical assembling skills** **2.Using tools and machines** **3.Interpersonal skills** **4.Analytical and reflective skills**

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
	As per the NOSs listed in the Qualification pack	
	Total Theory / Lecture Hours:	75
	Total Practical / Tutorial Hours:	125
	Total Hours:	200

Recommended Hardware:	1. Different type of Control panels 2. Screw driver, ratchets, spring driver, speciality wrenches, inspection fixtures, wire cutter, pliers, tester, spanner, hammer, hand bender, ladder, knife, voltmeter, ammeter, wattmeter, MEGGER
Recommended Software:	NA

Text Books:	NA
Reference Books:	NA

ESDM Courses

Level Code:	L3	**Vertical Name:**	Industrial Electronics

Course ID:	**NL/S/L3/C003** **EL/S/L3/C022** **TL/S/L3.C033**	**Course Name:**	2.6.2 Repair & Maintenance of Power Supply, Inverter & UPS (NIELIT/ESSCI/TSSC)

Objective of the Course:

This course has been designed to provide knowledge of repair and maintenance of Power Supply, Inverter and UPS. The participant will be able to troubleshoot problems of CVT, Inverter and UPS

Learning Outcomes:

At the end of the course the participants will be having knowledge of:-

- Electrical and Electronics Component
- UPS parts and repair
- Inverter, CVT and its operation, parts and installation
- Tools and Equipment used in Repair and Maintenance of Inverter, UPS etc.
- Troubleshooting Techniques

Expected Job Roles:

Inverter Repair Technician, UPS Repair Technician, Power Supplies Repair Technician

Duration of the Course (in hours)	350

Minimum Eligibility Criteria and pre-requisites, if any	10^{th} Pass/ITI

Professional Knowledge:

The individual on the job needs to know and understand:

PK1. Knowledge of Electronic and Electrical Components
PK2. Resistors, Capacitors and Inductors, their identification, types and application
PK3. Protection equipment (anti-static wrist bands, shoes, dress, packaging, and other appropriate insulations) that are required to be used
PK4. First aid requirements in case of electrical shocks, cuts and other common injuries
PK5. Soldering and De-Soldering Techniques
PK5. Need of stabilizer, working principle, types of stabilizer
PK6. Constant Voltage transformer, General Circuit diagram of CVT, Working principle of CVT
PK7. EMI/RFI filter, Surge Suppressor, Repairing of CVT
PK8. Introduction to Inverter, Block diagram of Inverter
PK9. UPS, Working principle, specifications, explanation with the help of block diagram
PK10. Find the total Load and Select suitable Inverter/UPS
PK11. Range of tools and testing equipment available and their functionality
PK12. Construction of Battery, Case Cover plates, Separator, Cells, Electrolyte, etc
PK13. Factor affecting charging, Cause of battery failure, diagnosis and testing, visual inspection, Heavy load test Standard fault-finding (troubleshooting) techniques
PK14. Component testing methods
PK15. Troubleshooting through circuit diagram
PK16. Removal and Replacement of faulty Component
PK17.

Professional Skill:

The individual on the job needs to know and understand:

Electrical and Electronic Component Identification and Use Skills

PS1. Understand use of Electrical Component such as cable, switches, transformers etc.
PS2. Understand use of Electronics Component such as Diodes, Transistors, ICs etc.
PS3. Use of Test and Measurement Equipment

Soldering skills

PS4. Understand Soldering Requirements
PS5. Operation of Equipment required for Soldering
PS6. Use of Desoldering Pump

Stabilizer and CVT Repairing Skill

PS7. Working principle, types of stabilizer
PS8. Transformer employed in stabilizer, multiwinding/multitaped transformer
PS9. Understanding General Circuit diagram of CVT, Working principle of CVT
PS10. Finding fault in Stabilizer and CVT
PS11. Replace faulty components in Stabilizer and CVT

Inverter and UPS Repairing Skill

PS12. Working principle of Inverter and UPS
PS13. Working Principle of Rectifier
PS14. Finding fault in Inverter and UPS
Replace faulty components in Inverter and UPS

Troubleshooting Skills

PS15. How to approach a defect
PS16. Make use of standard OEM specified troubleshooting steps
PS17. Interpret intermediate results and progress fault rectification accordingly
PS18. Utilize appropriate tools to rectify faults

Core Skill:

The individual on the job needs to know and understand how to:

Reading skills

CS1. Read and understand technical manuals, work orders and reports

CS2. Read and understand organizational health and safety instructions

Writing Skills

CS3. Fill up record sheets clearly, concisely and accurately as per company procedures

Communication Skills

CS4. Clearly communicate relevant information to supervisors

CS5. Respond appropriately to queries

CS6. Communicate with customer/customer facing teams to understand handset performance issues

CS7. Communicate in the local language

CS8. Convey proposed solution to the customers

Time Management Skills

CS9. Prioritize and execute tasks in a high-pressure environment

CS10. Use and maintain resources efficiently and effectively

Analytical Skills

CS11. Analyse (and understand) customer complaints

CS12. Interpret reports, readings and numerical data

CS13. Keep up to date with new technology and performance issues

Other Skills

CS14. Create and maintain effective working relationships and team environment through collaboration

CS15. Take initiatives and progressively assume increased responsibilities

CS16. Share knowledge with other team members and colleagues

Detailed Syllabus of Course

Sl. No.	Modules	Min: No. of Hours Theory/ Practical
1.	**Introduction to Electricity** Electric Charge, Voltage, Electric Current Ohm's Law, Electric Potential, Cell Serial and Parallel Circuit, their effect on Voltage and Current Transformer, Use and Operation	5 / 5

2.	**Electronic and Electrical components** Active and Passive Components Resistors, Capacitors and Inductors, their identification, types and application Semiconducting Devices: Diodes, its type, characteristics and applications Transistors, Integrated Circuits Study of a transistor, use of a transistor as an amplifier and as a switch. Analog ICs, 555 timer, IC741, characteristics of 741 Digital ICs, ICs for logic gates, Truth table verification of logic gates Connectors Fuse, types, Use of Fuses and its rating Relays and Switches Panel Components Digital electronics – gates and its application, multiplexers, de-multiplexers, counter	15 / 15
3.	**Soldering/ de- soldering techniques** Soldering Iron, Soldering wire, Soldering Flux, Soldering method, Zero defect soldering Desoldering pump, Temperature controlled soldering station, Hands-on-practices of Soldering)	10 / 10
4.	**Tools and equipment use for Repairing and maintenance of Electrical Equipment** Screw Driver Set Tweezers, Different Types of Tweezers, Nose Pliers, Wire Cutter Hot air gun Liquid solder pest, Magnifying Lamp and Measuring Tools Brush, CRO, Nipper Test and Measurement Equipment, Multimeter Operation etc.	10 / 10
5.	**Stabilizer and CVT** Need of stabilizer, working principle, types of stabilizer Autocut and automatic stabilizer, Servo Stabilizer, Study of Control Circuit of Stabilizer Transformer employed in stabilizer, multiwinding/multitaped transformer Introduction to Constant Voltage transformer, General Circuit diagram of CVT, Working principle of CVT EMI/RFI filter, Surge Suppressor, Repairing of CVT	20 / 30
6.	**Inverter and UPS** Introduction to Inverter, Block diagram of Inverter	20 / 30

	Rectifier, its type and working principle, PIV of Diode, Filter employed in rectifier Battery charger circuit, working of Inverter Oscillator, type of Oscillator, Square wave Generator PWM, DC to AC Convertor/Invertor, Designing an investor, Circuit using PWM UPS, Working principle, specifications, explanation with the help of block diagram UPS Installation Find the total Load and Select suitable Inverter/UPS	
7.	**Battery** Battery types, Primary Cell, Secondary Cell, Wet- charged, Dry-charged, Low maintenance Construction of Battery, Case Cover plates, Separator, Cells, Electrolyte, etc Lead Acid battery, Electrochemical reaction, N1-CD battery, Capacity rating, CCA, RC, AH & Power(watt) Factor affecting charging, Cause of battery failure, diagnosis and testing, visual inspection, Heavy load test	10 / 20
8.	**Troubleshooting techniques** Basic troubleshooting method, Getting into troubleshooting, selected instruments for troubleshooting Component testing methods, Testing of components in circuits , Logical steps of fault finding, Troubleshooting through circuit diagram Removal and Replacement of faulty component	40 / 60
9.	**Safety and Security Procedures** Reporting incidents, system failures, power failures etc., protection equipment First aid requirement in case of electrical shocks and other injuries	5 / 5
10.	**Reading, Writing and Communication Skills** Understanding Technical Manuals, Reports, Work orders etc. Understanding Organizational health and safety instructions Types of documentation in organization, their importance, Company guidelines and norms, activities after maintenance process Spare management, Service Level Agreements (SLAs) Fill-up forms, record sheets, log book etc. as per company procedures Customer Communication, Convey proposed solution to the customer, responding queries	15 /15

	Communication with supervisor, Report for unresolved problems Time Management and Team Skills	

Total Theory / Lecture Hours:	**150** hrs
Total Practical / Tutorial Hours:	**200** hr
Total Hours:	**350** hrs

Recommended Hardware:

For a batch size of 50Nos

1. Resistance of different value and Wattage ratings 20 nos. each
2. Capacitor of different types 20 nos. each
3. Transistors – BC 546, BC 547, SL 100, 2N3055 10 nos. each
4. Rectifier Diode 20 Nos.
5. Zener Diode of different values 10 nos. each
6. Step down Transformers of different ratings 04 nos. each
7. LED of different colours 20 nos. each
8. 3 Pin Voltage Regulators 05 nos. each
9. Logic GATE ICs 10 nos. each
10. Tool Kit 05 sets
11. Digital Multimeter 05 nos.
12. CRO 02 nos.
13. Soldering Iron 05 nos.
14. Solder Wire 250 gms
15. Soldering Flux 100 gms.
16. Microwatt Soldering Iron 02 nos
17. Desoldering Station 02 nos.
18. Desoldering Pump 05 nos.
19. Inverter 2 set
20. UPS 2 set
21. Stabilizer/CVT 5 nos
22. Battery Charger 1 No.

Recommended Software:

NA

Text Books:

1. Basic Electronics - Repair & Maintenance of Power supply, Invertor & UPS – NIMI Published by National Instructional Media Institute, Chennai
2. Switching Power Supply Design, 3rd Ed. by Abraham Pressman (Author),
3. Uninterruptible Power Supplies Alexander King, William Knight McGraw Hill Professional

Reference Books:

- user/service manuals

ESDM Courses

Level Code:	4	**Vertical Name:**	Electronic Security
Course Code:	EL/S/L4/C019	**Course Name:**	2.7.1 Security System Installer (ESSCI)

Objective of the Course:

Brief Job Description: Understanding the customer's requirements for installing the various types of electronic security systems and configuring the system for security functions

Learning Outcomes:

NOS # ELE/N4616 Engage with customer for installation

- Interact with the customer
- Understand their requirements
- Visit the site
- Understand the site condition and requirement
- Suggest possible solutions
- Decide on the system to be installed
- Achieve productivity and quality standards

NOS # ELE/N4617 Install and setup the access control system

- Procure the hardware required for installation
- Test the access control hardware before installation
- Install the wiring
- Install and setup the access controls
- Setup the system
- Use appropriate tools and equipment for installation

NOS # ELE/N4610IDS Install Intrusion Detection System

- Procure the hardware required for installation.
- Test the hardware before installation.
- Connect the cables.
- Install and setup the IDS.
- Use appropriate tools and equipments for installation.
- Achieve productivity and quality standards.

NOS # ELE/N4611IDS Setup IDS

- Procure the hardware required for installation.
- Test the hardware before installation.
- Connect the cables.
- Install and setup the IDS.
- Use appropriate tools and equipments for installation.
- Achieve productivity and quality standards.

NOS # ELE/N4610 Install CCTV camera

- Procure the hardware required for installation
- Test the hardware before installation
- Connect the cables
- Install and setup the camera
- Use appropriate tools and equipments for installation
- Achieve productivity and quality standards

NOS# ELE/N4611 Setup CCTV surveillance system

- Connect CCTV camera and DVR with the system
- Setup the CCTV system
- Ensure system functioning and perform a demo
- Complete the installation task and report
- Interact with customer
- Interact with superior
- Achieve productivity and quality as per company's norms

NOS# ELE/N4610FAS Install FAS detector

- Procure the hardware required for installation.
- Test the hardware before installation.
- Connect the cables.
- Install and setup the detectors, devices & Control Panels.
- Use appropriate tools and equipments for installation.
- Achieve productivity and quality standards.

NOS #ELE/N4611FAS Setup FAS

- Connect FAS detectors and devices with the Fire Alarm Control Panel.
- Setup the Fire Alarm System.
- Ensure system functioning and perform a demo.
- Complete the installation task and report.
- Interact with customer.
- Interact with superior.
- Achieve productivity and quality as per company's norms.

NOS # ELE/N4610 Install VDP Outdoor Unit and lock

- Procure the hardware required for installation
- Test the hardware before installation
- Connect the cables
- Install and setup the indoor and outdoor units.
- Use appropriate tools and equipments for installation
- Achieve productivity and quality standards

NOS # ELE/N4611 Setup VDP Indoor system

- Connect outdoor units and lock with the Indoor unit

- Setup the Video Door Phone system
- Ensure system functioning and perform a demo
- Complete the installation task and report
- Interact with customer
- Interact with superior
- Achieve productivity and quality as per company's norms

NOS # ELE/N0009 Coordinate with colleagues

- Interact with supervisor or superior
- Coordinate with colleagues

Expected Job Roles:

Installation technician of Electronic Security Systems

Duration of the Course (in hours)	350 Hrs
Minimum Eligibility Criteria and pre-requisites, if any	ITI / Diploma
Professional Knowledge:	

NOS # ELE/N4616 Engage with customer for installation

KA1. company's policies on: customer care, warranties, products
KA2. company's code of conduct
KA3. organisation culture and typical customer profile
KA4. company's reporting structure
KA5. company's documentation policy
KA6. company's service level agreements and policies
KB1. Installation requirement in terms of equipment, system , tools, applications appropriate for a particular site
KB2. preparation of field and site for installation
KB3. design criteria for installation

KB4. location criteria for installation
KB5. different types of equipments in the market, their specifications and prices
KB6. different types of and associated systems
KB7. different types of and their purposes
KB8. tools and equipment to carry for installations
KB9. precautions to be taken while handling field calls and dealing with customers
KB10. relevant reference sheets, manuals and documents to carry in the field

NOS # ELE/N4617 Install and setup the access control system

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. company's sales and after sales support policy
KA3. importance of the individual's role in the workflow
KA4. reporting structure
KA5. company's policy on product's warranty and other terms and conditions
KA6. company's line of business and product portfolio
KA7. company's customer support and service policy
KB1. basic electronics involved in the hardware
KB2. basic electrical and wiring techniques
KB3. different types of access control products and functionalities
KB4. functions of electrical and mechanical parts/ modules
KB5. typical customer profile
KB6. dismantling and assembling of hardware equipment
KB7. access control system concepts such as for master controller, card reader, door control units, smart-hub, etc.
KB8. company's portfolio of products and that of competitors
KB9. installation procedures given in the manuals
KB10. specification and the procedures to be followed for setting up the system
KB11. different type of cables used for data transmission and power transmission
KB12. power requirement of hardware
KB13. different types of access controls hardware available in the market
KB14. software requirement associated with acces controls
KB15. computing system and operating system requirements for access control system installation
KB16. voltage and power requirement for different hardware devices
KB17. how to operate the system and other hardware
KB18. all safety rules, policies and procedures
KB19. quality standards to be followed

NOS # ELE/N4610IDS Install Intrusion Detection System

KA1. company's policies on: incentives, delivery standards, and personnel Management.
KA2. company's sales and after sales support policy.
KA3. importance of the individual's role in the workflow.
KA4. reporting structure.
KA5. company's policy on product's warranty and other terms and conditions.
KA6. company's line of business and product portfolio.
KA7. company's customer support and service policy.
KB1. basic electronics involved in the hardware.
KB2. basic electrical and wiring.
KB3. different types of electronic Intrusion Detection and Alarm products and their Functionalities.
KB4. functions of electrical and mechanical parts or modules.
KB5. typical customer profile.
KB6. elements of IDS systems such as IDS sensors, IDS panel. Kb 7 company's portfolio of products and that of competitors.
KB8. installation procedures given in the manuals.
KB9. specification and the procedures to be followed for setting up the system. KB10. different type of cables used for data transmission and power transmission for a wired system.
KB11. power requirement of different IDS related equipment.
KB12. different types of IDS sensors available in the market.
KB13. IDS sensor specifications such as sensitivity, threshold, etc.
KB14. controls of different options in IDS sensors such as NO, NC Sensors.
KB15. voltage and power requirement for different hardware devices.
KB16. how to operate the system and other hardware.
KB17. safety rules, policies and procedures
KB18. quality standards to be followed

NOS # ELE/N4611IDS Setup IDS

KA1. company's policies on: incentives, delivery standards, and personnel management.
KA2. company's sales and after sales support policy.
KA3. importance of the individual's role in the workflow.
KA4. reporting structure.
KA5. company's policy on product's warranty and other terms and conditions.
KA6. company's line of business and product portfolio
KB1. different types of electronic IDS products and functionalities.
KB2. functions of electrical and mechanical parts/ modules.

KB3. specification and the procedures to be followed for setting up the system. KB4. different type of cables used for data transmission and power transmission.
KB5. different types IDS related equipment, different types of IDS Sensor, and Panels available in the market
KB6. IDS Sensor and Panels Specifications, such as, Sensitivity, Area of Coverage, etc.
KB7. controls of different options in IDS Panels.
KB8. voltage and power requirement for different hardware devices.
KB9. integration of hardware to setup the system.
KB10. parameters and specification for different types of system integration.
KB11. accessing IDS from remote locations.
KB12. IDS monitoring and control.
KB13. technology and networking principles.
KB14. basics of wireless Technology.
KB15. controls in IDS Panel and their usage.
KB16. how to operate the system and other hardware. KB17. safety rules, policies and procedures.
KB18. quality standards to be followed.

NOS # ELE/N4610 Install CCTV camera

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. company's sales and after sales support policy
KA3. importance of the individual's role in the workflow
KA4. reporting structure
KA5. company's policy on product's warranty and other terms and conditions
KA6. company's line of business and product portfolio
KA7. company's customer support and service policy
KB1. basic electronics involved in the hardware
KB2. basic electrical and wiring
KB3. different types of electronic surveillance products and functionalities
KB4. functions of electrical and mechanical parts or modules
KB5. typical customer profile
KB6. elements of CCTV systems such as camera, DVR, monitor
KB7. company's portfolio of products and that of competitors
KB8. installation procedures given in the manuals
KB9. specification and the procedures to be followed for setting up the system
KB10. different type of cables used for data transmission and power transmission
KB11. power requirement of different CCTV related equipment
KB12. video recording of footage – analog and digital

KB13. different types of camera available in the market
KB14. camera specifications such as focus, lens type, zoom
KB15. controls of different options in camera such as rotation, speed of movement in pan / tilt camera
KB16. voltage and power requirement for different hardware
KB17. how to operate the system and other hardware
KB18. safety rules, policies and procedures
KB19. quality standards to be followed

NOS # ELE/N4611 Setup CCTV surveillance system

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. company's sales and after sales support policy
KA3. importance of the individual's role in the workflow
KA4. reporting structure
KA5. company's policy on product's warranty and other terms and conditions
KA6. company's line of business and product portfolio
KB1. different types of electronic surveillance products and functionalities
KB2. functions of electrical and mechanical parts/ modules
KB3. specification and the procedures to be followed for setting up the system
KB4. different type of cables used for data transmission and power transmission
KB5. power requirement of different CCTV related equipment
KB6. video recording of footage – analog and digital
KB7. different types of camera available in the market
KB8. camera specifications such as focus, lens type, zoom
KB9. controls of different options in camera such as rotation, speed of movement in pan / tilt camera
KB10. voltage and power requirement for different hardware devices
KB11. integration of hardware to setup the system
KB12. parameters and specification for different types of system integration
KB13. accessing image from remote locations
KB14. CCTV monitoring and control over IP network / Internet
KB15. IP technology and networking principles
KB16. basics of networking
KB17. video recording technologies
KB18. controls in digital video recorder and their usage

KB19. how to operate the system and other hardware
KB20. safety rules, policies and procedures
KB21. quality standards to be followed

NOS # ELE/N4610FAS Install FAS detector

KA1. company's policies on: incentives, delivery standards, and personnel Management.
KA2. company's sales and after sales support policy.
KA3. importance of the individual's role in the workflow.
KA4. reporting structure.
KA5. company's policy on product's warranty and other terms and conditions.
KA6. company's line of business and product portfolio.
KA7. company's customer support and service policy
KB1. basic electronics involved in the FAS hardware.
KB2. basic electrical and wiring.
KB 3. Functioning of Fire Alarm System.
KB4. different types of electronic detection equipment and their functionalities.
KB5. Conventional and Addressable Fire Alarm Systems.
KB6. Elements of FAS systems such as Detector, Fire Panel, Sounder, Control Module, Monitor Module, etc.
KB7. company's portfolio of products and that of competitors. KB8. installation procedures given in the manuals.
KB9. specification and the procedures to be followed for setting up the system. KB10. different type of cables used for FAS.
KB11. power requirement of FAS Equipment.
KB12. different types of detectors and devices available in the market.
KB13. detector specifications such as smoke, heat, Rate of-rise or flame detector.
KB14. Installation of detectors & devices and assigning addresses to them.
KB15. how to operate hardware and the complete system.
KB16. safety rules, policies and procedures.
KB17. Various Quality Standards and Certifications, such as, UL, FM, NFPA, etc.
KB18. Integration with other Systems

NOS # ELE/N4611FAS Setup FAS

KB11. power requirement of FAS Equipment.
KB12. different types of detectors and devices available in the market.
KB13. detector specifications such as smoke, heat, Rate of-rise or flame detector.
KB14. Installation of detectors & devices and assigning addresses to them.
KB15. how to operate hardware and the complete system.
KB16. safety rules, policies and procedures.
KB17. Various Quality Standards and Certifications, such as, UL, FM, NFPA, etc.
KB18. Integration with other Systems.

NOS # ELE/N4610 Install VDP Outdoor Unit and lock

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. company's sales and after sales support policy
KA3. importance of the individual's role in the workflow
KA4. reporting structure
KA5. company's policy on product's warranty and other terms and conditions
KA6. company's line of business and product portfolio
KA7. company's customer support and service policy
KB1. basic electronics involved in the hardware
KB2. basic electrical and wiring
KB3. different types of electronic surveillance products and functionalities
KB4. functions of electrical and mechanical parts or modules
KB5. typical customer profile
KB6. Elements of VDP systems such as indoor units, outdoor units, locks
KB7. company's portfolio of products and that of competitors KB8. installation procedures given in the manuals
KB9. specification and the procedures to be followed for setting up the system KB10. different type of cables used for data transmission and power transmission KB11. power requirement of different VDP related equipment
KB12. VDP system– coloured and monochrome
KB13. different types of VDP systems available in the market
KB14. VDP specifications such number of indoor systems and outdoor systems

KB15. options in connection of locks , number of indoor
KB16. voltage and power requirement for different hardware devices
KB17. how to operate the system and other hardware
KB18. safety rules, policies and procedures
KB19. quality standards to be followed

NOS # ELE/N4611 Setup VDP Indoor system

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. company's sales and after sales support policy
KA3. importance of the individual's role in the workflow
KA4. reporting structure
KA5. company's policy on product's warranty and other terms and conditions
KA6. company's line of business and product portfolio
KB1. different types of electronic surveillance products and functionalities
KB2. functions of electrical and mechanical parts/ modules
KB3. specification and the procedures to be followed for setting up the system KB4. different type of cables used for data transmission and power transmission KB5. power requirement of different VDP related equipment
KB6. VDP system – colour or monochrome system.
KB7. different types of VDP systems available in the market
KB8. specifications such as light condition, vandal proof, IR
KB9. different options in outdoor units like IR, hard plastic, tamper proof
KB10. voltage and power requirement for different hardware devices
KB11. integration of hardware to setup the system
KB12. parameters and specification for different types of system integration
KB13. accessing input or output from remote locations
KB14. VDP and control from indoor unit
KB15. Technologies used in VDP
KB16. how to operate the system and other hardware
KB17. safety rules, policies and procedures
KB18. quality standards to be followed

NOS # ELE/N0009 Coordinate with colleagues

KA1. company's policies on: incentives, delivery standards, and personnel

management
KA2. importance of the individual's role in the workflow
KA3. reporting structure
KB1. how to communicate effectively
KB2. how to build team coordination

Professional Skill:

xxx. **Interpersonal skills**
xxxi. **Behavioural skills**
xxxii. **Reflective thinking**
xxxiii. Critical Thinking
xxxiv. **Decision Making**
xxxv. **Using tools and machines**

Core Skill:

17. Using tools and machines
18. Reading, writing and computer skills
19. Teamwork and multitasking
20. Communication skills

Detailed Syllabus of Course:

S.No.	Module. Name	Duration
1	• Engage with customer for installation	
2	• Install and setup the access control system	
3	• Install Intrusion Detection System	

4	• IDS Setup IDS	
5	• Install CCTV camera	
6	• Setup CCTV surveillance system	
7	• FAS Install FAS detector	
8	• FAS Setup FAS	
9	• Install VDP Outdoor Unit and lock	
10	• Setup VDP Indoor system	
11	• Coordinate with colleagues	
	Total Theory/Lecture	150 Hrs
	Total Practical / Tutorial Hours:	200 Hrs
	Total Hours:	350 Hrs

Recommended Hardware:	Different types of CCTV, Access control system
Recommended Software:	
Text Books:	
Reference Books:	

ESDM Courses

Level Code:	L1	**Vertical Name:**	Office Automation
Course ID:	**NL/S/L1/C001**	**Course Name:**	2.8.1 Installation & Maintenance of Photocopiers and Printers (NIELIT)

Objective of the Course:

This course has been designed to provide an introduction to installation and maintenance of Photocopiers and Printers. The participant will be able to troubleshoot problems of Photocopiers and Printers.

Learning Outcomes:

At the end of the course the participants will be having knowledge of:-

- Basic Electricity, Electrical and Electronic Components
- Soldering and De-soldering Techniques
- Tools and Equipment used
- Repair and maintain Photocopiers and Printers
- Troubleshooting Techniques

Expected Job Roles:

Photocopier and Printer Repair Technician

Duration of the Course (in hours)	200

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

Professional Knowledge:

The individual on the job needs to know and understand:

PK1. Knowledge of Electronic and Electrical Components
PK2. Resistors, Capacitors and Inductors, their identification, types and application
PK3. Protection equipment (anti-static wrist bands, shoes, dress, packaging, and other appropriate insulations)
PK4. that are required to be used
PK5. First aid requirements in case of electrical shocks, cuts and other common injuries
PK5. Soldering and De-Soldering Techniques
PK6. Principle of Operation of Photocopier
PK7. Dismantling and assembling of paper feed mechanism, paper tray, Thermal unit and Toner Unit.
PK8. Identify the various sensors used in the copier and their fixtures.
PK9. Paper trays, Paper feed mechanism and the sensors used for paper movement
PK10. Periodic cleaning and servicing of copier machines
PK11. Printers and their types
PK12. Thermal Printers and Inkjet Printer, their Working Principle
PK13. Laser Printers and its operation
PK14. Different Parts of Printer
PK15. Cartridges, toner, drum, their use and its replacement
PK16. Overall fault finding and repair of Printer
PK17. Standard fault-finding (troubleshooting) techniques
PK18. Component testing methods
PK19. Troubleshooting through circuit diagram
PK20. Removal and Replacement of faulty Component

Professional Skill:

The individual on the job needs to know and understand:

Electrical and Electronic Component Identification and Use Skills

PS1. Understand use of Electrical Component such as cable, switches, transformers etc.
PS2. Understand use of Electronics Component such as Diodes, Transistors, ICs etc.
PS3. Use of Test and Measurement Equipment

Soldering skills

PS4. Understand Soldering Requirements
PS5. Operation of Equipment required for Soldering
PS6. Use of Desoldering Pump

Photocopier Repairing Skill

PS7. Understand Operation of Photocopier
PS8. Dismantling and assembling of paper feed mechanism, paper tray, Thermal unit and Toner Unit.
PS9. Identify the various sensors used in the copier and their fixtures.
PS10. Fault finding and repairing in electrostatic high voltage unit.
PS11. Dismantling and fitting of drum unit- cleaning of drum unit
PS12. Dismantling and refitting of Carriage unit , mirror unit and light unit
PS13. Periodic cleaning and servicing of copier machines
PS14. Overall fault finding and repair a photo copier machine.

Printer Repairing Skill

PS15. Understand Working Principle of Thermal Printers and Inkjet Printer
PS16. Understand Operation of Laser Printers
PS17. Different Parts of Printer and their use
PS18. Cartridges, toner, drum, their use and its replacement
PS19. Overall fault finding and repair of Printers

Troubleshooting Skills

PS20. How to approach a defect
PS21. Make use of standard OEM specified troubleshooting steps
PS22. Interpret intermediate results and progress fault rectification accordingly
PS23. Utilize appropriate tools to rectify faults

Core Skill:

The individual on the job needs to know and understand how to:

Reading skills

CS1. Read and understand technical manuals, work orders and reports

CS2. Read and understand organizational health and safety instructions

Writing Skills

CS3. Fill up record sheets clearly, concisely and accurately as per company procedures

Communication Skills

CS4. Clearly communicate relevant information to supervisors

CS5. Respond appropriately to queries

CS6. Communicate with customer/customer facing teams to understand handset performance issues

CS7. Communicate in the local language

CS8. Convey proposed solution to the customers

Time Management Skills

CS9. Prioritize and execute tasks in a high-pressure environment

CS10. Use and maintain resources efficiently and effectively

Analytical Skills

CS11. Analyse (and understand) customer complaints

CS12. Interpret reports, readings and numerical data

CS13. Keep up to date with new technology and performance issues

Other Skills

CS14. Create and maintain effective working relationships and team environment through collaboration

CS15. Take initiatives and progressively assume increased responsibilities

CS16. Share knowledge with other team members and colleagues

Detailed Syllabus of Course

Sl. No.	Modules	Min: No. of Hours Theory/ Practical
1.	**Introduction to Electricity** Electric Charge, Voltage, Electric Current Ohm's Law, Electric Potential, Cell Serial and Parallel Circuit, their effect on Voltage and Current	5/ 5
2.	**Electronic and Electrical components** Active and Passive Components Resistors, Capacitors and Inductors, their identification, types and application	10/ 10

	Semiconducting Devices: Diodes, its type, characteristics and applications Transistors, Integrated Circuits Study of a transistor, use of a transistor as an amplifier and as a switch. Analog ICs, 555 timer, IC741, characteristics of 741 Digital ICs, ICs for logic gates, Truth table verification of logic gates Connectors Fuse, types, Use of Fuses and its rating Relays and Switches Panel Components Digital electronics – gates and its application, multiplexers, de-multiplexers, counter	
3.	**Soldering/ de- soldering techniques** Soldering Iron, Soldering wire, Soldering Flux, Soldering method, Zero defect soldering Desoldering pump, Temperature controlled soldering station, Hands-on-practices of Soldering	10 / 10
4.	**Tools and equipment** Screw Driver Set Tweezers, Different Types of Tweezers, Nose Pliers, Wire Cutter Hot air gun Liquid solder pest, Magnifying Lamp and Measuring Tools Brush, CRO, Nipper Test and Measurement Equipment, Multimeter Operation etc.	10 /10
5.	**Photocopiers** Principle of Operation of Photocopier Dismantling and assembling of paper feed mechanism, paper tray, Thermal unit and Toner Unit. Identify the various sensors used in the copier and their fixtures. Fault finding and repairing in electrostatic high voltage unit. Dismantling and fitting of drum unit- cleaning of drum unit Dismantling and refitting of Carriage unit , mirror unit and light unit Paper trays, Paper feed mechanism and the sensors used for paper movement Periodic cleaning and servicing of copier machines Overall fault finding and repair a photo copier machine.	20 / 20
6.	**Printers** Printers and their types.	25 / 25

	Thermal Printers and Inkjet Printer, their Working Principle Laser Printers and its operation Different Parts of Printer Cartridges, toner, drum, their use and its replacement Overall fault finding and repair of Printers	
7.	**Safety and Security Procedures** Reporting incidents, system failures, power failures etc., protection equipment First aid requirement in case of electrical shocks and other injuries	05 / 05
8.	**Reading, Writing and Communication Skills** Understanding Technical Manuals, Reports, Work orders etc. Understanding Organizational health and safety instructions Types of documentation in organization, their importance, Company guidelines and norms, activities after maintenance process Spare management, Service Level Agreements (SLAs) Fill-up forms, record sheets, log book etc. as per company procedures Customer Communication, Convey proposed solution to the customer, responding queries Communication with supervisor, Report for unresolved problems Time Management and Team Skills	15 / 15

Total Theory / Lecture Hours:	**100** hrs
Total Practical / Tutorial Hours:	**100** hrs
Total Hours:	**200** hrs

Recommended Hardware:

For a batch size of 50Nos

1.	Resistance of different value and Wattage ratings	20 nos. each
2.	Capacitor of different types	20 nos. each
3.	Transistors – BC 546, BC 547, SL 100, 2N3055	10 nos. each
4.	Rectifier Diode	20 Nos.
5.	Zener Diode of different values	10 nos. each
6.	LED of different colours	20 nos. each
7.	3 Pin Voltage Regulators	05 nos. each
8.	Logic GATE ICs	10 nos. each
9.	Tool Kit	05 sets
10.	Digital Multimeter	05 nos.
11.	CRO	02 nos.
12.	Soldering Iron	05 nos.

13.	Solder Wire	250 gms	
14.	Soldering Flux	100 gms.	
15.	Microwatt Soldering Iron	02 nos	
16.	Desoldering Station	02 nos.	
17.	Desoldering Pump	05 nos.	
18.	Project Board	05 nos.	
19.	Multistand Connecting wire		01 Coil each
20.	Single stand connecting wire		01 coil each
21.	Photocopier (Mono)	01 nos.	
22.	Photocopier Color	01 nos.	
23.	Different types of Printers	01 no each	

Recommended Software:

Printer Drivers etc.

Text Books:

1. MES - Electronics - Repair & Maintenance of Photocopier and Fax Machine (With DVD) - NIMI
2. Easy Laser Printer Maintenance and Repair Paperback - Stephen J. Bigelow

Reference Books:

user/service manuals

ESDM Courses

Level Code:	L4	**Vertical Name:**	Office Automation, IT & networking
Course Code:	NL/S/L4/C014 TL/S/L4/C035 EL/S/L4/C027	**Course Name:**	2.8.2 Telecom Technician - PC Hardware and Networking (NIELIT/TSSC/ESSCI)

Objective of the Course:

To obtain proficiency in the different components of PC (processors, mother board, RAM, I/O Devices) and networking components (Simple Network Components, Networking Components like Switch, Router, Hub, NIC, PC/Laptop, Router) and the various processes of setting up different kinds of network. It also helps to gain proficiency in trouble shooting of networks, installation of software, setting up network security
The students are also equipped with good Communicative English Skills, soft Skills and Basic IT skills required for good performance in any job in the modern world .

Learning Outcomes:

Acquire hands on training in assembling a PC using the scrap components. Also get a detailed knowledge on the basic networking concepts and complete hands on training in setting up different kinds of network. Efficient in managing, configuring, installing and troubleshooting different hardware and networking resources.
Have Good Communicative English Skills, Soft Skills & IT skills

Expected Job Roles:

1. Troubleshooting PC & it's Components
2. Maintenance of Computer Hardware
3. Network Administrators
4. Hardware Technicians
5. Entrepreneurs - Consultancy Services

Duration of the Course (in hours)	350 hrs

Minimum Eligibility Criteria and pre-requisites, if any	12th Pass

Professional Knowledge:

KA1. Knowledge to assemble a PC using scrap components and standard methodologies to set up a system using various components of the system

KA2. Understanding on designing the network and set up a network

KA3. How to troubleshoot the various hardware resources like printer, scanner, hard disk, mouse, keyboard etc.

KA4. How to troubleshoot the software resources (application troubleshooting)

KA5. How to troubleshoot of networks and networking resources like routers, switches, hub, cable, modem etc.

KA6. To interpret design requirements of different types of networks

KA9. SMPS and Specifications- Form factors, Power Connectors

KA10. Knowledge to prepare HDD- Configuring, Mounting, Partitioning, Formatting and loading OS

KA11. Introduction to Computer Software- Application Software, Open Source Software , Proprietary Software, Functions of System Software

KA12. Protocols and topologies to simulate, analyze and synthesize design options

KA13. Number Conversion systems and IP addresses

KA14. IP Addressing and sub-netting

KA15. Broadband, Network Architecture & Wireless networks

Professional Skill:

SA1. Assemble a PC using scrap components and standard methodologies to set up a system using various components of the system

SA2. Designing the network topologies and setting up various types of networks

SA3. Troubleshooting of hardware resources like printer, scanner, hard disk, mouse, keyboard etc., software resources (application troubleshooting) and the networks and networking resources like routers, switches, hub, cable, modem etc.

SA4. Connecting SMPS and use of Form factors, Power Connectors

SA5. Usage of number conversion systems, IP addresses and IPV6

SA6. Setting up Broadband Network & Wireless networks

Core Skill:

SA1. Complete accurate well written work with attention to detail on the different components of PC (processors, mother board, RAM, I/O Devices)

SA2. Setting up networks and understanding of various network topologies

SA3. IP Addresses and IPV6

SA4. Number conversion systems and it's usage

SA5. Information on Broadband & Wireless Networks

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1	**PC Hardware**	25

	1. Know your computer, PC case , SMPS 2. Motherboard of clients, Motherboard of Servers 3. Hard disks , CPUs-Intel/AMD , Keyboards , Mouse , USB Devices 4. Monitors – CRT / TFT / LCD / LED 5. I/O devices – Printers , Webcams, Scanners, Digital Camera, 6. USB Wifi, USB BT, USB Storages, UPS 7. Overhead/LCD/DLP/LED Projectors 8. Assembling of a PC, Severs and trouble shooting	
2	**PC Hardware Practical** 1. Loading and configuration procedure of Microsoft Client O/S – Win XP /Win 7 and Windows 8 2. Loading and configuration procedure of Microsoft Server O/S – Win 2003 server /Win 2008 Server 3. Loading and configuration procedure of Linux Clients and server OS 4. Firewall configuration, Antivirus/Internet security loading and configuration procedure 5. Installation and configuration of , I/O devices – Printers , Webcams , Scanners , Digital Camera , USB Wifi , USB BT, USB Storages , Projectors 6. Multiple OS loading and trouble shooting	35
3	**Computer Networking** 1. Introduction to Networking, Types of Networks and Topologies available and its areas of use 2. Protocols used in networking- Its purpose, use and types 3. Introduction to ISO-OSI Layer Protocols	25

	4. Different Networking elements used to build a network and its purpose-like NIC, Hubs, Switches, Routers 5. Addressing used in Networking-IP address 6. Basics of Internet protocol TCP/IP 7. Different types of cabling used in networking and their standards 8. UTP cable types and its purpose, UTP cable crimping using RJ 45 connectors- Straight through and Cross over Crimping 9. Introduction to Server- features, Hardware features and Software features, RAID etc. 10. Basics of routers- Difference from switches, uses, features 11. Configuration aspects, Basic concepts of Switching and Routing 12. Internet connection mechanisms-Dial up, Broadband etc 13. Overview of a Service Provider network to connect Internet 14. Wireless Networking- Wireless networking concepts, different wireless standards like Blue tooth, Wifi, WiMaX etc	
4	**Computer Networking Practical** 1. Familiarization of Internetworking elements like Hubs, switches, routers 2. Network Cable Crimping- Straight through and Cross over Crimping using UTP cables and testing 3. Installation of NIC in PCs and trouble shooting 4. Client configuration for networking, advanced client configuration for connecting multiple networks 5. Setting up of a simple LAN ,Checking the connectivity using DOS commands 6. Sharing files, Printers, CD drives	35

	7. Sharing desktops, Remote desktop, Using Applications like Team Viewer for accessing a remote computer 8. Configuration of client PCs for connecting multiple networks etc 9. Installation of Windows server, Configuration of server for Web Server and FTP server, Verification from a client 10. Basic router configuration, Connecting through Hyper terminal, Configuring router connecting different networks 11. Broadband Lab- Type 1 and Type 2 Modems, Modem configuration for internet connection 12. Wireless modem configuration for Wi Fi connectivity, Internet connection sharing to multiple clients	
5	**Internship** Internship at various BSNL Units	50

Total Course Theory / Lecture Hours: 50

Total Course Practical / Tutorial Hours: 120

Total Course Hours: 170

(Training in 100 hrs of Communicative English and 80 hrs of Basic IT Skills also provided, as required)

Recommended Hardware:	Scrap CPUs, Scrap PC Cabinet, SMPS and other basic components, Scrap Motherboard and Different Types of Processors, Scrap RAM, Desktop PC without loading OS, Scrap UPS, Laptop, Tablet, Smart Phones, Simple Network Components, Networking Components like Switch, Router, Hub, NIC, PC/Laptop, Router, Connectivity Network lab of BSNL

Recommended Software:	
Text Books:	
Reference Books:	Material prepared by BSNL.
Evaluation criteria:	

ESDM Courses

Level Code:	L4	**Vertical Name:**	Office Automation, IT & Networking
Course ID:	**NL/S/L4/C020**	**Course Name:**	2.8.3 CHM-O Level (NIELIT)

Objective of the Course:

The Objective of CHM-O Level course is to train candidates to acquire basic knowledge in:

- Computer Hardware and Peripherals
- Installation, troubleshooting and Maintenance
- System Software
- Networking
- Data Backup and Recovery

Learning Outcomes:

On completion of the course the participants will be able to:-

- Assemble and Repair PC
- Trouble shoot H/W and S/W Components of PC
- Installation of System Software and other tools

- Install and maintain Networks
- Perform backup and recovery operation
- Interacting with customer effectively

Expected Job Roles:

Hardware Engineer, Network Engineer

Duration of the Course (in hours)	400 hrs
Minimum Eligibility Criteria and pre-requisites, if any	12th Pass/ITI/Diploma, graduation or more

Professional Knowledge:

The individual on the job needs to know and understand:	
PK1.	Knowledge of components of PC
PK2.	Protection equipment (anti-static wrist bands, shoes, dress, packaging, and other appropriate insulations) that are required to be used
PK3.	First aid requirements in case of electrical shocks, cuts and other common injuries
PK4.	Functionality and features/working of PC Components
PK5.	PC operating system and user interface
PK6.	Functionality of hardware components like SMPS, Motherboard, processor, screen, Keyboard, Mouse etc.
PK7.	Have basic knowledge of electronic components on PC motherboard
PK8.	Procedure to assemble and dismantle PC and PC Components

PK9. Range of tools and testing equipment (multimeters, soldering iron etc.) available and their functionality
PK10. Knowledge of PC OS and related software installation (Windows, Linux, antivirus, MS office etc)
PK11. Knowledge of networking components and its installation-switch, Hub, router
PK12. Knowledge of setting wired and wireless LAN
PK13. Basic knowledge to be able to run diagnostic tools
PK14. Functionality of hardware components, software applications etc.
PK15. Knowledge of networking problem and their possible solutions
PK16. Knowledge of PC related problem and Standard fault-finding (troubleshooting) techniques
PK17. Standard software testing techniques
PK18. Standard backup and recovery operations

Professional Skill:

The individual on the job needs to know and understand:

PC operating Skills

PS1. Use and access the features and applications

PS2. Data backup and restoration

PS3. Installation of Operating system and other related software

PS4. Installation of peripheral specific software like printer, scanner, web cam etc

PS5. Use the software diagnostic tools

PC Component maintenance skills

PS6. Assemble and dis-assemble PC components

PS7. Interpret diagnostic test results to identify and localize faults

PS8. Utilize appropriate mechanisms and tools to rectify the faults

PS9. Utilize appropriate communication channels to escalate unresolved problems

PS10. Undertake corrective repairs or replacing component

PS11. Undertake checks to confirm that the problem is resolved

Networking Skill

PS12. Able to use networking basic equipment- cutter, crimping tools, cable tester etc

PS13. Preparing UTP straight and cross patch cable

PS14. Configuring IP –address on PC for LAN

PS15. Configuring switch and router for LAN & WAN

PS16. Configuring Shared resources on network like printer, storage device etc

Software Skills

PS17. Identifying software version and its installation

PS18. Configuring Windows and Linux Server

PS19. Diagnosing peripheral software related problem

Troubleshooting Skills

PS20. How to approach a defect

PS21. Make use of standard OEM specified troubleshooting steps

PS22. Interpret intermediate results and progress fault rectification accordingly

PS23. Utilize appropriate tools to rectify faults

Core Skill:

The individual on the job needs to know and understand how to:
Reading skills
CS1. Read and understand technical manuals, work orders and reports
CS2. Read and understand organizational health and safety instructions
Writing Skills
CS3. Fill up record sheets clearly, concisely and accurately as per company procedures
Communication Skills
CS4. Clearly communicate relevant information to supervisors
CS5. Respond appropriately to queries
CS6. Communicate with customer to understand handset performance issues
CS7. Communicate in the local language
CS8. Convey proposed solution to the customers
Time Management Skills
CS9. Prioritize and execute tasks in a high-pressure environment
CS10. Use and maintain resources efficiently and effectively
Analytical Skills
CS11. Analyse (and understand) customer complaints
CS12. Interpret reports, readings and numerical data
CS13. Keep up to date with new technology and performance issues
Other Skills
CS14. Create & maintain effective working relationships environment & collaboration
CS15. Take initiatives and progressively assume increased responsibilities
CS16. Share knowledge with other team members and colleagues
CS17. Improve social responsibilities and environmental understanding.

Detailed Syllabus of Course

Sl. No.	Modules	Min: No. of Hours
		Theory/Practical
1.	PC Hardware & Components	30/30
2.	PC Architecture	30/20
3.	Advanced networks and networking peripherals	40/40
4.	Operating System, Software & Tools	40/40
5.	Personality Development	34/16
6,	Devices and Applications	40/40
	Total Theory / Lecture Hours:	**214 hrs**
	Total Practical / Tutorial Hours:	**186** hrs
	Total Hours:	**400** hrs

Recommended Hardware:

For a batch size of 50Nos

A. Instruments :

1. Dual Traced CRO, 20 MHz - 2 Nos.
2. Signal generator, 1 GHz - 2 Nos.
3. Digital multimeter - 10 Nos.
4. Cable Tester, RJ-45 to Rj-45 - 2 Nos.
5. Soldering station 6V/10W - 10 Nos.

6. Printer (Laser, Ink-jet, Dot-Matrix)- 01 No. each

7. Scanner (flatbed Or handheld OR MFD) - 01 No.

8 . Latest mid-range servers with DUAL Processors.

9. Anti-Static PAD

B. Hardware :

1. Computers - 25 Nos.

2. Various Types of motherboards - 10 Nos.

3. Various types of Processors, RAM compatible with motherboards,

4. Blu-ray disc, DVD, CDROM and floppy Drive - 2Nos. each,

5. Hard Disk Drive like IDE, SATA, SCSCI - 2 Nos. each.

6. Cabinet with SMPS- 10 Nos.

7. Add-on cards Graphics Cards, sound Card, ethernet Cards Etc.

8. Monitors like CRT, LCD, LCD backlit LED various sizes.

9. 16, 24 port switches, UTP CAT-6 cable, Rj-45 Connectors,

10. CISCO 2800 Series or compatible Router

11. wireless AP, Wireless Router and Wireless ethernet Card.

Recommended Software:

1. Linux and other popular OS, Office productivity tools.

2. Network Operating system Advanced Windows Server 2008/2012, RedHat Enterprise, Linux 6. - 01 Each.

3. Latest Anti-virus software,

4. Software compatible for different types of Handsets/Gadgets

Text Books:	A number of books are available in market, which can be referred. Efforts are being made to publish a standard text book.
Reference Books:	- user/service manuals

ESDM Courses

Level Code:	L5	**Vertical Name:**	Office Automation, IT & Networking
Course ID:	**NL/S/L5/C023**	**Course Name:**	2.8.4 CHM-A Level (NIELIT)

Objective of the Course:

The Objective of CHM-A Level course is to train candidates to acquire basic knowledge in:

- Computer Networks, Hardware and Peripherals
- Installation, troubleshooting and Maintenance of Networks
- Operating Systems in Network Environment, Software and data security
- Network administration
- Entrepreneurship, financial planning and first aid.

Learning Outcomes:

On completion of the course the participants will be able to:-

- Assemble and manage Computer Networks
- Trouble shoot H/W and S/W Components of Computer Networks

- Installation of System Software and other tools
- Install and maintain Networks
- Perform backup and recovery operation.
- Plan a business venture with financial viability.
- Interacting with customer effectively

Expected Job Roles:

Hardware Engineer, Network Administration, Network Supervisor, Entrepreneur

Duration of the Course (in hours)	470 hrs
Minimum Eligibility Criteria and pre-requisites, if any	Diploma

Professional Knowledge:

The individual on the job needs to know and understand:
PK19. Knowledge of components of Computer Networks
PK20. First aid requirements in case of electrical shocks, cuts and other common injuries
PK21. Functionality and features/working of Computer Networks Components
PK22. Knowledge of networking components and its installation-switch, Hub, router
PK23. Knowledge of setting wired and wireless LAN
PK24. Computer Networks operating system and user interface
PK25. Have basic knowledge of electronic components on Computer Network switches
PK26. Procedure to assemble and dismantle Computer Networks and Computer Networks Components
PK27. Knowledge of Computer Networks OS and related software installation (Windows, Linux, antivirus, etc)
PK28. Basic knowledge to be able to run diagnostic tools
PK29. Functionality of hardware components & software in network environment.
PK30. Knowledge of networking problem and their possible solutions
PK31. Knowledge of Computer Networks related problem and Standard fault-finding (troubleshooting) techniques
PK32. Standard software testing techniques in different Network topologies
PK33. Standard backup and recovery operations in Networking environment.

Professional Skill:

The individual on the job needs to know and understand:

Computer Networks operating Skills

PS24. Use and access the features and applications

PS25. Data backup and restoration

PS26. Installation of Operating system and other related software

PS27. Installation of peripheral specific software like network printer, scanner, web cam etc.

PS28. Use the software diagnostic tools

Computer Networks Component maintenance skills

PS29. Assemble and dis-assemble Computer Networks components

PS30. Interpret diagnostic test results to identify and localize faults

PS31. Utilize appropriate mechanisms and tools to rectify the faults

PS32. Utilize appropriate communication channels to escalate unresolved problems

PS33. Undertake corrective repairs or replacing component

PS34. Undertake checks to confirm that the problem is resolved

Networking Skill

PS35. Able to use networking basic equipment- cutter, crimping tools, cable tester etc

PS36. Preparing UTP straight and cross patch cable

PS37. Configuring IP –address on Computer Networks for LAN

PS38. Configuring switch and router for LAN & WAN

PS39. Configuring Shared resources on network like printer, storage device etc

Software Skills

PS40. Identifying software version and its installation

PS41. Configuring Windows and Linux Servers

PS42. Diagnosing peripheral software related problem

Troubleshooting Skills

PS43. How to approach a defect

PS44. Make use of standard OEM specified troubleshooting steps

PS45. Interpret intermediate results and progress fault rectification accordingly

PS46. Utilize appropriate tools to rectify faults

Core Skill:

The individual on the job needs to know and understand how to:
Reading skills
CS18. Read and understand technical manuals, work orders and reports
CS19. Read and understand organizational health and safety instructions
Writing Skills
CS20. Fill up record sheets clearly, concisely and accurately as per company procedures
CS21. Prepare a project report based on the objectives, literature survey, methodology, results and conclusion.
Communication Skills
CS22. Communicate relevant information to superiors, subordinates and colleagues
CS23. Respond appropriately to queries
CS24. Communicate with customer/customer facing teams & convey proposed solution
CS25. Communicate through technical documentation.
Time Management Skills
CS26. Plan, procure and execute a project in a given time frame
CS27. Prioritize and execute tasks in a high-pressure environment
CS28. Use and maintain resources efficiently and effectively
Analytical Skills
CS29. Analyse (and understand) customer complaints
CS30. Analyse and provide solution to the co-workers and subordinates.
CS31. Interpret reports, readings and numerical data
CS32. Keep up to date with new technology and performance issues
Other Skills
CS33. Create and maintain effective leadership and team environment
CS34. Take initiatives and progressively assume increased responsibilities
CS35. Share knowledge with other team members and colleagues
CS36. Improve social responsibilities and environmental understanding.

Detailed Syllabus of Course

Sl. No.	Modules	Practical	Theory	Total No. of Hours
1.	Advance PC Hardware & Networking Components	25	35	60
2.	Data Communication and Computer Networks	35	40	75
3.	Network Management and Administration	40	40	80
4.	Linux Administration	35	45	80
5.	Entrepreneurship Development	10	35	45
6.	Project	60	0	60
7,	(Elective) IT Security/ Networking with Advanced components	30	40	70
	Total Practical / Tutorial Hours:	**235**		
	Total Theory / Lecture Hours:		**235**	
	Total Hours:			470

Recommended Hardware:

For a batch size of 50Nos

A. Instruments :

1. Dual Traced CRO, 20 MHz - 2 Nos.
2. Signal generator, 1 GHz - 2 Nos.
3. Digital multimeter - 10 Nos.
4. Cable Tester, RJ-45 to Rj-45 - 2 Nos.
5. Soldering station 6V/10W - 10 Nos.

6. Printer (Laser, Ink-jet, Dot-Matrix)- 01 No. each

7. Scanner (flatbed Or handheld OR MFD) - 01 No.

8 . Latest mid-range servers with DUAL Processors.

9. Anti-Static PAD

B. Hardware :

1. Computers - 25 Nos.

2. Various Types of motherboards - 10 Nos.

3. Various types of Processors, RAM compatible with motherboards,

4. Blu-ray disc, DVD, CDROM and floppy Drive - 2Nos. each,

5. Hard Disk Drive like IDE, SATA, SCSCI - 2 Nos. each.

6. Cabinet with SMPS- 10 Nos.

7. Add-on cards Graphics Cards, sound Card, ethernet Cards Etc.

8. Monitors like CRT, LCD, LCD backlit LED various sizes.

9. 16, 24 port switches, UTP CAT-6 cable, Rj-45 Connectors,

10. CISCO 2800 Series or compatible Router

11. wireless AP, Wireless Router and Wireless ethernet Card.

Recommended Software:

1. Linux and other popular OS, Office productivity tools.

2. Network Operating system Advanced Windows Server 2008/2012, RedHat Enterprise, Linux 6. - 01 Each.

3. Latest Anti-virus software,

4. Software compatible for different types of Handsets/Gadgets

Text Books:	A number of books are available in market, which can be referred. Efforts are being made to publish a standard text book.
Reference Books:	- user/service manuals

2.9 Electronic Product Design

ESDM Courses

Level Code:	L3	**Vertical Name:**	Electronic Product Design
Course ID:	**NL/S/L3/C002** **EL/S/L3/C021** **TL/S/L3/C032**	**Course Name:**	2.9.1 Certificate Course in Electronic Product Testing (NIELIT/ESSCI/TSSC)

Objective of the Course:

This course has been designed to provide the knowledge and expertise of Systematic Testing of selected Electronics Products along with Communicative English and soft Skills and Basic IT skills required for good performance in any job in the modern world.

Learning Outcomes:

To systematically test electronic equipments using appropriate tools and equipments.
Have good Communicative English skills, soft Skills & Basic IT Skills

Expected Job Roles:

Technician-In Electronic Products Testing / QA Areas

Duration of the Course (in hours)	360 Hrs
Minimum Eligibility Criteria and pre-requisites, if any	10^{th} / 12^{th} Pass with Science background

Professional Knowledge:

1. Fundamentals of electricity & Electronics
2. Use of Tools and Test and Measuring equipments such as CRO, Multimeter, Signal Generator,LCR meter etc
3. Handling of Different electronics Components and Electrostatic discharge
4. Awareness of Types of Product testing ,Safety Standards & Certificates
5. Awareness of Quality standards, Calibration of Equipments etc
6. Specifications of Products and their testing Procedures
7.Basic knowledge of working principle of Different Electronic Products
8.Understanding of internal modules and major components used in the Product
9. Testing of Electronic Components
9. Safety rules, policies and procedures

Professional Skill:

1.Systematic Approach to Testing of Products

2. Use of Tools and Test and Measuring equipments such as CRO, Multimeter, Signal Generator, LCR meter etc

3. Fault Diagnosing skills- Detect basic electrical faults such as improper earthing, defective power chord, connector or wiring defects, loose connections etc.,

4. Good Soldering & de-soldering Skills

5. Use oscilloscope for diagnosing faults

6. Sound Judgement based on quality Standards and Company Policy

Core Skill:

1. Reading and writing skills
2. To record the details of tests & Measurements and Observations
3. to know and understand: how to read product and module serial numbers and interpret details such as make, date, availability , how to note problems on job sheet and details of work done.
4. To read and understand Product manuals
5. to read and understand warnings, instructions and other text material on product labels, and components
6. Safety Habits

Detailed Syllabus of Course

Communication and Soft skills

Module. No	Module Name	Minimum No. of Hours
Module 1.	**Personal Skills** Knowing Oneself, Confidence Building, Defining Strengths, Thinking Creatively, Personal Values, Time and Stress Management	**10 hrs**
Module 2.	**Social Skills** Appropriate and Contextual Use of Language, Nonverbal Communication, Interpersonal Skills, Problem Solving, Understanding Media, Public Speaking	**30 hrs**
Module 3.	**Professional Skills** Organizational Skills, Team Work, Business/Technical Communication, Job Oriented Skills, Professional Etiquette	**30 hrs**
Module 4.	**Training for Language Proficiency Tests** Integrated Skills, Integrated Skills, Integrated Skills, Practice Exercises, Practice Tests	**20 hrs**
Module 5.	**Preparing and Presenting a Project** Brainstorming, Gathering, Selecting, Processing, Cohesive and Coherent Organization, Drafting and Revising, Presentation of the Project	**10 hrs**

Theory / Lecture Hours: 100

Module 1.	Fundamentals of Electricity and Electronics 1. Identification of basic electronic components, ICs, PCBs, Battery &Sensors. 2. Basics of electricity, wave form , frequency value, peak value, average value of voltage and current 3. Awareness of tools, testing and measuring instruments – CROs, Multimeter, Power supplies, LCRs, Signal Generator and Power Analyzer.	25

IT Skills

Module. No	**Module Name**	**Minimum No. of Hours**
Module 1.	Introduction to internet, Office Writer, Emails Module Project and Evaluation	16 hrs
Module 2.	Operating Systems , Edit Images, Presentations, Internet Security, Chat and Social Networking ,Malayalam in Computer, Module Project and Evaluation	24 hrs
Module 3.	Computer Networks, Spreadsheet, Online Services, Interoperability, Module Project and Evaluation	24 hrs
Module 4.	Final Project and Evaluation	16 hrs

Practical / Tutorial Hours: 80

Module 2.	Soldering Practices 1. Handling of components, Instruments etc. ESD – (Electrostatic discharge). 2. Basics of SMD, its soldering and desoldering 3. Basics of Transformer , ICs ,thyristors and IGBT testing Pin configuration of some important ICs used in SMPS,UPS and Inverters, testing of Induction cookers	15
Module 3.	Types of Product Testing Acceptance Testing, Type Testing , Safety Testing, Identification of legends, symbols, colour codes, Safety, safety standards, safety certificates (CE, UL and VDE) Effect of environmental testing(refer to IEC 60068-1 for guidance), General awareness of quality standards, quality management systems & documentation, Awareness on ISO 17025, ISO 9001, Calibration and Uncertainty of measurements, Awareness on disposal of Electronic waste	20
Module 4.	Testing Procedures(Practical) Testing of Basic Electronic Components Resistor (Parameter to be measured: Resistance Value), Capacitor(Parameter to be measured: Capacitance Value, IR at rated Voltage), Inductor(Parameter to be measured: Inductance Value, DC Resistance), Diode(Parameter to be measured: Resistance in forward direction and reverse direction), Transistors-PNP and NPN (Parameter to be measured: Each PN Junction shall be tested as in diode testing), Transformer basics, ICs, Thyristors and IGBT testing, Pin configuration of some important ICs used in SMPS,UPS and Inverters, testing of Induction cookers	90

	2. Switch Mode Power Supply (Applicable Standard : IS 14886) Safety Testing(Earth Leakage current Test, Dielectric Test, Short Circuit Protection), Performance Testing (Line Regulation, Load Regulation for a variation of Load Min to Max load and vice versa, Efficiency at nominal input and rated load) 3. Tubular Batteries (Applicable standard : IS 1651) Test for Capacity, Test for voltage during discharge 4. Personal Computer (Applicable Standard : IS 14896) Safety Testing (Earth Leakage current Test, Dielectric Test) Performance Testing (Microprocessor used, RAM expansion Capacity, Clock Rate and RAM Capacity, Effect of Power Supply variations) 5. Invertor (Applicable Standard : IS 13314) Visual Inspection, High Voltage Test, Insulation Resistance Test, No –Load Test, Output Test 6. UPS (Applicable Standard : IEC 62040-3) Steady State Input Voltage Tolerance, Output-Normal Mode – No Load, Output- Normal Mode – Full Load, Output-Stored Energy Mode – No Load, Output- Stored Energy Mode – Full Load, Output-Normal Mode – Over Load, Output-Stored Energy Mode – Over Load Output-Normal Mode – Short Circuit, Output- Stored Energy Mode – Short Circuit, Efficiency and Input Power factor 7. Electronic Ballast (Applicable Standard : IS 13021) Operating Supply Voltage, Total Circuit Power, Circuit Power factor, Supply Current 8. Safety Testing of Household Appliances (Applicable Standard IS 302-1) Definitions and Terminology, Protection	

	against Shock, Power Input and Current, Leakage Current and Electric Strength at Operating Temperature, Earthlings 9. Testing of Electric Iron/Electric Kettle (Applicable Standard : IS 302-2) Ground bond resistance, Touch Current, Temperature (Thermostatic Cut off) Power Consumption. 10. Audio Amplifier (Applicable Standard : IEC 60065) Audio frequency response at various power levels, Response to various inputs sources like DVD player, IPOD, CD player, etc., audio output power, Power Consumption, Voltage range test, Touch Current	
	Intership/ Practical training	30

Total Course Theory / Lecture Hours: 160

Total Course Practical / Tutorial Hours: 200

Total Course Hours: 360

Recommended Hardware:	Electronics lab in Polytechnic Colleges
Recommended Software:	Nil

Text Books:	
Reference Books:	
Evaluation criteria:	

ESDM Courses

Level Code:	L3	**Vertical Name:**	Medical Electronics
Course ID:	**NL/S/L3/C004**	**Course Name:**	2.10.1 Repair & Maintenance of Dental equipment (NIELIT)

Objective of the Course:

Have knowledge about the various devices used in medical field.
Have an awareness of the safety aspects of medical instruments.
Understand the basics of how the signals are obtained from the body that is to be measured by various machines.

Learning Outcomes:

Have knowledge about various devices used in medical field
Have the basic understanding of how the signals are obtained from the body
Be aware of the safety aspects in this field.

Expected Job Roles:

Operation and Maintenance of Dental Equipment

Duration of the Course (in hours)	350 Hours

Minimum Eligibility Criteria and pre-requisites, if any	10^{TH} Pass

Professional Knowledge:

a) Basics of Mechanical Foundry Equipments
b) Working of Motor, Drilling.
c) Basic concept of suction apparatus.
d) Have understanding related to medical Lights, Shadow less lights.
e) Basics of X-rays.
f) Understanding of basics of dental machines.
g) Basic Knowledge of Dental tools.
h) Basic Of active and passive components
i) Types of components with its working.
j) Working and usage of OP AMP 741.
k) Basics of ultrasonic s waves ,concepts and Units

Professional Skill:

a) Knowledge and hands on experience with designing of circuits
b) Working and designing of PCB's
c) Basics of dental chairs usage
d) Concepts of hydraulics and Suction system,
e) Working and Concept Of TTL .
f) Understanding and theory related to ultrasonics, Internal circuitry.

Core Skill:

a) Basic understanding and co-ordinating skills.
b) Basic Numeracy and co-ordination.
c) Should have a strong determination and curiosity to learn new things
d) Adaptable with the environment.
e) Should have understanding and adaptability with new concepts.

f) Blending with the technical aspects.

Detailed Syllabus of Course

Module. No	Modules	Minimum No. of Hours
1.	Basics understanding of Dental Chair	50
2.	Tools & Aids for servicing & maintenance, Hard & soft tools	200
3.	Soft Skills	100
	Total Theory / Lecture Hours:	250
	Total Practical / Tutorial Hours:	100
	Total Hours:	350

Recommended Hardware:

Recommended Software:

Text Books:

Reference Books:

ESDM Courses

Level Code:	L3	**Vertical Name:**	Medical Electronics
Course ID:	**NL/S/L3/C005**	**Course Name:**	2.10.2 Repair & Maintenance of Imaging Equipment (X-Ray & Ultrasound machine) (NIELIT)

Objective of the Course:

Have knowledge about the various devices used in medical field.
Have an awareness of the safety aspects of medical instruments.
Understand the basics of how the signals are obtained from the body that is to be measured by various machines.

Learning Outcomes:

Have knowledge about various devices used in medical field
Have the basic understanding of how the signals are obtained from the body
Be aware of the safety aspects in this field.

Expected Job Roles:

Operation and Maintenance of Imaging Equipment (X-Ray & Ultrasound machine)

Duration of the Course (in hours)	350 Hours
Minimum Eligibility Criteria	10th Pass

and pre-requisites, if any

Professional Knowledge:

a) Basics of Mechanical Foundry Equipments
b) Working of Motor, Drilling.
c) Basic concept of suction apparatus.
d) Have understanding related to medical exposure of X-Rays.
e) Basics of X-rays.
f) Understanding of basics of dental machines.
g) Basic Knowledge of Medical computer usage and applications in imaging field
h) Basic Of active and passive components
i) Types of components with its working.
j) Working and usage of OP AMP 741.
k) Basics of ultrasonic s waves ,concepts and Units

Professional Skill:

a) Knowledge and hands on experience with designing of circuits
b) Working and designing of PCB's
c) Basics of XRay units,
d) Concepts of hydraulics and Suction system,
e) Working and Concept of xray Tubes, collimator.
f) Understanding of basics of optics.
g) Knowledge of Spectrum.
h) Basics of Non Invasive Xrays.

Core Skill:

a) Basic understanding and co-ordinating skills.
b) Basic Numeracy and co-ordination.
c) Should have a strong determination and curiosity to learn new things
d) Adaptable with the environment.
e) Should have understanding and adaptability with new concepts.
f) Blending with the technical aspects.

Detailed Syllabus of Course

Module. No	Modules	Minimum No. of Hours
1.	Basic Building Blocks of Bio-Medical Equipment	40
2.	Imaging Equipment	80
3.	Bio-Medical Instrumentation and Measurement	30
4.	On Job Training	100
5	Soft Skills	100
	Total Theory / Lecture Hours:	250
	Total Practical / Tutorial Hours:	100
	Total Hours:	350

Recommended Hardware:	
Recommended Software:	
Text Books:	
Reference Books:	

ESDM Courses

Level Code:	L3	**Vertical Name:**	Medical Electronics
Course ID:	**NL/S/L3/C006**	**Course Name:**	2.10.3 Repair & Maintenance of ECG and ICCU Equipment (NIELIT)

Objective of the Course:

Have knowledge about the various devices used in medical field.
Have an awareness of the safety aspects of medical instruments.
Understand the basics of how the signals are obtained from the body that is to be measured by various machines.

Learning Outcomes:

Have knowledge about various devices used in medical field
Have the basic understanding of how the signals are obtained from the body
Be aware of the safety aspects in this field.

Expected Job Roles:

Operation and Maintenance of Clinical Equipment (ECG &ICCU)

Duration of the Course (in hours)	350 Hours
Minimum Eligibility Criteria and pre-requisites, if any	10th Pass

Professional Knowledge:

a) Should have the understanding of Use of CRO, Multimeter, Measurement of voltage, current, resistance
b) Testing of diodes,resisitors
c) Basic Knowledge about the waveforms.
d) PCB repairing and locating the faults.
e) Know basic medical terminologies like ECG,EEG,EMG
f) Working of BP kit,measuremnt principle .
g) Knowledge of transistors, types and working, usage.
h) Knowledge of electromechanical components, relays, switches.

Professional Skill:

a) Testing and working of resistors, capacitors, transistors, diodes, Inductors, OPAMP,
b) Working Of ECG amplifiers, ECG instrumentation
c) Knowledge about ECG, Defibrillators, pulse oximeters , ICCU equipments.
d) Basics of Non invasive blood pressure, Soldering, seven segment display.
e) Identification of PCB fuses
f) Performance evaluation of components

Core Skill:

a) Analytical strong competency.
b) Practical Evaluation and understanding of the basics.
c) Strong approach towards the theoretical and practical applications.
d) Eagerness and curiosity to learn more.

Detailed Syllabus of Course

Module. No	**Modules**	**Minimum No. of Hours**
1.	Tools and servicing maintenance of Hard and soft.	75
2.	Familiarization and working with components, ECG , ICCU equipments	175

3	Soft Skills	100
	Total Theory / Lecture Hours:	250
	Total Practical / Tutorial Hours:	100
	Total Hours:	350

Recommended Hardware:	
Recommended Software:	
Text Books:	
Reference Books:	

ESDM Courses

Level Code:	L5	**Vertical Name:**	Medical Electronics
Course ID:	**NL/S/L5/C008**	**Course Name:**	2.10.4 Post Diploma in Repair & Maintenance of Hospital Equipment (NIELIT)

Objective of the Course:

Have knowledge about the various devices used in medical field.
Have an awareness of the safety aspects of medical instruments.
Understand the basics of how the signals are obtained from the body that is to be measured by various machines.

Learning Outcomes:

Have knowledge about various devices used in medical field
Have the basic understanding of how the signals are obtained from the body
Be aware of the safety aspects in this field.

Expected Job Roles:

Operation & Maintenance of Hospital Equipment

Duration of the Course (in hours)	400 Hours
Minimum Eligibility Criteria	Diploma/B.Sc

and pre-requisites, if any

Professional Knowledge:

a) Basic knowledge regarding ECG electrodes
b) ECG working, Waveform generation.
c) Calibration and testing Of ECG Equipment
d) Working principles of Analytical Instrument.
e) Working and analysis of pH meter
f) Basics of diagnostic equipment.
g) Diagnostics Technique and various physiology system

Professional Skill:

a) Have knowledge of working of microscope, standard Procedure,
b) Have understanding about the terms and definition like pH meter ,pH value, basics of chemistry
c) Have basic understanding of human Physiology, and various human systems.
d) Basics of bioelectric Potentials and measurements in human body

Core Skill:

a) Basic understanding and co-ordinating skills.
b) Basic Numeracy and co-ordination.
c) Should have a strong determination and curiosity to learn new things
d) Adaptable with the environment.
e) Should have understanding and adaptability with new concepts.
f) Blending with the technical aspects.

Detailed Syllabus of Course

Module. No	**Modules**	**Minimum No. of Hours**
1.	Basic Block of Biomedical Equipment	30
2.	ECG Machine and analytical	30

3.	Diagnostic Equipment	30
4.	Biomedical instrumentation	30
5.	Hands on Experience	200
6	Soft Skills	30
	Total Hours:	350

Recommended Hardware:	
Recommended Software:	
Text Books:	
Reference Books:	

ESDM Courses

Level Code:	L4	**Vertical Name:**	Medical Electronics
Course Code:	TL/S/L4/C020	**Course Name:**	2.10.5 Tele-health technician (TSSC)

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,	20

	UK, DSM,CD2,CFR10, Meta-data and data standards for health domain	
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

2.11 Industrial Automation

ESDM Courses

Level Code:	L5	**Vertical Name:**	Industrial Automation
Course ID:	**NL/S/L5/C009** **EL/S/L5/C024**	**Course Name:**	2.11.1 Diploma in Repair & Maintenance of Industrial Instrumentation &Automation System (NIELIT/ESSCI)

Objective of the Course:

To develop the competency to install, operate & maintain industrial instruments and automation systems.

Learning Outcomes :

On completion of the course the participants will be able to:-

1. Understand P & ID and other trade related codes and standards
2. Identify a particular instrument in plant from P&ID.
3. Demonstrate the working of different field instruments/sensor.
4. Install, calibrate, operate and maintain all control loop elements.
5. Develop and test PLC programs.
6. Identify the requirements of open loop and closed loop stability.

Expected Job Roles:

As Technician in Process Industries.

Duration of the Course (in hours)	400 hrs
Minimum Eligibility Criteria and pre-requisites, if any	ITI / Diploma / BSc

Professional Knowledge:

The individual on the job needs to know and understand:

PK1.	Protection equipment that are required to be used
PK2.	First aid requirements in case of electrical shocks, cuts and other common injuries
	Have basic knowledge of electrical and electronic components
PK3.	Standard fault-finding techniques
PK4.	Standard repairing process
PK5.	Range of tools and testing equipments available and their functionality
PK5.	Principle of operation and features/working of instruments
PK6.	Knowledge to dismantle and assemble the faulty instrument
PK7.	Basic computer knowledge to be able to run diagnostic tools in case of smart instruments

PK8.	Range of instrument related problems and their possible solutions
	Knowledge of spare management and repair
PK9.	Vendor specific configuration and user interfaces
PK10.	Functionality of hardware components and software applications.
PK11.	
PK12.	

Professional Skill:

The individual on the job needs to know and understand:	
	Instrument operating Skills
PS1.	Use and access all instrument features and applications
PS2.	Operate instrument calibration equipments and testing equipments
PS3.	Connect instrument to PC for diagnostics for smart instruments
PS4.	Initialize PC based diagnostic tools
	Instrument repairing skills
PS5.	Undertake fault diagnostic
PS6.	Interpret test results to identify and localize faults
PS7.	Utilize appropriate mechanisms and tools to rectify the faults
PS8.	Utilize appropriate communication channels to rectify unresolved problems
PS9.	Test instruments to confirm the rectification of the reported fault
PS10.	Interpret diagnostic test results to identify and localize faults
PS11.	Connect instrument to PC using connectors/cables
PS12.	Undertake corrective repairs by software if any.
PS13.	Undertake checks to confirm that the problem is resolved
	Instrument Handling skills

PS14.	Safely dismantle/assemble instrument using the right tools
PS15.	Safe remove and replace components using right tools
PS16.	Compliance to ESD protection measures
	Software Skills
PS17.	Identifying correct software version for the modules for smart instruments
PS18.	Execute basic software commands for calibration and use diagnostic tools
PS19.	Use vendor specific software by navigating through it based on screen commands.
	Troubleshooting Skills
	How to approach a defect
PS20.	Make use of standard OEM specified troubleshooting steps
PS21.	Interpret intermediate results and progress fault rectification accordingly
PS22.	Utilize appropriate tools to rectify faults
PS23	

Core Skill:

The individual on the job needs to know and understand how to:	
	Reading skills
CS1.	**Read and understand technical manuals, work orders and reports**
CS2.	**Read and understand organizational health and safety instructions**
	Writing Skills
CS3.	**Fill up record sheets clearly, concisely and accurately as per company procedures**
	Communication Skills
	Clearly communicate relevant information to higher officials
CS4.	**Respond appropriately to queries**
CS5.	**Communicate with other team members to understand instrument performance issues**
CS6.	**Communicate in the local language**
	Convey proposed solution to the customers and higher officials if necessary

CS7.	**Time Management Skills**
CS8.	**Prioritize and execute tasks in a high-pressure environment**
	Use and maintain resources efficiently and effectively
CS9.	**Analytical Skills**
CS10.	**Analyse (and understand) performance issues of the instrument**
	Interpret reports, readings and numerical data
CS11.	**Keep up to date with new technology and performance issues**
CS12.	**Other Skills**
CS13.	**Create and maintain effective working relationships and team environment through collaboration**
	Take initiatives and progressively assume increased responsibilities
CS14.	**Share knowledge with other team members and colleagues**
CS15.	
CS16.	

Detailed Syllabus of Course

Module. No	Modules	Min. No. of hours

1.	**Fundamentals**
	
	Plan and perform routine trade activities
	• Examine types of trade related personal protective equipment
	  ○ Head protection - hard hat
	  ○ Eye protection - goggles and face shield
	  ○ Hearing protection - Ear plugs & Ear muffs
	  ○ Hand protection - Types of gloves and mitts
	  ○ Clothing - Types of materials suitable to work environment
	  ○ Foot protection - safety boots with suitable soles
	  ○ Personal Breathing Apparatus
	• Maintain safe work environment
	  ○ Safe housekeeping practices
	  ○ Appropriate recycling and disposal procedures
	• Use and maintain hand and power tools
	  ○ Trade specific hand and power tools
	• Examine mounting and installation hardware and practices
	  ○ Manufacturer instructions
	  ○ Types of mounting hardware (uni-strut, clamps, u-bolts…)
	  ○ Location for installation of mounting hardware
	Scope of Instrumentation
	• Scope and necessity of Instrumentation
	• functional block diagram of measurement system
		12

	• calibration and calibration standards
	  ○ basic, secondary and working standards
	• the metric system
	  ○ base and supplementary units
	  ○ derived units
	  ○ Multiplying factors (milli,micro, nano…….Mega,Giga…).
	• Instrument Characteristics
	• Instrument performance terminology
	  ○ Repeatability and Accuracy
	  ○ Zero, span and Linearity errors
	• Types of errors.
	• Standard Signals
	• Different number bases
	  ○ Binary
	  ○ Octal
	  ○ Hex
	Explain codes, standards and regulations
	• Examine work-related safety regulations and publications
	  ○ OHS Regulation
	  ○ General Requirements of OHS
	  ○ Chemical and biological agents
	  ○ Noise, vibration, radiation and temperature
	  ○ Tools machinery and equipment safety
	  ○ Ladders, scaffolds and temporary work platforms
	  ○ Rigging, cranes and hoists
	  ○ Mobile equipment	

	○ Electrical safety ○ Oil and gas industries **Identify electrical hazards and apply safe work practices** Packaging & Enclosures of Instrumentation System ○ Safety Measures ▪ Measurement Categories ○ Nature of Environment & Safety Measures ▪ Enclosures of electric equipment for Non-Hazardous location • International standards ▪ Enclosures of electric equipment for Hazardous location • International standards ○ Intrinsically Safe Equipment ○ Design Consideration of Enclosures for Different Market Segments • Examine regulations ○ Sizing of wire, fuses and circuit breakers ○ Overloads and Inrush current ○ Proper installation and grounding of electrical equipment **Use trade related schematics and drawings** • Examine types of schematics and drawings ○ P&ID and Loop wiring diagrams • Examine symbols and conventions ○ ISA and SAMA symbols • Use basic schematics and drawings ○ P&ID, Loop drawings	
2.	**Installation and Maintenance of Measuring and Indicating Devices** **Calibrate and service indicating and recording instruments** • Types of recording devices	**140**

	○ Chart recorders ▪ Electronic • Indicating devices ○ Digital displays ○ Analog displays ○ Configurable ▪ LCD • Calibrate and service indicating devices ○ Gauges ○ Bourdon tube ▪ Helical ▪ Spiral ○ Bellows ▪ Diaphragm capsule ○ Accessories ▪ Pigtail siphons ▪ Damping mechanisms ▪ Chemical seals ○ Measuring element and range ○ Fill fluid specifications ○ Differential measuring devices ○ Device calibration using principles of zero, span and angularity adjustments as they relate to links and levers • Service recording devices (Electronic) ○ Identification of measuring element and input measurement scale ○ Power supply ○ Troubleshooting procedures (instrument specific - according to manuals)	

	Introduction to pressure measurement
	• Types of pressure
	  ○ Absolute, Differential, Gage, Vacuum
	  ○ Conversion tables
	  ○ Pressure conversion formulas
	  ○ Steam tables (relationship between temperature and pressure)
	  ○ Head correction calculation
	• Types of pressure measuring devices and transmitters
	  ○ Pneumatic
	  ○ Electronic
	  ▪ Analog
	  ▪ Digital
	  ○ Pressure Transmitters
	• Installation of pressure measuring devices
	  ○ Manufacturers' specifications
	  ○ Selection of device
	  ○ Air / power supply requirements
	  ○ Location of device
	  ○ Isolation of device
	  ○ Connection of device to process
	  ○ Connection of device to control system
	  ○ Sealants and gaskets
	• Configure / calibrate pressure measuring devices
	  ○ Device Operation
	  ○ Primary Calibration Standards
	  ○ Differential Pressure Measurement
	  ○ Pascal's Law
	  ○ Absolute and Atmospheric Pressure	

	○ Relationship between Pressure and Column of Liquid ○ Hydrostatic Head Pressure ○ U-Tube and Well Manometers ○ Bourdon Pressure Gage ▪ Spiral and Helical Elements ○ Bellows and Diaphragm Elements ○ Calibration / configuration parameters ○ Interpretation of results ○ Identification of cause/effect of calibration errors ○ Adjustments to bring device within calibration parameters ○ Document calibration results • Maintain device ○ Manufacturers' recommended maintenance procedures **Introduction to temperature measurement** • Define Temperature, Heat and Energy • Temperature scales ○ Fahrenheit ○ Celsius ○ Kelvin ○ Conversions between scales • Temperature measuring devices, their operation and Transmitters ○ Thermometer ○ Thermocouple ○ Thermocouple tables ○ Resistance Temperature Detectors (RTD) ▪ RTD tables ○ Thermistor ○ Liquid in Glass and Filled bulb systems	

	○ Pyrometer ○ Semi-conductor mechanical thermal system ○ Infrared radiation ○ Fibre Optic ○ Thermal Expansion Thermometers ○ Temperature Transmitters • Temperature calibrating instruments ○ Thermometers ○ Multimeters ○ Millivolt source ○ Resistance source ○ Temperature baths ○ Dry block calibrators ○ Thermocouple simulators ○ Decade box • Installs, calibrates and services temperature measuring devices ○ Manufacturers' specifications ○ Best Practices for selection /location of measuring device ○ Response time ○ Temperature ranges ○ Resolution ○ Thermo well selection and installation ○ Thermocouples ▪ Grounding ▪ Cold junction compensation ▪ Types (J, K…T) ▪ Extension wires ▪ Colour codes (North American and European colour codes)	

	○ RTDs ▪ Alpha value and Different standards (IEC, DIN etc..) ▪ 2, 3 and 4 wire ▪ 100, 200…1000 ohm ○ Device check / calibration ○ Wheatstone bridge ○ Simulators ▪ Decade box ○ Interpretation of calibration results ○ Cause / effect of calibration error ○ Device adjustments ○ Repairing/replacing device components ○ Verification of operation ○ Documenting calibration **Introduction to level measurement** • Level measuring devices, their operation and Transmitters ○ Dip Stick Level Measurement ○ Basic Sight Glasses ○ Float and Cable Arrangements ○ Ultrasonic ○ Capacitance Probe ○ Rotating Paddle ○ Radar Level System ○ Laser Level System ○ Interface Measurement ○ Hydrostatic Pressure ○ Open Tank Level ▪ Air Bubbler System	

	○ Level Transmitters • Calibration instruments used on level measuring devices ○ Pressure calibrator ○ Laptop / software ○ Handheld programmer • Install, calibrate and service level measuring devices ○ Manufacturers' specifications ○ Selection /Location of measuring device ○ Process application ○ Zero Suppression/Elevation ○ Process medium ○ Best practices ○ Device check / calibration ○ Interpretation of calibration results ○ Cause / effect of calibration error ○ Device adjustments ○ Repairing/replacing device components ○ Verification of operation ○ Documenting calibration **Introduction to density measurement** • Density measuring devices and their operation ○ Applications and Selection ○ Hydrometer ○ Hydrostatic head ○ Displacers ○ Radiation Densitometers ○ Oscillating Coriolis Densitometer ○ Ultrasonic Sludge and Slurry Densitometers	

	○ Gas Densitometers ○ Effect of temperature on density • Calibration instruments used on density measuring devices ○ Pressure calibrator ○ Laptop / software ○ Handheld programmer • Install, calibrate and service density measuring devices ○ Manufacturers' specifications ○ Selection /Location of measuring device ○ Process application ○ Process medium ○ Best practices ○ Verify operation ○ Device check / calibration ○ Interpretation of calibration results ○ Cause / effect of calibration error ○ Device adjustments ○ Repair/replace device components ○ Documenting calibration **Introduction to weight measurement** • Weight measuring devices and their operation ○ Load cells ○ Scales ○ Strain gauges • Calibration instruments used on weight measuring devices ○ Test weights ○ Wheatstone bridge ○ Laptop / software	

	○ Handheld programmer (configurator) • Install, calibrate and service weight measuring devices ○ Manufacturers' specifications ○ Selection /Location of measuring device ○ Process application ○ Best practices ○ Verify operation ○ Device check / calibration ○ Interpretation of calibration results ○ Cause / effect of calibration error ○ Device adjustments ○ Repair/replace device components ○ Documenting calibration **Introduction to flow measurement (volumetric, mass flow)** • Flow measuring devices and their operation ○ Types of Flow ▪ Reynolds Number ○ Types of flow meters ▪ head type ▪ variable area type ▪ quantitative flow meters ▪ mass flow meters ○ Differential Pressure Flowmeters ▪ Concentric and Eccentric Orifices ▪ Flow Nozzle ▪ Venturi and Pitot Tubes ○ Target Flowmeter ○ Rotameter or Variable Area Meter	

	○ Magnetic, Vortex, Turbine, and Ultrasonic Flowmeters ○ Doppler Effect ○ Flow Tube Vibration and Twist ○ Coriolis ○ Thermal Mass Flowmeters ○ Positive Displacement Flowmeters ▪ Rotary Vane, Oval Gear, and Nutating Disc Designs ○ Open Channel Flow Measurement ▪ Weirs ○ Parshall Flume ○ Solid flow meters • Calibration instruments used on flow measuring devices ○ Pressure calibrators ○ Temperature calibrator ○ Frequency generator ○ Laptop / software ○ Handheld programmer • Install, calibrate and service flow measuring devices ○ Manufacturers' specifications ○ Selection /Location factors ○ Pressure taps ○ Straight pipe requirements ○ Accuracy requirements ○ Process application ○ Process medium ○ Best practices ○ Verify operation ○ Device check / calibration	

	○ Interpretation of calibration results ○ Cause / effect of calibration error ○ Device adjustments ○ Repair/replace device components ○ Documenting calibration	
3.	**Installs & Maintains Safety and Process Monitoring Systems** **Service ESD (emergency shutdown devices)** • Types of ESD control systems ○ Levels of Shutdown ▪ Unit Shutdown ▪ Process Shutdown ▪ Emergency Shutdown ▪ Emergency Depressurize Shutdown ○ Types of ESD ▪ Electric ▪ Pneumatic ▪ Hydraulic ▪ Mechanical • Purposes of different types of ESD ○ Personnel protection ○ Environmental protection ○ Equipment protection • ESD testing procedures ○ Partial Stroke Test ○ Time test ○ Valve integrity ○ Interlock checks (system shut down check) **Service and calibrate personal safety systems**	**10**

	• Personal gas monitors and standard calibration routines
	  ○ Portable personal gas monitor (Cl, SO2, H2S, O2 , CO)
	  ○ Pull tube (Draeger)
	• Radiation safety devices
	  ○ Radiation (gamma) survey meter
	  ○ Personal dosimeter	

4.	**Installs and Maintains Pneumatic Systems**
	
	Air supply systems
	• Instrument air systems and equipment
	  ○ Need for clean, dry air
	  ○ Air compressors
	  ○ Air dryers
	  ○ Air receivers
	  ○ Air filters
	• Air distribution systems
	• Use of relative humidity to infer dew point
	  ○ Hygrometers
	  ○ Sling psychrometer
	  ○ Digital psychrometer
	  ○ Bulk polymer resistance sensor
	• Servicing procedures for air supply systems
	  ○ Servicing requirements
	  ○ Traps
	  ○ Dessicant
	  ○ Pre and post filters
	Tubing and fittings
	• Types of tubing and installation procedures
		20

	○ Plastic ○ Stainless steel ○ Copper ○ Rubber ○ Process and pressure requirements ○ Sizes ○ Pressure and Temperature Ratings • Tube bending techniques ○ Calculating dimensions ○ Manual tube benders ○ Hydraulic tube benders • Install tubing and fittings ○ Ferrule fitting ○ Tightening fittings ○ Follow P&ID drawings ○ Select appropriate tubing and fittings **Install and service pneumatic instruments** • Specifications and hazards of pneumatic equipment ○ Compressed air safety ○ Pneumatic signal ranges • Types of pneumatic equipment ○ Transmitters ○ Converters (I/P) ○ Positioners ○ Controllers ○ Relays • Operating principles of pneumatic equipment	

	○ Force balance ○ Motion balance • Calibrate pneumatic transmitters ○ Calibration block diagram ○ Five point calibration check ○ Shop or field calibration ○ Force balance calibration procedure ○ Motion balance calibration procedure ○ Documentation of calibration results ○ Manufacturers' specifications for installation	
5.	**Installs and Maintains Electrical and Electronic Systems** **Identification of various Electrical and Electronic components** • Active components • Passive Components • Switches • Plugs • Sockets • Relays/Solenoids/Contactors • Inductive proximity switch • Symbols of electrical components ○ Switch ○ Contacts ○ Solenoids ○ Relay ○ LED • Electrical Ladder Diagram • Panel controls • Integrated Circuits	**60**

	○ Pin identification and numbering convention ○ IC handling and installation • Safety ○ Need for Electrostatic Discharge Protection **Apply basic principles of DC electricity** • operation and applications of various batteries ○ Lead acid ○ NiCad ○ NiMh • Measure electrical current, voltage and resistance ○ Analog multimeters ○ Digital Multimeters • Calculate currents, voltages and resistance using Ohm's law ○ Series circuits ○ Parallel and combination circuits ○ Formula E= I x R • Define and reference voltage measurement to circuit common ○ Difference between ground and circuit common ○ Multimeter ○ Oscilloscope and scope meter ○ Frequency generator ○ Circuit schematic • Calculate electrical power in watts ○ Apply Watt's Law to define power rating of appliances ○ Watts = E x I • Examine resistors, potentiometers and rheostats ○ Differences ○ Power ratings	

	○ Applications ○ Colour codes **Apply basic principles of AC electricity** • Define AC electricity ○ Generation ○ Polarity and waveform analysis ▪ Peak/RMS voltages • various types of transformers ○ Step up ○ Step down ○ Autotransformer ○ Isolation ○ Three phase transformer • Examine the use of capacitors and inductors in AC circuits ○ Applications ○ Filtering ○ Regulating voltage ○ Power factor correction • Size electrical components for various circuits ○ Capacitors ○ Inductors ○ Resistors ○ Wire ○ Fuses • Build and test circuits ○ Understand various components in circuits ▪ Electromagnetism	

	▪ Lenz's Law ▪ Inductive Reactance ▪ Inductive Kick ▪ Capacitive Reactance ▪ Capacitor Types ▪ Time Constants and Their Application ▪ Filters and Resonance ▪ Effect of frequency on a circuit o Measuring techniques and equipments • Types of AC circuits o Different classes (based on different standards) • installation procedures for AC equipment o Wiring methods o Support o Grounding o Shielding • Apply proper circuit connection techniques o Soldering o Crimping **Introduction to Power Electronics (Only Block diagrams)** • SMPS • Convertor • Inverter • UPS • DC and AC Drives	

6.	**Installs and Maintains Final Control Elements**
	
	Service regulators and examine relief valves
	• Examine regulators
	  ○ Purpose
	  ○ Pressure drops
	  ○ Types
	  ▪ Relieving
	  ▪ Non- Relieving
	  ▪ Pilot operated
	  ○ Definitions
	  ▪ Droop
	  ▪ Turndown
	  ○ Applications
	  ▪ Pressure reducing
	  ▪ Pressure relieving
	• Examine operation and applications of regulators
	  ○ Air
	  ○ Water
	  ○ Steam
	  ○ Oil
	  ○ Gas
	  ○ Differential
	• Service and maintain regulators
	  ○ Components
	  ▪ Diaphragms
	  ▪ Bolts
	  ▪ Springs
	  ▪ Seats
		50

	▪ Gaskets ○ Disassembling ▪ Spring compression ○ Reassemble ○ Test • Examine relief valves ○ Applications ○ Safety Device ○ Reset Differential ○ Certification and testing **Service, size and install control valves and actuators** • Examine actuators ○ Types ▪ Pneumatic ▪ Hydraulic ▪ Electric ○ Applications ▪ Fail open ▪ Fail close ▪ Fail last ○ Actions ▪ Spring return ▪ Double–acting ○ Components ▪ Diaphragms ▪ Plates ▪ Stem connector (coupling) ▪ Bushings	

	▪ O-rings ▪ Pistons ▪ Motors ▪ Springs ○ Required Operating Environment • Examine control valves ○ Process applications ○ Seal / shut off requirements ○ Flow Characteristics ▪ Quick opening ▪ Linear ▪ Equal percentage ○ Body Types ○ Valve sizing ○ Sliding stem ▪ Globe ▪ Bar stock ▪ Pinch valve ○ Rotary ▪ Butterfly ▪ E-Disc ▪ Segmented ball ▪ Through-bore ball ▪ Restricted trim ○ Components ▪ Cages ▪ Plugs ▪ Seats	

	▪ Stems ▪ Packing • Types and applications of valve packing ○ Teflon ○ Graphite ○ Rope • Install and service control valves ○ Gaskets ○ Sealants ○ Positioning valve in process ○ Securing valve using appropriate process ▪ Flanged ▪ Screwed ▪ Wafered / Flangeless ○ Isolation of valve from process ○ Testing procedures ○ Stroke to ensure proper operation ○ Leak testing ○ Possible faults ▪ Leaking packing ▪ Valve passing ▪ Damaged parts ▪ Incorrect travel ○ Cleaning / lubricating ○ Repairing / Rebuilding • Install and service actuators ○ Matching to valve	

	○ Connecting to valve ○ Valve travel ○ Bench set ○ Verifying operation ○ Correct air supply pressure ○ Function testing ○ Possible faults ▪ Leaking diaphragms ▪ Broken springs ▪ Damaged/worn O-rings ○ Removing /replacing components ○ Cleaning/lubricating components ○ Assembling/disassembling ▪ Spring compression ○ Loading on stem connector **Install and service valve positioners** • Valve positioners ○ Types ▪ Pneumatic ▪ Electronic ▪ Digital ▪ Electro hydraulic ▪ Electro mechanical ○ Applications ○ Single Acting	

	○ Double Acting ○ Components ▪ Levers ▪ Nozzles ▪ Flappers ▪ Relays ▪ Auxiliaries ▪ Locks ▪ Boosters ▪ Speed controls ○ Relation to actuator type / application • Install and service valve positioners ○ Mounting ○ Connecting to actuator ○ Connecting to process control system ○ Configuring ○ Set stroke ○ Set pressures ○ Match to actuator ○ Auto tune ○ Calibrating	

	○ Connecting calibration instruments ○ Calibration parameters ○ Interpretation of calibration results ○ Cause/effect of calibration errors ○ Component maintenance	
7.	**Installs and Maintains Communications, Networking and Signal Transmission Systems** **Install wiring in accordance with different standards** • Examine wiring requirements ○ Materials ○ Connections ▪ Crimping ▪ Terminal blocks ▪ Marrettes ▪ Soldering ▪ Protection (heat shrink, taping etc.) ○ Shielding ○ Grounding ○ Grounding loops • Install wiring ○ Sizing wire ○ Routing of wiring runs ○ Stripping wire ○ Labeling / colour-coding wire ○ Connecting wire **Trends in control technologies** • Smart Components	**28**

	○ Typical smart DP Transmitter ○ Smart temperature transmitter ○ Benefits **Service supervisory control and data acquisition (SCADA) systems** • types of SCADA protocols and configurations ○ Applications ○ Online history ○ Remote equipment operation ○ Network layout ○ Protocols ○ Host ○ Field ○ Addressing methods • types of SCADA equipment and servers for data acquisition and storage ○ Radio Telemetry Units (RTU) ○ Wireless Communications systems ○ Cellular ○ Satellite **communication systems** • types of signal transmission systems ○ Fibre optics ○ Armoured cable ○ Non armoured cable ○ Multimode / single mode transmission ○ Wired ○ Coax ○ UTP ○ Wireless	

	○ Satellite ○ Blue tooth ○ RF ○ IR ○ IEEE standards • features and limitations of communication protocols ○ Types of protocols ○ RS232 ○ RS422/485 ○ MODBUS ○ ASi BUS ○ Device Net ○ Profibus ○ Highway Addressable Remote Transducer(HART) ○ Foundation Fieldbus H1 & H2 ○ Ethernet TCP/IP ○ Addressing methods and components ○ Potential sources of interference ○ Related standards, codes, licenses	
8.	**Installs and Maintains Control Systems** **Stand alone Controllers** • Electronic Controllers • Single loop controllers **Programmable Logic Controllers (PLCs)** • Examine types of PLCs ○ Hardware Architecture	**80**

	○ Control Capabilities ▪ Discrete control ▪ Analog control ○ Compatibility with other process systems ○ Networks ○ Protocols • PLC languages and symbols ○ Structured Text ○ Instruction list ○ Ladder Logic ○ Function block ○ Sequential function chart • PLC components ○ CPU ○ Memory organization ○ Input interface ○ Output interface ○ Power supply ○ Programming/Monitoring interface ○ Data Table ○ User Program **fundamental theories of process operation and equipment** • Common industrial processes ○ Continuous Process ○ Batch process **Introduction to control theory**	

	• Basic control theory
	  ○ Set point / process variable / manipulated variable
	  ○ Relation of output to input
	  ○ Steady state value and dynamic component
	  ○ Control loop gains / loop stability
	• Control modes
	  ○ On / Off control
	  ○ Differential Gap
	  ○ Proportional only
	  ○ Integral only
	  ○ Proportional plus Integral
	  ○ PID -Proportional, Integral, Derivative
	  ▪ Reset rate / Reset time
	  ▪ Series / parallel
	  ○ Interactive / non-interactive / rate on PV
	• Controller action
	  ○ Direct acting
	  ○ Reverse acting
	• Controller operating modes
	  ○ Automatic
	  ○ Manual
	  ○ Remote
	  ○ Local
	  ○ Supervisory
	Introduction to process control techniques and strategies
	• Control techniques
	  ○ Loop tuning
	  ○ Zeigler Nicholls	

	○ Lambda ○ Tuning from manual output changes • Basic control strategies ○ Feedback control ▪ Process Dynamics • Lags • Dead Time ○ Feed forward control ○ Cascade control ○ Ratio Control ○ Gap action control ○ Multi variable control **Implement process control strategies** • Implement process control strategies ○ Determining required controller action based on process and valve action ○ Consulting loop diagrams ○ Override ○ Interlocks ○ Limits ○ Select relays ○ Loop impact on overall process ○ Alarming ○ control strategy design ○ Implementation on live processes ○ Upset recovery	
	Total Theory / Lecture Hours:	150

Total Practical / Tutorial Hours:	250
Total Hours:	400

Recommended Hardware:

- Personal Protective equipments for demonstration
- Electronic Chart recorder
- Indicating devices- Digital, Analog and LCD
- Bourdon tube and bellows
- Pressure transmitter (conventional 4 - 20 mA)
- Pressure calibrator
- Multimeter
- Thermometer
- Thermocouple simulator
- Resistance source
- Temperature bath
- Thermocouple (J)
- RTD (Pt 100)
- Capacitance probe for level measurement
- Ultrasonic Levelsensor
- Level transmitter
- Hydrometer
- Load cell
- Orifice plate
- Magnetic flow meter
- Portable gas monitor
- Hygrometer
- I to P converter

- Positioner
- Pneumatic relay
- Compressor
- Electro mechanical relay
- Contactor
- Solenoid
- Electric actuator
- Pneumatic control valve
- Pressure regulator
- Soldering Kit
- Crimping tool
- Marretes, wire terminator
- Standard tool box (Mechanical and Electrical)
- SCADA
- PLC
- Fieldbus cable
- Function generators
- Computers/ Laptop with associated softwares

Recommended Software:

Software compatible for different types of instruments

Text Books:

- Instrument Engineers Handbook: Process Measurement and Analysis, Liptak, Bela G, CRC Press
- Instrument Engineers Handbook: Process Control and Optimization,, Liptak, Bela G, CRC Press
- Instrument Engineers Handbook. Process Software and Digital Networks,

Liptak, Bela G, CRC Press

- Advanced temperature measurement and control, McMillan, Gregory K.
- Control instrument mechanisms, Warren, John E
- Fundamentals of industrial control, Coggan, Donald A
- Hydraulics and Pneumatics, Parr, E.A
- Digital Fundamentals, Floyd, Thomas L.
- Industrial Flow Measurement, Spitzer, David W.
- A Guide to the Automation Body of Knowledge, Trevathan, Vernon L., Ed.
- Wireless communication systems/ Design and construction, Eren, Halit.
- Practical Industrial Safety, Risk Assessment and Shutdown Systems, Macdonald, Dave.
- Linear Position Sensors, Nyce, David S
- Practical Data Communication for Instrumentation and Control, Park, John
- Practical Industrial Data Networks, Mackay, Steve
- Fundamentals of Electronics DC/AC Circuits, Terrel, David L
- Basic Math for Electronics, Cooke and Adams
- Instrumentation, PTEC
- Fundamentals of Process Control Theory, Murrill, Paul W
- Experiments of Digital Fundamentals, Buchla, David
- Principals of Electric Circuits, Floyd
- Instrumentation and Process Control, Bartlet, Terry
- Pneumatic Instrumentation, Patrick, Dale R & Steven R
- Industrial Instrumentation, Faulk, Sutko
- Fundamentals of Instrumentation, Thomson, Delmar Learning
- Elements of Data Processing Math, Price, Winston T & Miller, Merlin
- Electricity 3, Alerich, Walter N & Keljik, Jeff
- Process Industrial Instrumentation and Control Hand Book, Considine, Douglas M

- Instruments for Process Measurement and Control, Anderson, Norman A
- Fundamentals of Electric Circuits, Bell, David A
- Basic Fluid Power, Rease, Dudley A
- Fundamentals of Analytical Chemistry, Skoog, Douglas A & West, Donald M
- Elements of Physics, Shortley and Williams
- Electrical Machines, Drives and Power Systems, Wildi, Theodore
- Process Control Instrument Technologies, Johnson, Curtis D
- Low Pressure Boilers, Steingress, Frederick M
- Fundamentals of Physics Heath, Macnaughton and Martindale

- ANSI/ISA5.1-2009 – Instrumentation Symbols and Identification
- ANSI/ISA5.4-1991 – Instrument loop Diagrams
- ANSI/ISA5.06.01-2007- Functional Requirements Documentation for Control Software Applications
- ANSI/ISA20-1981 – Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves
- ISA-TR20.00.01-2007 – Specification Forms for Process Measurement and Control Instruments Part1: General Considerations Updated with 27 New Specification forms in 2004-2005
- Canadian Electrical Code, Part 1, 20th Edition. CSA, January 2006
- Industrial Hydraulics manual, Eaton Corporation
- Closed loop electro hydraulic systems manual, Vickers, Incorporated Training Center
- www.abb.com
- www.boschrexroth.
- www.control.com

- www.controlglobal.com/whitepapers
- www.controlsweekly.com
- www.cpecn.com
- www.cvs-controls.com
- www.cyberlaboratory.com
- www.documentation.emersonprocess.com
- www.emersonprocess.com
- www.enmet.com
- www.fisherregulators.com
- www.flowcontrolnetwork.com
- www.foxboro.com
- www.galvanic.com
- www.gongol.net
- www.graceindustries.com
- www.honeywell.com
- www.iceweb.com.au/Technical/LevelTechnologies.html
- www.invensys.com
- www.isa.org
- www.joliettech.com
- www.metsoautomation.com
- www.modelingandcontrol.com
- www.multimediahrd.com
- www.omega.com
- www.ohsonline.com
- http://source.theengineer.co.uk/
- www.raesystems.com
- www.scadalink.com
- www.smar.com/PDFs/Catalogues/FBTUTCE.pdf

- www.smar.com/PDFs/Catalogues/HARTTUTCE.PDF
- www.spitzerandboyes.com
- www.vegacontrols.co.uk
- www.worksafebc.com
- www.yokogawa.com
- www.zoneni.com

ESDM Courses

Level Code:	L2	Vertical Name:	Computer Hardware
Course ID:	NL/S/L2/C010	Course Name:	2.12.1 Assembly and Maintenance of Personal Computer (NIELIT)

Objective of the Course:

To train students in the area of Assembling of Computer, Troubleshooting, Installation of Software and Peripherals.

Learning Outcomes:

After completing the course the person should be able to

- Assembled & Dissembled the computers installing the peripherals devices
- Repair of Computer up to Card label
- Install different software of computers
- Data recovery
- Maintenance & formatting the computers
- Password breaking
- Protect the computer from virus

Expected Job Roles:

Act as Computer Hardware Technician Starting his own Computer Assembling and Maintenance Shop

Duration of the Course (in hours)	240 Hrs
Minimum Eligibility Criteria and pre-requisites, if any	Polytechnic Diploma/Graduation/ ITI/12th/10th

Professional Knowledge:

- Basic parts of Computer system
- Studies of Different types of Mother Board
- Power Supply
- Different types of Cards
- Different types of Monitors
- Different types of Printers and Scanners and their installation procedures

Professional Skill:

- Identification of Desktop Motherboard IC's and tracing of North Bridge Section
- Identification of Desktop Motherboard IC's and tracing of RAM/ROM/Clock Section
- Identification of Desktop Motherboard IC's and tracing of PS/2/Audio Section
- Practical on Diagnostics Card Error Code
- Fault finding of Desktop Computer Motherboard
- Card level Test along with error code
- Mother Board Practical Test
- Diagnostics Card Level Test
- Fault Tracing through CRO Test
- Different Drivers Loading Test
- Soldering and De-soldering Test

- BGA Chip Replacement and Rebolling Test

Core Skill:

- Fault Diagnostic Skill
- Soldering and De-soldering Skill
- Motherboard Repair Skill
- Operation of BGA Machine Skill
- Software Installation Skill
- BIOS Programming Skill
- Partition making without Formatting Skill
- How to make Multi boot Pen Drive Skill
- How to Recover window by Command Prompt Skill

Detailed Syllabus of Course

Module. No	Module. Name with detailed syllabus	Minimum No. of Hours (Theory/Practical)
➢ **Module-I**	Introduction to Computer, Uses of Computer, Different between Hardware & Software, Different types of computers inside PC and its peripherals devices, Booting concept of computer in DOS and Windows environment, Different input and output devices/ cables, connectors identifications, Identifications of different types of motherboard, controller cards, display cards, sound card AGP cards FAX/Modem Cards, TV Tuner Cards, LAN Cards, Ethernet cards, Different types of RAM used in PC's.	40 Hrs
➢ **Module-II**	BIOS setting, Formatting of Hard Disk, Installation of Operating System i.e. DOS/Windows, Off-line drive installation / online drive installation / Driver backup / restore / partition formatting / Windows file repairing / BIOS password break / Administrative password break / Data recovery / Pen Driver bootable / Sound Problem / USB Problem / LAN problem etc.	30 Hrs

➢ **Module-III**	Application Software Installation/ Different types of Application Software/ Antivirus Software Installation/ different types of Antivirus Software/ Protect PC from Virus / Hard Disk utility Software / Dual Booting Installation etc	40 Hrs
➢ **Module-IV**	System integration of different types of computers, such as PC,PC-XT, PC –AT etc. upto Pentiem-4 label, Trouble shooting of shooting of different types of faults, Different computer cards identifications and trouble shooting, Power supplies installation and trouble shooting, Different types of SMPS identifications, Hard Disk driver installation and configuration setting, Use of CD ROM and DVD Drivers, Using of FDD drives, Different types of keyboards, repairing and maintenance, different types of monitors, Monitors Repairing / Maintenance / Mouse repairing and Installation	50 Hrs
➢ **Module-V**	Different types of printers, working of printers, working / repairing of DMP printers, working / repairing of inkjet printer, working / repairing of LaserJet printer, Checking of printer interface cable and dip switch setting, self test and loading of printer drives, introduction to UPS, different types of UPS maintenance and servicing of UPS, battery replacement of UPS	30 Hrs
➢ **Module-VI** ➢	Assembly and dismantling of PCs front panel connection, preventing maintenance and Cleaning, servicing of computer, Type of Backup, Taking Backup files and fine tuning the system, running diagnostics tool, running of virus protection programme, FAQ and feedback.	50 Hrs
	Total Theory / Lecture Hours:	
	Total Practical / Tutorial Hours:	
	Total Hours:	

Recommended Hardware(minimum batch size 10):	Different types of Mother Board • Desktop Different types of Cards • VGA • AGP • NIC • Audio Different types of Tools and instrument • BGA Machine • Soldering and Disordering Station • Oscilloscope 25-100 Mhgz • Multi-meter • Digital IC Tester • Analog IC Tester • Function Generator • Power Supply 0-30 V • Small screw Driver kit • Different types of small Plair set • De-soldering pump • Soldering wire • Twizer, • Bond make liquid flux 0% some respective components etc.
Recommended Software:	Operating System Diagnostic Card for Desktop and Laptop
Text Books:	Modern Computer Hardware Course Computer Hardware Course
Reference Books:	Inside Module 13 Motherboard 14 GT Publishers Author S K Gupta Tablet PC Servicing Manual GT Publishers Author S K Gupta Circuit Diagram Books of different types of Mother Boards

ESDM Courses

Level Code:	L2	**Vertical Name:**	Telecom Segment
Course Code:	NL/S/L2/C011 TL/S/L2/C034	**Course Name:**	2.13.1 Installation/Repair & Maintenance of EPABX System (NIELIT/TSSC)

Objective of the Course:

TO DEVELOP SKILLED PEOPLE IN THE FIELD OF INSTALLATION & MAINTENANCE OF EPABX SYSTEM

Learning Outcomes:

AT THE END OF PROGRAM TRAINEE WILL BE ABLE TO INSTALL AN EPABX SYSTEM .HE WILL BE ABLE TO REPAIR IT AND CAN WORK IN THE FIELD OF MAINTENANCE OF EPABX SYSTEM. HE CAN OPEN A SERVICE CENTRE.

Expected Job Roles:

The job potentials are as follows:

- Job as technician/operator in different telephone exchanges in Government/Private sector
- Job in telephone industries like BSNL, MTNL and others
- Job & Repairing Centre
- Self Employment

Duration of the Course (in hours)	200 Hrs.
Minimum Eligibility Criteria	9th Pass

and pre-requisites, if any

Professional Knowledge:

The Learners must have the following professional knowledge as follows:

- Typical Telephone network
- Introduction to EPABX system
- Basic of Digital and data communication system
- Knowledge of Push button telephone system

Professional Skill:

The Learner will comprises the professional skills as :

- Installation and maintenance of EPABX system
- Principles of Space division switches and knowledge of digital exchange and its working

Core Skill:

- Basic Communication
- Analog and digital modulation technic
- Coding
- Data Transmission
- Modems

Detailed Syllabus of Course

Module. No	**Module. Name**	**Minimum No. of Hours**	
		Theory (Hrs.)	**Practical (Hrs.)**
1.	Basic Communication System	05	05
2.	Digital Modulation Technique	10	10
3.	Modems	05	10
4.	Push button Telephones	20	20
5.	Electronic Exchange	10	30

6.	EPABX systems	10	30
7.	Digital Exchange	10	25
	Total Theory / Lecture Hours:	70	
	Total Practical / Tutorial Hours:	130	
	Total Hours:	200	

MODULE 1 Basic Communication System (05 Periods)

Basic block diagram of digital and data communication systems. Their comparison with analog communication systems. Basic information theory.

MODULE 2 Digital Modulation Technique

- Basic block diagram and principle of working of the following:
- Amplitude shift keying (ASK): Interrupted continuous wave (ICW), two tone modulation
- Frequency Shift keying (FSK)
- Phase shift keying (PSK),
- Quadrature Amplitude modulation (QAM)

MODULE 3 Modems

Need and function of modems, Mode of modems operation (low speed, medium speed and high speed modems). Modem interconnection, Modem data transmission speed, Modem modulation method, Modem interfacing (RS 232 Interface, other interfaces).

MODULE 4 Push button Telephones

BASIC BLOCK DIAGRAM OF A TELEPHONE
FUNCTION OF EACH BLOCK
VARIOUS TONES USED IN THE PHONE CIRCUITS
USE OF MICROPHONE AND SPEAKER

PULSE DIALING AND TONE DIALING AND THEIR APPLICATIONS

FUNCTION OF DIALER CIRCUIT,SPEECH CIRCUIT,RINGER CIRCUIT,PROTECTION CIRCUIT,

FUNCTION & WORKING OF KEY PAD USED IN PUSHBUTTON TELEPHONE

TESTING METHODS OF PUSHBUTTON TELEPHONE FOR PROPER FUNCTIONS

USE OF VARIOUS ADAPTORS, CONNECTORS AND SOCKETS USED IN THE TELEPHONE CIRCUITS

FAMILARISATION TO KEY TELEPHONE SYSTEM
Trouble shooting and corrective maintenance

MODULE 5 Electronic Exchange

- Typical telephone network. Various switching offices (Regional Centre, District Centre, Toll Centre, Local Office) and their hierarchy.
- Principles of space division switches. Basic block diagram of a electronic exchange and it's working.
- Basic idea of FAX system and its applications. Basic Principle of operation and block diagram of modern FAX system. Important features of modern FAX machines.

Trouble shooting and corrective maintenance

MODULE 6 EPABX systems

BASIC BLOCK DIAGRAM OF EPABX SYSTEM
DIFFERENT TYPES OF EPABX SYSTEM
METHODS TO CONNECT THE TRUNK LINE AND EXTENSION LINE IN A EPABX
DIFFERENT FACILITIES AVAILABLE IN EPABX SYSTEM EG CALL WAITING, CALL TRANSFER, CONFERENCE FACILITY
WIRING CIRCUITS AND UNDERSTAND THE WIRING OF EXTENSION CIRCUITS
Trouble shooting and corrective maintenance

MODULE 7 Digital Exchange

Working Principle and operation of digital exchange, Trouble shooting and corrective maintenance

Detail of Practical Work

1 FAMILARISATION OF TOOLS & INSTRUMENTS USED FOR WIRING AND TESTING OF EPABX SYSTEM
2 IDENTIFY & TEST THE COMPONENTS USED IN THE PUSHBUTTON TELEPHONE
3 IDENTIFY THE VARIOUS TONE SIGNALS USED IN THE PHONES
4 TESTING OF MICROPHONE AND SPEAKER
5 TESTING & REPLACING COMPONENTS IN THE PROTECTION CIRCUIT AND RINGER CIRCUIT
6 TESTING OF KEY PAD FOR PROPER FUNCTION AND REPAIR THE KEY PAD PROBLEMS
7 IDENTIFY THE FAULTY COMPONENT AND REPLACE IN THE DIALER CIRCUIT AND SPEECH CIRCUIT
8 TEST AND IDENTIFY THE FAULT IN A PUSHBUTTON TELEPHONE
9 IDENTIFY AND FIX THE VARIOUS ADAPTORS, CONNECTORS AND SOCKETS
10 IDENTIFY THE TERMINALS OF TRUNK LINE AND EXTENSION LINE AND CONNECT THE EXTENSIONS

11 SETTING THE CALL TRANSFER, CALL WAIT AND OTHER FACILITIES AVAILABLE ON EPABX
12. TRACE THE WIRING AND LOCATE THE FAULT IN THE EXTENSION WIRING CIRCUIT
13. TROUBLE SHOOTING AND MAINTENANCE PRACTICES OF EPABX, ELECTRONICS AND DIGITAL EXCHANGE

Recommended Hardware:	1. EPABX OF 2 TO 6 LINE - 1 NO 2. EPABX OF 2 TO 10 LINE - 1 NO 3. PUSHBUTTON TELEPHONES - 10 NOS 4. TELEPHONE ANALYZER - 1 NO. 5. CRIMPING TOOL - 1 NO. 6. MULTIMETER – 1 NO
Recommended Software:	NIL
Text Books:	4. Electronic Communication Systems By George Kennedy Tata McGraw Hill Education Pvt Ltd, New Delhi 5. Communication system By A.K. Gautam S.K. Kataria Sons, Delhi 6. Electronics communication by K.S. Jamwal, Dhanpat Rai and Sons, Delhi
Reference Books:	1. Manual of EPABX/ Digital Exchange

ESDM Courses

Level Code:	L3	**Vertical Name:**	4.3 Telecom
Course Code:	TL/S/L3/C001	**Course Name:**	2.13.2 Optical Fiber Splicer (TSSC)

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)	350 Hours

Minimum Eligibility Criteria and pre-requisites, if any	10^{th} Pass

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/C002	**Course Name:**	2.13.3 Tower Technician (TSSC)

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
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:	L4	**Vertical Name:**	Telecom
Course Code:	TL/S/L4/C003	**Course Name:**	2.13.4 Handset repair Engineer (Level II) (TSSC)

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 hrs

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

ESDM Courses

Level Code:	L4	**Vertical Name:**	Telecom
Course Code:	TL/S/L4/C004 EL/S/L4/C035	**Course Name:**	2.13.5 Broadband Technician (TSSC/ESSCI)

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 hours)	350 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.
Reference Books:	NIL

ESDM Courses

Level Code:	L4	**Vertical Name:**	Telecom
Course Code:	TL/S/L4/C005	**Course Name:**	2.13.6 Optical Fiber Technician (TSSC)

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:**	2.13.7 Installation Engineer – SDH (Synchronous Digital Hierarchy) & DWDM (Dense Wavelength Division Multiplexing) (TSSC)

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. 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:	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 EL/S/L5/C036	**Course Name:**	2.13.8 Installation Engineer – Networking Layer2 & Layer3 (TSSC/ESSCI)

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 (including final year candidate)

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

ESDM Courses

Level Code:	L2	**Vertical Name:**	Telecom (Passive Infra)
Course Code:	TL/S/L2/C011	**Course Name:**	2.13.9 Telecom Installation and Repair Worker (TSSC)

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	8th Pass

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 • 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.	10Hr

	• 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:	L3	**Vertical Name:**	Telecom Industry Engineer
Course Code:	TL/S/L3/C012	**Course Name:**	2.13.10 Telecom Industry Network Security Technician (TSSC)

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-	ITI / Diploma

requisites, if any	

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 • 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	20 Hours

	- 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 conjunction with IPv4 Describe IPv6 addresses	20 Hours
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	25 Hours

	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)	
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 Configure and verify ACLs to limit telnet and SSH access to the router	10 Hours
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	20 Hours

	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	
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 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	50 hours

	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 (Passive Infra)
Course Code:	TL/S/L4/C018	**Course Name:**	2.13.11 Telecom Tower Equipment Installer and Integrator (TSSC)

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. - 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.	70 Hours

	- 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 - 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	70 Hours

	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:	

ESDM Courses

Level Code:	L4	**Vertical Name:**	Network Management
Course Code:	TL/S/L4/C014 EL/S/L4/C039	**Course Name:**	2.14.1 Grass Root Telecom Provider (TSSC/ESSCI)

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	10^{th} + ITI, 12^{th} 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	10 Hr.

	• Layer- 2 WAN circuit technologies	
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:	

ESDM Courses

Level Code:	L4	**Vertical Name:**	Network Operation & Maintenance
Course Code:	TL/S/L4/C019	**Course Name:**	2.15.1 Telecom Industry Network Specialist (TSSC)

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	150 Hours

	- Troubleshooting layer 3 technologies	
4	**VPN Technologies** - Tunnelling - Encryption - Troubleshooting VPN technologies	100 Hours
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

3 Manufacturing Sector

3.1 Consumer Electronics

ESDM Courses

Level Code:	IV	**Vertical Name:**	Consumer Electronics

Course Code:	EL/M/L4/C017	**Course Name:**	3.1.1 Assembly Operator-RAC (Refrigerator, AC) (ESSCI)

Objective of the Course:

Assembly Operator – Refrigeration and Air-conditioning (RAC): RAC Assembly Operator assembles and connects together the various modules and parts of the refrigerator or air conditioner.

Brief Job Description: The individual at work is responsible for assembling and wiring up of various components, modules or sub-assemblies and systems to make the complete product.

Personal Attributes: The individual must: have strength to lift heavy parts and modules, ability to work in high-decibel noise environment and in a standing position for long hours

Learning Outcomes:

NOS # ELE/N3506Assemble Refrigerator

1. Understand requirement from the supervisor
2. Assemble the refrigerator
3. Report problems to supervisor
4. Achieve productivity, quality and safety standards as per company's norms

NOS # ELE/N3507Assemble Air conditioner

1. Understand requirement from the supervisor
2. Assemble the air conditioner

3. Report problems to supervisor
4. Achieve productivity, quality, and safety standards as per company's policy

ELE/N9902- Coordinate with colleagues

1. Interact with superior
2. Coordinate with colleagues

ELE/N9903-Maintain safe work environment

1. Follow standard safety procedures of the company
2. Participate in company's safety and fire drills
3. Maintain good posture at work for long term health

Expected Job Roles:

Assembly Operator-RAC

Duration of the Course (in hours)	350 hours
Minimum Eligibility Criteria and pre-requisites, if any	10^{TH} + ITI or 12^{th} Pass

Professional Knowledge:

NOS # ELE/N3506 Assemble Refrigerator

KA1. company's policies on: incentives, delivery standards and personnel management
KA2. reporting and documentation processes
KA3. importance of the individual's role in the workflow
KA4. reporting structure

KB1. electro-mechanical assembly instructions
KB2. general principles of wiring and assembly, methods used and purpose of each
KB3. circuit knowledge and functioning of different modules of the refrigerator

KB4. principles of refrigeration, sealing systems
KB5. methods of refrigeration and their uses
KB6. types of compressors such as reciprocating, rotary, centrifugal, scroll and their functions
KB7. different types of refrigerants such as R12, R22, R134a, R290, R600a, R410, R32
KB8. safety norms in handling hydro carbon gases, nitrogen
KB9. fundamentals of electricity such as Ohms law, difference between AC and DC, series and parallel connections
KB10. basic electronics of components such as diode, transformer, LED, photo transistor, capacitor, resistor, inductor, thermisters
KB11. how to read values of resistors, capacitors, diodes and integrated circuits with specific reference to colour coding, polarity, orientation, tolerance
KB12. specific safety precautions that need to be taken while working in an electronic assembly unit
KB13. personal protective equipment/gear such as goggles, gloves, rubber base shoes, etc., to be worn while carrying out wiring activities
KB14. selection and maintenance of various tools used during the assembly process
KB15. frequently occurring errors in the assembly process, causes and preventive measures
KB16. continuous improvement processes and work place organization methods such as 5S and Kaizen

NOS # ELE/N3507 Assemble Air conditioner

KA1. company's policies on: incentives, delivery standards and personnel management
KA2. reporting and documentation processes
KA3. importance of the individual's role in the workflow
KA4. reporting structure

KB1. electro-mechanical assembly instructions
KB2. general principles of wiring and assembly, methods used and purpose of each
KB3. circuit knowledge and functioning of different modules of the air conditioner
KB4. principles of refrigeration, understanding of sealed systems, methods of refrigeration and their uses
KB5. types of compressors such as reciprocating, rotary, centrifugal, scroll and their functioning
KB6. different types of refrigerants such as R12, R22, R134a, R290, R600a, R410, R32
KB7. safety norms in handling hydro carbon gases, nitrogen
KB8. fundamentals of electricity such as Ohms law, difference between AC and DC, series and parallel connections
KB9. basic electronics of components such as diode, transformer, LED, photo transistor, capacitor,

resistor, inductor, thermister
KB10. how to read values of resistors, capacitors, diodes and integrated circuits with specific reference to colour coding, polarity, orientation, tolerance
KB11. specific safety precautions that need to be taken while working in an assembly unit
KB12. personal protective equipment/gear such as goggles, gloves, rubber base shoes, etc., to be worn while carrying out wiring activities
KB13. selection and maintenance of various tools used during the assembly process
KB14. frequently occurring errors in the assembly process, causes and preventive measure.

NOS# ELE/N9902 - Coordinate with colleagues

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. importance of the individual's role in the workflow
KA3. reporting structure
\KB1. how to communicate effectively
KB2. how to build team coordination

NOS # ELE/N9903 - Maintain safe work environment

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. company occupational safety and health policy followed
KA3. company emergency evacuation procedure
KA4. company's medical policy

KB1. how to maintain the work area safe and secure
KB2. how to handle hazardous materials, tools and equipment
KB3. emergency procedures to be followed such as fire accidents, etc.
KB4. long term value of good posture and use of appropriate handling equipment

Professional Skill:

i. **Electro-mechanical assembling skills**
ii. **Using tools and machines**
iii. **Interpersonal skills**
iv. Analytical and reflective skills
v. Decision making skills
vi. Reflective thinking

Core Skill:

1. **Reading and Writing Skills**
2. **Team work**
3. **Multitasking**
4. **Documentation skills**

Detailed Syllabus of Course

Module. No	**Module. Name**	**Minimum No. of Hours**
	Assemble Refrigerator	
	Assemble Air conditioner	
	Coordinate with colleagues	
	Maintain safe work environment	
	Total Theory / Lecture Hours:	175

Total Practical / Tutorial Hours:	225
Total Hours:	400

Recommended Hardware:	
Recommended Software:	NA
Text Books:	NA
Reference Books:	NA

ESDM Courses

Level Code:	IV	**Vertical Name:**	Consumer Electronics
Course Code:	EL/M/L4/C047	**Course Name:**	3.1.2 Mobile Phone Assembly Operator (ESSCI)

Objective of the Course:

Mobile Phone Hardware Assembly Technician: This job holder in the electronics sector is responsible for assembling components to produce smartphone in line of work following given work instructions.

Brief Job Description: An assembly line technician (Smartphone) should be capable of assembling mobile phone components in correct position and alignment using approved techniques and equipment in a production unit. The candidate must ensure that given job duties are carried out in compliant with standard operational pararmeters.

Personal Attributes: Needs to be receptive to repetitive nature of work. Should possess an alert mind, manual dexterity and a physically active body. Capable of working in standing or sitting position for long hours. Should be flexible towards rotational job duties in an assembly line and be focused on deliverying quality output. He/she should be open to owning responsiblity to outcomes and work in a team.

Learning Outcomes:

- NOS # ELE/N 3901: Perform assembly operation of mobile phone using appropriate methods & equipment

  - Working safely
  - Preparing work place for smartphone assembling operations
  - Carrying out assembling of smart phones
  - Maintaining production assembly line
  - Post assembly operation activities

  - ELE/N 3902: Carry out fixing operation of connectors and routing cables in a mobile phone assembly
  - Working safely
  - Preparing work place for smartphone assembling operations
  - Carry out fixing operation in smartphone assembly
  - Maintaining production assembly line
  - Post assembly operation activities

- ELE/N 1001: Use basic health and safety practices in electrical and electronics work
- Health and safety
- Fire safety
- Emergencies, rescue and first-aid procedures

- CSC/N 1336: Work effectively in team
- Working in a team
-

-
- Entrepreneurship Module

Expected Job Roles:

Assemblt Line Technician (Smartphone)

Duration of the Course (in hours)	350 Hrs
Minimum Eligibility Criteria and pre-requisites, if any	ITI/ 12th Pass

Professional Knowledge:

NOS # ELE/N 3901: Perform assembly operation of mobile phone using appropriate methods & equipment

KA1. relevant legislation, standards, policies, and procedures followed in the company relevant to own employment and performance conditions
KA2. relevant health and safety requirements applicable in the work place
KA3. own job role and responsibilities and sources for information pertaining to employment terms, entitlements, job role and responsibilities
KA4. reporting structure, inter-dependent functions, lines and procedures in the work area
KA5. how to engage with specialists for support in order to resolve incidents and service requests
KA6. importance of working in clean and safe environment practices and procedures
KA7. relevant people and their responsibilities within the work area
KA8. escalation matrix and procedures for reporting work and employment related issues

KB1. importance of using appropriate personal protection equipment and how to minimize injury to self and others at work
KB2. possible risks and hazards involved in smartphone assembly operations Hazards: chemical hazards e.g. battery corrosion; exposed electrical wiring; exposure to (electrical shock, live power, noise, manual handling, improper working posture, etc.)
KB3. precautionary measures or safe working practices to be followed while working in an industrial unit
KB4. adherence to electrical safety practices when handling electrical equipment and tools
KB5. organization's quality standards, standard operational parameters, safety compliance and relevant regulatory requirements in smartphone assembly operations
KB6. basic of electricals and electronics e.g. circuits (load, conductor, voltage), D.C & A.C. power source, current, etc.
KB7. basic units of measurement used in smartphone or other telecommunication equipment
KB8. diagrams, drawings and schedules pertaining to smartphone assembling

KB9. basic principle of electro static discharge (ESD) and protection methods
KB10. necessity of earthing systems arrangements and requirements
KB11. range of equipment and hand tools used in assembly operation of smartphone
KB12. key components of a smartphone and their functions
KB13. different types of smartphone connectors and their uses
KB14. range of materials used in smartphone
KB15. importance of product identification and key product descriptors used
KB16. various types of product category and trending smartphone features
KB17. list the types of smartphone assembling methods and their applications
KB18. different kinds of components securing techniques, equipment and fastening devices
KB19. use of ESD tray in a smartphone assembling
KB20. importance of following safe product/components handling techniques
KB21. role of correct components, positioning and aligning in an assembly operation
KB22. importance of identifying faults and defects in components
KB23. apply safe working practices during lifting and carrying heavy equipment
KB24. adherence to relevant regulatory requirements in smartphone assembly and production compliances
KB25. escalation matrix used to report technical problems or malfunction in tools, equipment, etc. to responsible authority
KB26. importance of leaving the work place in clean and safe condition after completing work

KB27. safe disposal of hazardous and non-hazardous waste materials
KB28. documenting work completion report with required information as per organization's standard operational procedures
KB29. technical terminology, jargons, signs, symbols, etc. related to smartphone Assembly

ELE/N 3902: Carry out fixing operation of connectors and routing cables in a mobile phone assembly
KA1. relevant legislation, standards, policies, and procedures followed in the company relevant to own employment and performance conditions
KA2. relevant health and safety requirements applicable in the work place
KA3. own job role and responsibilities and sources for information pertaining to employment terms, entitlements, job role and responsibilities
KA4. reporting structure, inter-dependent functions, lines and procedures in the work area
KA5. how to engage with specialists for support in order to resolve incidents and service requests
KA6. importance of working in clean and safe environment practices and procedures
KA7. relevant people and their responsibilities within the work area
KA8. escalation matrix and procedures for reporting work and employment related Issues
KB1. importance of using appropriate personal protection equipment and how to minimize injury to self and others at work
KB2. possible risks and hazards involved in smartphone assembly operations Hazards: chemical hazards e.g. battery corrosion; exposed electrical wiring; exposure to (electrical shock, live power, noise, manual handling, improper working posture, etc.)
KB3. precautionary measures or safe working practices to be followed while working in an industrial unit
KB4. adherence to electrical safety practices when handling electrical equipment and tools
KB5. organization's quality standards, standard operational parameters, safety compliance and relevant regulatory requirements in smartphone assembly operations
KB6. basic of electricals and electronics e.g. circuits (load, conductor, voltage), D.C & A.C. power source, current, etc.
KB7. basic units of measurement used in smartphone or other telecommunication equipment
KB8. diagrams, drawings and schedules pertaining to smartphone assembling
KB9. basic principle of electro static discharge (ESD) and protection methods
KB10. necessity of earthing systems arrangements and requirements
KB11. range of equipment and hand tools used in assembly operation of smartphone

KB12. key components of a smartphone and their functions
KB13. different types of smartphone connectors and their uses
KB14. range of materials used in smartphone
KB15. importance of product identification and key product descriptors used
KB16. various types of product category and trending smartphone features
KB17. list the types of smartphone assembling methods and their applications
KB18. different kinds of components securing techniques, equipment and fastening devices
KB19. use of ESD tray in a smartphone assembling
KB20. importance of following safe product/components handling techniques
KB21. role of correct components, positioning and aligning in an assembly operation
KB22. importance of identifying faults and defects in components
KB23. apply safe working practices during lifting and carrying heavy equipment
KB24. adherence to relevant regulatory requirements in smartphone assembly and production compliances
KB25. escalation matrix used to report technical problems or malfunction in tools, equipment, etc. to responsible authority
KB26. importance of leaving the work place in clean and safe condition after completing work
KB27. safe disposal of hazardous and non-hazardous waste materials
KB28. documenting work completion report with required information as per organization's standard operational procedures
KB29. technical terminology, jargons, signs, symbols, etc. related to smartphone Assembly

ELE/N 1001: Use basic health and safety practices in electrical and electronics work
KA1. names (and job titles if applicable), and where to find, all the people responsible for health and safety in a workplace.
KA2. names and location of documents that refer to health and safety in the workplace

KB1. meaning of "hazards" and "risks"
KB2. health and safety hazards commonly present in the work environment and related precautions
KB3. possible causes of risk, hazard or accident in the workplace and why risk and/or accidents are possible
KB4. possible causes of risk and accident
Possible causes of risk and accident: physical actions; not following instructions; inattention; sickness and incapacity (such as drunkenness); health hazards (such as untreated injuries and contagious illness); not taking safety precautions
KB5. methods of accident prevention
Methods of accident prevention: training in health and safety

procedures; using health and safety procedures; use of equipment and working practices (such as safe carrying procedures); safety notices, advice; instruction from colleagues and supervisors
KB6. safe working practices when working with tools and equipment
KB7. safe working practices while working at various hazardous sites
KB8. where to find all the general health and safety equipment in the workplace
KB9. various dangers associated with the use of electrical equipment
KB10. positive isolation of electrical equipment and system
KB11. safe handling and disposal of hazardous wastes
KB12. risks of electric shock while using electrical equipment
KB13. various safety procedures and equipment used to work at heights, trenches and confined places
KB14. safe methods used to repair building surfaces
KB15. preventative and remedial actions to be taken in the case of exposure to toxic materials
Exposure: ingested, contact with skin, inhaled
Preventative action: ventilation, masks, protective clothing/ equipment);
Remedial action: immediate first aid, report to supervisor
Toxic materials: solvents, flux, lead
KB16. importance of using protective clothing/equipment and other insulated work gear while handling electrical system and equipment
KB17. precautionary activities taken to prevent fire accident
KB18. various causes of fire
Causes of fires: heating of metal; spontaneous ignition; sparking; electrical heating; loose fires (smoking, welding, etc.); chemical fires; etc.
KB19. techniques of using the different fire extinguishers
KB20. different methods of extinguishing fire
KB21. different materials used for extinguishing fire
Materials: sand, water, foam, CO2, dry powder
KB22. building fire safety regulations
KB23. emergency rescue techniques applied during a fire hazard
KB24. various types of safety signs and what they mean
KB25. appropriate basic first aid treatment relevant to the condition e.g. shock, electrical shock, bleeding, breaks to bones, minor burns, resuscitation, poisoning, eye injuries
KB26. content of written accident report
KB27. potential injuries and ill health associated with incorrect manual handing
KB28. safe lifting, carrying and transporting practices
KB29. personal safety, health and dignity issues relating to the movement of

a person by others
KB30. potential impact to a person who is moved incorrectly

CSC/N1336:Work effectively in team

KA1. legislation, standards, policies, and procedures followed in the company relevant to own employment and performance conditions
KA2. reporting structure, inter-dependent functions, lines and procedures in the work area
KA3. relevant people and their responsibilities within the work area
KA4. escalation matrix and procedures for reporting work and employment related Issues
The user/individual on the job needs to know and understand:
KB1. various categories of people that one is required to communicate and coordinate with in the organization
KB2. importance of effective communication in the workplace
KB3. importance of teamwork in organizational and individual success
KB4. various components of effective communication
KB5. key elements of active listening
KB6. value and importance of active listening and assertive communication
KB7. barriers to effective communication
KB8. importance of tone and pitch in effective communication
KB9. importance of avoiding casual expletives and unpleasant terms while communicating professional circles
KB10. how poor communication practices can disturb people, environment and cause problems for the employee, the employer and the customer
KB11. importance of ethics for professional success
KB12. importance of discipline for professional success
KB13. what constitutes disciplined behavior for a working professional
KB14. common reasons for interpersonal conflict
KB15. importance of developing effective working relationships for professional success
KB16. expressing and addressing grievances appropriately and effectively
KB17. importance and ways of managing interpersonal conflict effectively

Professional Skill:

Interpersonal skills
Behavioural skills
Reflective thinking
Critical Thinking
Decision Making
Using tools and machines

Core Skill:

Using tools and machines
Assembling Skills
Reading, writing and computer skills
Teamwork and multitasking
Communication skills

Detailed Syllabus of Course

S. No.	Module. Name	Duration
1	Perform assembly operation of mobile phone using appropriate methods & equipment	
2	Use basic health and safety practices in electrical and electronics work	
3	Carry out fixing operation of connectors and routing cables in a mobile phone assembly	
4	Work effectively in team	
	Total Theory/Lecture	140 Hrs
	Total Practical / Tutorial Hours:	210 Hrs
	Total Hours:	350 Hrs

Recommended Hardware:

Recommended Software:	
Text Books:	
Reference Books:	

ESDM Courses

Level Code:	V	**Vertical Name:**	Consumer Electronics
Course Code:	EL/M/L5/C048	**Course Name:**	3.1.3 Mobile Phone quality Inspector (ESSCI)

Objective of the Course:

Mobile Phone Hardware Assembly Technician: This job role in the electronics sector is responsible for final quality checking of finished assemblies in a mobile manufacturing unit.

Brief Job Description: A mobile phone quality inspector conducts physical inspection and functions testing of finished assemblies based on given physical and functions parameters. The job holder must comply with relevant quality standards and ensure final products meet production requirements. Personal

Attributes: Needs to be receptive to repetitive nature of work. Should possess an alert mind, good manual dexterity and a physically active body. Capable of working in standing or sitting position for long hours. Should posses good decision-making skills and be committed to deliverying scheduled targets. Should also exhibit negotiation skills when faced with situations demanding rejection or acceptance of final products. He/she should be open to owning responsiblity to outcomes and work in a team.

Learning Outcomes:

- NOS # ELE/N 4001: Perform physical inspection and functional testing of assembled mobile phone

  - Working safely
  - Preparing work place for inspection and testing activities
  - Performing physical inspections & functions testing of assembled products
  - Maintaining quality standards in production line
  - Post inspecting & testing activities

  - ELE/N 1001: Use basic health and safety practices in electrical and electronics work
  - Health and safety
  - Fire safety
  - Emergencies, rescue and first-aid procedures
    -
    - CSC/N 1336: Work effectively in team
    - Working in a team

- Entrepreneurship Module

Expected Job Roles:

Mobile Phone Quality Inspectotr

Duration of the Course (in hours)	400 Hrs
Minimum Eligibility Criteria and pre-requisites, if any	Diploma / Other Graduates

Professional Knowledge:

ELE/N 4001: Perform physical inspection and functional testing of assembled mobile phone
KA1. relevant legislation, standards, policies, and procedures followed in the company relevant to own employment and performance conditions
KA2. relevant health and safety requirements applicable in the work place
KA3. own job role and responsibilities and sources for information pertaining to employment terms, entitlements, job role and responsibilities
KA4. reporting structure, inter-dependent functions, lines and procedures in the work area
KA5. how to engage with specialists for support in order to resolve incidents and service requests
KA6. importance of working in clean and safe environment practices and procedures
KA7. relevant people and their responsibilities within the work area
KA8. escalation matrix and procedures for reporting work and employment related issues
KB1. importance of using appropriate personal protection equipment and how to minimize injury to self and others at work
KB2. possible risks and hazards involved in smartphone assembly operations
Hazards: chemical hazards e.g. battery corrosion; exposed electrical wiring; exposure to (electrical shock, live power, noise, manual handling, improper working posture, etc.)
KB3. precautionary measures or safe working practices to be followed while working in mobile production unit
KB4. adherence to electrical safety practices when handling electrical equipment

and tools
KB5. organization's quality standards, standard operational parameters, safety compliance and relevant regulatory requirements in smartphone functions testing
KB6. basic of electricals and electronics e.g. circuits (load, conductor, voltage), D.C & A.C. power source, current, etc.
KB7. basic units of measurement used in smartphone or other telecommunication equipment
KB8. diagrams, drawings and schedules pertaining to mobile phone functions testing
KB9. basic principle of electro static discharge (ESD) and protection methods
KB10. necessity of earthing systems arrangements and requirements
KB11. range of equipment and hand tools used functions testing of mobile phone
KB12. key components of a smartphone and their functions
KB13. different types of mobile phone test platform and their applications
KB14. range of materials used in smartphone
KB15. importance of product identification and key product descriptors used
KB16. various types of product category and feature variants
KB17. list the types of smartphone assembling methods and their applications
KB18. list the range of functions test parameters
KB19. different kinds of components securing techniques, equipment and fastening devices
KB20. use of ESD tray in a smartphone assembling
KB21. importance of following safe product/components handling techniques
KB22. inspection of correct components, positioning and aligning in an assembly operation
KB23. importance of identifying faults and defects in components
KB24. approved methods used to test functions of mobile phones
KB25. how to read and interpret test results on equipment display panel
KB26. apply safe working practices during lifting and carrying heavy equipment
KB27. adherence to relevant regulatory requirements in smartphone assembly and production compliances
KB28. escalation matrix used to report technical problems or malfunction in tools, equipment, etc. to responsible authority
KB29. importance of leaving the work place in clean and safe condition after completing work
KB30. safe disposal of hazardous and non-hazardous waste materials
KB31. documenting work completion report with required information as per organization's standard operational procedures
KB32. technical terminology, jargons, signs, symbols, etc. related to mobile phone functions testing

ELE/N 1001: Use basic health and safety practices in electrical and electronics work
KA1. names (and job titles if applicable), and where to find, all the people responsible for health and safety in a workplace.
KA2. names and location of documents that refer to health and safety in the workplace.
KB1. meaning of “hazards” and “risks”
KB2. health and safety hazards commonly present in the work environment and related precautions
KB3. possible causes of risk, hazard or accident in the workplace and why risk and/or accidents are possible
KB4. possible causes of risk and accident
Possible causes of risk and accident: physical actions; not following instructions; inattention; sickness and incapacity (such as drunkenness); health hazards (such as untreated injuries and contagious illness); not taking safety precautions
KB5. methods of accident prevention
Methods of accident prevention: training in health and safety procedures; using health and safety procedures; use of equipment working posture, etc.)
and working practices (such as safe carrying procedures); safety notices, advice; instruction from colleagues and supervisors
KB6. safe working practices when working with tools and equipment
KB7. safe working practices while working at various hazardous sites
KB8. where to find all the general health and safety equipment in the workplace
KB9. various dangers associated with the use of electrical equipment
KB10. positive isolation of electrical equipment and system
KB11. safe handling and disposal of hazardous wastes
KB12. risks of electric shock while using electrical equipment
KB13. various safety procedures and equipment used to work at heights, trenches and confined places
KB14. safe methods used to repair building surfaces
KB15. preventative and remedial actions to be taken in the case of exposure to toxic materials
Exposure: ingested, contact with skin, inhaled
Preventative action: ventilation, masks, protective clothing/ equipment);
Remedial action: immediate first aid, report to supervisor
Toxic materials: solvents, flux, lead
KB16. importance of using protective clothing/equipment and other insulated work gear while handling electrical system and equipment
KB17. precautionary activities taken to prevent fire accident
KB18. various causes of fire

Causes of fires: heating of metal; spontaneous ignition; sparking; electrical heating; loose fires (smoking, welding, etc.); chemical fires; etc.
KB19. techniques of using the different fire extinguishers
KB20. different methods of extinguishing fire
KB21. different materials used for extinguishing fire
Materials: sand, water, foam, CO2, dry powder
KB22. building fire safety regulations
KB23. emergency rescue techniques applied during a fire hazard
KB24. various types of safety signs and what they mean
KB25. appropriate basic first aid treatment relevant to the condition e.g. shock, electrical shock, bleeding, breaks to bones, minor burns, resuscitation, poisoning, eye injuries
KB26. content of written accident report
KB27. potential injuries and ill health associated with incorrect manual handing
KB28. safe lifting, carrying and transporting practices
KB29. personal safety, health and dignity issues relating to the movement of a person by others
KB30. potential impact to a person who is moved incorrectly

CSC/N 1336: Work effectively in team
KA1. legislation, standards, policies, and procedures followed in the company relevant to own employment and performance conditions
KA2. reporting structure, inter-dependent functions, lines and procedures in the work area
KA3. relevant people and their responsibilities within the work area
KA4. escalation matrix and procedures for reporting work and employment related issues
KB1. meaning of “hazards” and “risks”
KB2. health and safety hazards commonly present in the work environment and related precautions
KB3. possible causes of risk, hazard or accident in the workplace and why risk and/or accidents are possible
KB4. possible causes of risk and accident
Possible causes of risk and accident: physical actions; not following instructions; inattention; sickness and incapacity (such as drunkenness); health hazards (such as untreated injuries and contagious illness); not taking safety precautions
KB5. methods of accident prevention
Methods of accident prevention: training in health and safety procedures; using health and safety procedures; use of equipment and working practices (such as safe carrying procedures); safety

notices, advice; instruction from colleagues and supervisors
KB6. safe working practices when working with tools and equipment
KB7. safe working practices while working at various hazardous sites
KB8. where to find all the general health and safety equipment in the workplace
KB9. various dangers associated with the use of electrical equipment
KB10. positive isolation of electrical equipment and system
KB11. safe handling and disposal of hazardous wastes
KB12. risks of electric shock while using electrical equipment
KB13. various safety procedures and equipment used to work at heights, trenches and confined places
KB14. safe methods used to repair building surfaces
KB15. preventative and remedial actions to be taken in the case of exposure to toxic materials
Exposure: ingested, contact with skin, inhaled
Preventative action: ventilation, masks, protective clothing/ equipment);
Remedial action: immediate first aid, report to supervisor
Toxic materials: solvents, flux, lead
KB16. importance of using protective clothing/equipment and other insulated work gear while handling electrical system and equipment
KB17. precautionary activities taken to prevent fire accident
KB18. various causes of fire
Causes of fires: heating of metal; spontaneous ignition; sparking; electrical heating; loose fires (smoking, welding, etc.); chemical fires; etc.
KB19. techniques of using the different fire extinguishers
KB20. different methods of extinguishing fire
KB21. different materials used for extinguishing fire
Materials: sand, water, foam, CO2, dry powder
KB22. building fire safety regulations
KB23. emergency rescue techniques applied during a fire hazard
KB24. various types of safety signs and what they mean
KB25. appropriate basic first aid treatment relevant to the condition e.g. shock, electrical shock, bleeding, breaks to bones, minor burns, resuscitation, poisoning, eye injuries
KB26. content of written accident report
KB27. potential injuries and ill health associated with incorrect manual handing
KB28. safe lifting, carrying and transporting practices
KB29. personal safety, health and dignity issues relating to the movement of a person by others
KB30. potential impact to a person who is moved incorrectly

CSC/N1336:Work effectively in team

KA1. legislation, standards, policies, and procedures followed in the company relevant to own employment and performance conditions
KA2. reporting structure, inter-dependent functions, lines and procedures in the work area
KA3. relevant people and their responsibilities within the work area
KA4. escalation matrix and procedures for reporting work and employment related Issues
KB1. various categories of people that one is required to communicate and coordinate with in the organization
KB2. importance of effective communication in the workplace
KB3. importance of teamwork in organizational and individual success
KB4. various components of effective communication
KB5. key elements of active listening
KB6. value and importance of active listening and assertive communication
KB7. barriers to effective communication
KB8. importance of tone and pitch in effective communication
KB9. importance of avoiding casual expletives and unpleasant terms while communicating professional circles
KB10. how poor communication practices can disturb people, environment and cause problems for the employee, the employer and the customer
KB11. importance of ethics for professional success
KB12. importance of discipline for professional success
KB13. what constitutes disciplined behavior for a working professional
KB14. common reasons for interpersonal conflict
KB15. importance of developing effective working relationships for professional success
KB16. expressing and addressing grievances appropriately and effectively
KB17. importance and ways of managing interpersonal conflict effectively
The user/individual on the job needs to know and understand how to:
nil

Professional Skill:

- Interpersonal skills
- Behavioural skills
- Reflective thinking
- Critical Thinking
- Decision Making
- Using tools and machines

Core Skill:

- Using tools and machines
- Assembling Skills
- Reading, writing and computer skills
- Teamwork and multitasking
- Communication skills

Detailed Syllabus of Course

S. No.	Module. Name	Duration
1	Perform physical inspection and functional testing of assembled mobile phone	
2	Use basic health and safety practices in electrical and electronics work	
3	Work effectively in team	
	Total Theory/Lecture	140 Hrs
	Total Practical / Tutorial Hours:	210 Hrs
	Total Hours:	350 Hrs

Recommended Hardware:

Recommended Software:

Text Books:

Reference Books:	

ESDM Courses

Level Code:	L4	**Vertical Name:**	Solar Electronics
Course Code:	NL/M/L4/C022 EL/M/L4/C034	**Course Name:**	3.2.1 Solar-LED Lighting Products (Design and Manufacturing) (NIELIT/ESSCI)

Objective of the Course:

The objective of this module is to provide the knowledge of basic characteristics of light sources. Basic parameters related with measurement of lights intensity, designing and assembling of LED based luminaries, etc. It familiarizes the participants with the basic terminology and various parts of Solar Panel, would cover manual assembly of LED light products. In addition, the participants would be familiarized with solar powered LED products.

Learning Outcomes:

Participant will be able to

- Design & develop LED based Product
- Solar panel installation
- Solar powered LED products

Expected Job Roles:

Acquire the foundation level knowledge required to use LEDs as light source, Design of low cost LED products for common use like Lanterns, table lamps, etc. Assembly of LED based luminaries, Use of Solar

panel for energy applications, Installation of Solar Panel, Assemble and Maintenance of Solar Panel

Duration of the Course (in hours)	350 hrs
Minimum Eligibility Criteria and pre-requisites, if any	10^{th} + ITI, 12^{th} pass .

Professional Knowledge:

Pass out would be able to understand :

- **PK 1.** The operation and significance of various electronic, electrical and mechanical components of LED luminary,
- **PK 2.** Product design basics and significance of optics,
- **PK 3.** To handle LED's and PCB's, IP rating , ESD precautions,
- **PK 4.** Assembly of SPV chargeable Light sources as Marketable products,
- **PK 5.** Testing of SPV – Voltage & Current measurement at various intensities.
- **PK 6.** Testing and calculating peak power output of SPV and comparing with specified ratings,
- **PK 7.** Calculation and practical measurement of power output from SPV for various exposed area of SPV,
- **PK 8.** Install and maintain solar panels of different ratings

Professional Skill:

The individual on the job needs to know and understand:

PS 1. How to operate machine/meters like drilling machine, multi-meter, soldering iron, cathode ray oscilloscope, LUX meter , PCB design software etc.,

PS 2. The skill to interact with customer to understand the problem faced in case of service and to analyze and identify the fault relating to solar powered LED products.

Core Skill:

Pass out would be able to read warnings, instructions and other text material on product labels, components etc. and interact with customers and colleagues

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours Theory/Practical
1	Introduction of light sources and their characteristics • Light sources, characteristics of light sources, introduction to light units- candela, lux & nits	15/15
2	Comparative study of LED and other light sources • Introduction of LEDs, principles of operation, Efficiency, lifetime and quality of LEDs, type of LEDs. • Electrical and Optical behaviour of LEDs with Temperature: Parallel circuit of LEDs, white light production from LEDs. • Calculation of current in the use of LEDs : Basic ideas for reliability • General principles of working of LED flash light, USB light, automobile taillight and replacement of Bulb and CFL by LED lights. • Ideas on quality of light, human visual function: receptors, retina, brain, warm white and daylight white colour spectrum and their effect on human being.	15/15

3	Basic Principle , Design and Assembly of LED based products • General principles of working of LED luminaries. Design of constant current drive circuits. • Assembly and testing procedures for LED based products. • Significance of optics, riveting process, insulation tape and heat shrinkable tube, PCB cleaning, potting material and use of potting machine, press for making mechanical frame parts, tools required in process control like weighing machine, torque measurement meter, temperature meter & calibrator, magnifying glass, etc. • IP rating and CREE standards, 5S standards (sorting, setting, standardise, sustain, shining) • ESD and work safety precautions. • Handling and disposal of hazardous material.	20/30
4	Introduction of Renewable Energy & Study of Characteristics of SPV Cells • Introduction to Solar Energy as Renewable source, Historical perspective of using Solar energy, Concept of Solar Photovoltaic Cells (SPV), Basic Principle & Working of SPV's. • Rating & Specifications of SPV, Peak Voltage and Voltage/ Current on load, Types of Solar Photovoltaic Cells (SPV), Area of SPV & Energy, SPV efficiency. • Charging of Battery & Operating life of SPV, Storage battery size & Autonomy of SPV system	30/30
5	Installation and maintenance of solar panel • Tools involved in installation of system, occupational health and safety standards and waste management procedures, precautions to be taken while installation, voltage requirement of various equipment, site surveying methods and evaluation parameters, • Sunlight and direction assessment, panel mounting and inclination and angle of tilt, assembly of solar panel mounting, placement of solar panel mounting, installation of solar plates on holding clamp, • wiring multiple PV modules, wiring of solar panel to inverter, Maintenance of solar panels.	20/30

6	Project Work- PCB designing • Introduction to PCB Designing and future scope o Different techniques to implement circuit o Advantages of PCB based products o Advantages of designing with CAD softwares • Designing circuits in schematic o To capture the circuit to make a PCB o Different techniques of modelling of design o Top down and Bottom up methodology for design o Creating Netlist of design and producing files for layout • Designing layout of circuits and generating output o Creating a layout of board using layout tool o Auto-routing and manual routing of a board o Making footprints of different components o Post processing and generating gerber files	50/60
7	Project Work- Led luminaries design	0/20
	Total Theory / Lecture Hours:	150
	Total Practical / Tutorial Hours:	200
	Total Hours:	350

Recommended Hardware:	Multimeter, Desktop PC, Oscilloscope, Soldering and De-soldering station, Electronic Work Bench, PCB designing and fabrication lab, basic circuit trainer boards, power circuit board trainers, linear and switching circuit board trainer, power meter

Recommended Software:	Circuit simulation Software, PCB design software
Text Books:	Course material by NIELIT, Chandigarh
Reference Books:	

ESDM Courses

Level Code:	L3	**Vertical Name:**	PCB Assembly

Course Code:	EL/M/L3/C012 TL/M/L3/C029	**Course Name:**	3.3.1 Through Hole Assembly Operator (ESSCI/TSSC)

Objective of the Course:

Through Hole Assembly Operator: Through hole assembly operator inserts electronic components for assembling the printed circuit board (PCB), as per the design, either manually or through automated machine

Brief Job Description: The individual on the job is responsible for manually fixing components using hand tools, operating and maintaining the automated insertion machine used for placing different types of components on the through-hole PCBs.

Personal Attributes: The job requires the individual to have: attention to details, good eyesight, and ability to work for long hours generally in a standing or sitting position

Learning Outcomes:

NOS # ELE/N5101Perform through-hole assembly

1. Mount the prepared and binned components on the PCB manually
2. Operate the through-hole machine for automated assembling
3. Check visually after assembly is complete
4. Undertake preventive maintenance of the machine
5. Achieve productivity and quality standards

NOS # ELE/N9919Work with superiors and colleagues

1. Interact with supervisor or superior
2. Coordinate with colleagues

ELE/N9920- Follow safety procedures

1. Understand potential sources of accidents
2. Use safety gear to avoid accidents
3. Understand the safety procedures followed by the company

Expected Job Roles:

Through Hole Assembly Operator

Duration of the Course (in hours)	350 hours
Minimum Eligibility Criteria and pre-requisites, if any	10th + ITI or 12th pass

Professional Knowledge:

NOS # ELE/N5101 Perform through-hole assembly

KA1. company's policies on: incentives, delivery standards and personnel management and Intellectual Property Rights (IPR)
KA2. work flow involved in assembly process of the company
KA3. importance of the individual's role in the workflow
KA4. reporting structure
KA5. profile of clients
KA6. component binning and stocking policy
KA7. safety and quality standards followed in the organization

KB1. basic electronics and component identification
KB2. components and forming
KB3. hand tools for manual assembly
KB4. Through-hole insertion machine types and their functions and controls
KB5. setting up, loading, basic programming of through-hole machine
KB6. basic characteristics of through-hole and SMT components
KB7. comparison between RoHS and Non-RoHS compliant solder
KB8. basics of soldering and types of soldering such as dry and cold solder
KB9. LEDs and mounting techniques
KB10. Spike correction techniques along with ESD and high-voltage soldering for LEDs
KB11. significance of junction temperature at PCB for light engine
KB12. metal core sink assembly for LEDs
KB13. colour codes and polarity of components
KB14. regulation of operating speed and temperature of machine
KB15. electro-static discharge (ESD) precautions
KB16. manual soldering and rework of components
KB17. handling the soldering iron, iron temperature, etc.
KB18. basics of wave soldering such as flux and their types, pre-heat conditions, wave profile
KB19. typical soldering problems such as solder short, effect of quantity of solder or flux
KB20. zero defect soldering
KB21. lead cutting and component lifting
KB22. PCB design basics
KB23. commonly occurring machine problems

KB24. IPC standards for PCBs

NOS # ELE/N9919Work with superiors and colleagues

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. work flow involved in company's process
KA3. importance of the individual's role in the workflow
KA4. reporting structure

KB1. how to communicate effectively
KB2. how to build team coordination

NOS # ELE/N9920 Interact with co-workers

KA1. company's policies on handling: harmful chemicals and sharp tools, safety and hazards of machines, fire safety/drill, first aid and, disposal of harmful chemicals and materials, quality standards
KA2. company occupational safety and health policy followed
KA3. company emergency evacuation procedure
KA4. company's medical policy

KB1. how to maintain the work area safe and secure
KB2. how to handle hazardous material
KB3. how to follow safety procedures while operating hazardous tools and equipment
KB4. emergency procedures to be followed such as fire accidents and fire safety education
KB5. how to use machines and tools without causing bodily harm
KB6. first aid execution
KB7. disposal of hazardous chemicals, tools and materials by following prescribed environmental norms or as per company policy

Professional Skill:

i. **Decision making**

ii. **Reflective thinking**

iii. **Using tools and machines**
iv. **Analytical and reflective skills**
v. **Critical thinking**
vi. **Handling safety equipment**

Core Skill:

1. **Reading and Writing Skills**
2. **Team work**
3. **Multitasking**
4. **Communication Skills**

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
	Perform through-hole assembly	
	Work with superiors and colleagues	
	Interact with co-workers	
	Total Theory / Lecture Hours:	175
	Total Practical / Tutorial Hours:	225
	Total Hours:	400

Recommended Hardware:	
Recommended Software:	NA
Text Books:	NA
Reference Books:	NA

ESDM Courses

Level Code:	L3	**Vertical Name:**	PCB Assembly

Course Code:	EL/M/L3/C013 TL/M/L3/C030	**Course Name:**	3.3.2 Circuit Imaging Operator (ESSCI/TSSC)

Objective of the Course:

Circuit Imaging Operator: Also known as 'Photo Imaging Operator', the Circuit Imaging Operator imprints the circuit design layout on the laminated printed circuit board (PCB) with ultraviolet (UV) light exposure.

Brief Job Description: The individual at work places the circuit design layout printed on a 'positive' translucent film on the laminated and photo-sensitive PCB panel and exposes it to UV light, thereby curing the photo- resist under the clear portions of the film in order to get the circuit printed onto the panel.

Personal Attributes: The job requires the individual to have: attention to details, hand-eye coordination, appreciation for accuracy, ability to lift heavy panels and orientation towards work safely

Learning Outcomes:

NOS # ELE/N2201Imprint circuit layout on PCB panel

1. Clean the PCB panels and prepare for UV exposure
2. Set up the machine and laminate dry film rolls on the panel
3. Expose the laminated panel to UV light
4. Develop the circuit image on the panel
5. Undertake preventive maintenance of the machines
6. Achieve productivity and quality standards

NOS # ELE/N9917Interact with superiors and colleagues

1. Interact with supervisor or superior
2. Coordinate with colleagues

ELE/N9918- Follow safety standards

1. Understand potential sources of accidents
2. Use safety gear to avoid accidents
3. Understand the safety procedures followed by the company

Expected Job Roles:

Circuit Imaging Operator

Duration of the Course (in hours)	350 hours
Minimum Eligibility Criteria and pre-requisites, if any	10^{th} pass

Professional Knowledge:

NOS # ELE/N2201 Imprint circuit layout on PCB panel

KA1. company's policies on: incentives, delivery standards and personnel management and IPR
KA2. PCB manufacturing process of the organization
KA3. importance of the individual's role in the workflow
KA4. organizational capabilities with respect to input materials/processes
KA5. reporting structure and be clear about the hierarchy
KA6. documentation procedures
KA7. safety and quality standards followed in the organization

KB1. basic electronics and circuit design layouting
KB2. UV, photo resist, light exposure time and intensity, vacuum, alignment and their importance in the circuit imaging process
KB3. operation and maintenance of machines such as laminator, imaging and developing machines
KB4. circuit imaging process including surface preparation, lamination, exposure, cooling and developing
KB5. photo tools, i.e, negatives or positives, development of the UV cured circuit, chemicals used for developing, etc.
KB6. different types of imaging processes other than ultraviolet exposure and their uses
KB7. different types of films and chemicals used in imaging and their purpose
KB8. manual and automated exposure machines and standard procedures
KB9. dry film resist (DFR) lamination and development including process parameters, chemicals, calibration,

exposure time, etc.
KB10. probable defects in imaging process
KB11. environment and safety norms to follow
KB12. defects in machines an remedies with causes
KB13. IPC standards for printed circuit boards

NOS # ELE/N9917 Interact with superiors and colleagues

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. work flow involved in company's process
KA3. importance of the individual's role in the workflow
KA4. reporting structure

KB1. how to communicate effectively
KB2. how to build team coordination

Professional Skill:

i. **Reflective Thinking**
ii. Operating Machines and Material Handling
iii. Problem solving
iv. Critical Thinking
v. **Decision Making**
vi. **Handling Safety Equipment**

Core Skill:

1. **Reading and Writing Skills**
2. **Team work**
3. **Communication skills**
4. **Multitasking**

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
	Imprint circuit layout on PCB panel	
	Interact with superiors and colleagues	
	Follow safety standards	
	Total Theory / Lecture Hours:	150
	Total Practical / Tutorial Hours:	200
	Total Hours:	350

Recommended Hardware:

Recommended Software: NA

Text Books: NA

Reference Books: NA

ESDM Courses

Level Code:	L4	Vertical Name:	Electronics Product Design
Course ID:	NL/M/L4/C015 TL/M.L4/C036 EL/M/L4/C028	Course Name:	3.4.1 Computer Aided Product Design (NIELIT/TSSC/ESSCI)

Objective of the Course:

To train students in the area of Electronic Product Design

Learning Outcomes:

After completion of the training, participants would be able to:

Prepare working Drawing of Electronics products

Do the work on 2D Engineering drafting

To apply this knowledge to understand the engineering design work flow

Process in the Industry

- Acquire knowledge of basic 3D modeling concepts.

Expected Job Roles:

Act as a Product Designer of Electronics Products

Duration of the Course (in hours)	360 Hrs
Minimum Eligibility Criteria and pre-requisites, if any	Polytechnic Diploma/Graduation/ ITI/12th/10th

Professional Knowledge:

- Making plan of Projection.
- • Creation Multi-view Orthographic projection.
- • Drafting views in First angle & Third angle Projection.

- • Creating Auxiliary views & Sections.
- • Freehand Sketching.
- • Representing Standard base 2D drafting.
- Modeling
    - Solid Modeling –Extrude sketch geometry,
    - Sweep geometry along a path, revolve
    - sketch geometry, Coil feature, Rib & Web feature.
    - Create hole feature on part, Create a shell feature with varying thickness.
    - • Add chamfer & edge fillet feature to a part.
- • Surface Modeling – Create a curved surface, Revolved surface, Ruled Surface, Edge Surface.
  • Creating 3D Solid drawing with template, using Title block, Detailing & Section view

Professional Skill:

- Practise on Drawing basics
- Geometrical Drawing Practise
- Making Projection.
- Creation Multi-view Orthographic projection.
- Drafting views in First angle & Third angle Projection.
- Creating Auxiliary views & Sections.
- Freehand Sketching.
- Representing Standard base 2D drafting.
- Drawing with Elementary CADD command –Line, Polyline, Polygon, Circle, Polyline, arc, ellipse, Text- Single Text, Multitext, Dtext.
- Modifying Elementary Commands – Erase,Move, Copy , Mirror, Offset, Scale, Stretch, Chamfer, fillet & explode.
- Making layers, line type & Lineweight.
- Different menus of Auto-Cad, Function keys, Shortcut keys, Paper size.
- Making Title Block, Writing it & inserting it in any drawing file with scale, angle & explode options.
- Creating a new template file (.Dwt file) & applying it to every drawing file.
- Drafting of building plan , Elevation , Section Views.
- Applying dimensions to various views by using dimension style.
- Creating Revolved, Ruled, and Tabulated & Edge surfaces.
- Creating Isometric drawing with the Isoplane (Left, Top & Right Plane)
- Making Solid Model – Box, Polysolid,
    - Building Model.

- Modeling
- Solid Modeling –Extrude sketch geometry,
- Sweep geometry along a path, revolve
- sketch geometry, Coil feature, Rib & Web feature.
- Create hole feature on part, Create a shell feature with varying thickness.
- Add chamfer & edge fillet feature to a part.

- Surface Modeling – Create a curved surface, Revolved surface, Ruled Surface,
  - Edge Surface.
- Creating 3D Solid drawing with template, using Title block, Detailing & Section view.
- Apply material, background, light – Point, Distance, Spot light, landscaping.
- Making slide & running run script file.
- Creating view ports & views & plotting it.
- Creating a flat & flange wall in sheet metal modeling.
- Constraining component by mating plane faces.
- Creating assembly components in place.
- Creating component pattern.
- Copying & mirroring assembly.
- Making exploded assemblies - Making detailed drawing of Machine drawing, dismantling machine component. Adaptive Assemblies.
- Project-

Core Skill:

Introduction
- Principle of drafting, Terminology, & fundamentals.
- Size & shape descriptions.
- Geometric Construction.

Views
- Plan views, Auxiliary views, Section Views.

Projection
- Method of Projection.
- Multi-view Orthographic Projection.
- Projection Techniques.

Modeling
- Modeling Fundamental for Engineering design
- Shape Modeling and it's application.

CADD
- Introduction of CADD (Computer Aided Drafting & Designing).
- Function keys, Shortcut keys,
- Different sizes of paper.
- Application of CADD – Automatic Drafting ,

Geometric Modeling

• Geometric Modeling – Wire frame Modeling, Surface Modeling, and Solid Modeling.

CADD Application & it's feature

• Introduction to Standard based 2D drafting

3D Design

• Concept of 3D Design.

• X, Y, Z Co-ordination System.

Documentation

• Manufacturing Process & Material

Detailed Syllabus of Course

Module. No	Module. Name with detailed syllabus	Minimum No. of Hours (Theory/Practical)
➢ **Module-I**	Creating a Simple Drawing Getting Started with AutoCAD o Starting AutoCAD o AutoCAD's Screen Layout o Working with Commands o Opening an Existing Drawing File o Saving Your Work o AutoCAD's Cartesian Workspace Drawing & Editing Commands o Drawing Lines o Erasing Objects o Drawing Lines with Polar Tracking o Drawing Rectangles o Drawing Circles o Viewing Your Drawing o Undoing and Redoing Actions	40Hrs
➢ **Module-II**	Drawing Precision in AutoCAD o Using Object Snap o Object Snap Overrides Polar Tracking Settings o Object Snap Tracking	60 Hrs

	o Drawing with SNAP and GRID Making Changes in Your Drawing o Selecting Objects for Editing o Moving Objects o Copying Objects o Rotating Objects o Scaling Objects o Mirroring Objects o Editing Objects with Grips	
➢ **Module-III**	Drawing Organization and Information Layers o Creating New Drawings With Templates o What are Layers? o Layer State o Changing an Object's Layer Advanced Object Types o Drawing Arcs o Drawing Polylines o Editing Polylines o Drawing Polygons o Drawing Ellipses Getting Information From Your Drawing o Measuring Objects o Working with Properties	40 Hrs
➢ **Module-IV**	Advanced Editing Commands o Trimming and Extending o Stretching Objects o Creating Fillets and Chamfers o Offsetting Objects o Creating Arrays of Objects Blocks o What are Blocks? o Inserting Blocks from Tool Palettes o Inserting Blocks using Insert o Inserting Blocks with Design Center	40 Hrs

➢ **Module-V**	Annotating Your Drawing Text o Working with Annotations o Adding Text in a Drawing o Modifying Multiline Text o Formatting Multiline Text Hatching o Hatching Adding Dimensions o Dimensioning Concepts o Adding Linear Dimensions o Adding Radial and Angular Dimensions o Editing Dimensions o Adding Notes to Your Drawing Preparing to Print o Setting Up a Layout	40 Hrs
➢ **Module-VI**	3D Foundations o Why use 3D? o Introduction to the 3D Modeling Workspace o Basic 3D Viewing Tools o 3D Navigation Tools o Introduction to the User Coordinate System Simple Solids o Working with Solid Primitives o Solid Primitive Types o Working with Composite Solids Working with Mesh Models Creating Solids & Surfaces from 2D Objects o Complex 3D Geometry o Extruded Solids and Surfaces o Swept Solids and Surfaces o Revolved Solids and Surfaces o Lofted Solids and Surfaces Advanced Solid Editing o Editing Components of Solids o Editing Faces of Solids o Fillets and Chamfers on Solids Working Drawings from 3D Models	80 Hrs

	o Creating Multiple Viewports o 2D Views from 3D Solids	
➢ **Module-VII**	10. Advanced Layouts and Printing □ Advanced Layouts o Creating and Using Named Views o Creating Additional Viewports o Layer Overrides in Viewports o Additional Annotative Scale Features □ DWF Printing and Publishing o DWF Plotting and Viewing o Publishing Drawing Sets	40 Hrs
➢	Practical Project	60 Hrs
	Total Theory / Lecture Hours:	120
	Total Practical / Tutorial Hours:	240
	Total Hours:	360

Recommended Hardware(minimum batch size 10):	20 Workstations of suitable configuration
Recommended Software:	20 licenses AutoCAD software
Text Books:	Illustrated Auto Cad (BPB Publications) Thinking in Auto Cad (Wheeler Publication) AutoCAD 2015 Instant Reference (BPB Publications) Beginning AutoCad 2011 (BPB Publications) Introduction to AutoCAD 2002 (BPB Publications)
Reference Books:	DRAUGHTSMAN - CIVIL – PRACTI CAL – ENGLISH (NIMI) P&M - Draughtsman Mechanical -Trade Practical - First Semester-NCVT (NIMI) Mastering Auto Cad (Tech Publication) Auto Cad 3D Book (Venlana Publication

ESDM Courses

Level Code:	L4	**Vertical Name:**	Industrial Automation
Course Code:	NL/M/L4/C012 EL/M/L4/C025	**Course Name:**	3.5.1 Automation Technology – Basic Level (NIELIT/ESSCI)

Objective of the Course:

Student will be exposed to cutting edge technologies in automation, knowledge new developments in automation.
Student will be industry ready for Automation technology hydraulic pneumatic and electric automation.
The students are also equipped with good Communicative English Skills, soft Skills and Basic IT skills required for good performance in any job in the modern world .

Learning Outcomes:

Students will be able to read and understand the circuit and process in any of the trained areas. They will be able to perfom the specification reading and suggest sensors as per requirement. They can also do troubleshooting to a certain extend.
Have Good Communicative English Skills, Soft Skills and Basic IT Skills

Expected Job Roles:

Helper and assistants in regular production areas, quality, logistics and maintenance areas

Duration of the Course (in hours)	For Technical Students : 330 Hrs Non Technical Students : 390 Hrs

Minimum Eligibility Criteria and pre-requisites, if any	Diploma in /Electronics/Instrumentation/ Mechanical/Electrical – for Technical students. Non Technical Students: 12th pass with science background and affinity towards technical studies.

Professional Knowledge:

To be competent, the user/ individual must be able to:

PK1. Understand the overview of automation
PK2 Different devices used in Automation,
PK3. interact with the technical lead engineer in order to understand the work schedules,
PK4. understand the roles and responsibilities of the work
PK5. understand broad level activities involved in the Industrial automation
PK6. list the various department to interact with for completing the work
PK7. interact with higher officials to understand the specifics of work
PK8. understand the different Communication Protocols/Field Buses
PK9. establish module requirement and constraints
PK10. understand Network Settings/Communication Settings
PK11. understand the PLC Software
PK12. understand the basics of electro hydraulics
PK13. define the design flow for the specific system
PK14. use agreed language and application as per standards
PK15. define the requirement specification of the electro pneumatics
PK16. get approval from superior and relevant department on the electro pneumatics
PK17. Understand different types of pumps
PK18. Understand different types of valves
PK19. understand the functionality of the electro pneumatics
PK20. assist in system testing, product verification and validation

Professional Skill:

PS 1: Overview of Automation System
PS 2: Overview of Switchgears.
PS 3: Different Communication Protocols/Field Buses
PS 4: Introduction to PLC
PS 5: Network Settings/Communication Settings
PS 6: Digital Signals/IO's, Relay Logic
PS 7: Timer/Counters/Triggers/FlipFlops,
PS 8: Trouble Shooting the PLC programming errors
PS 9: Basic and electrohydraulics
PS 10: Force pressure and weight

PS 11: Laminar and turbulent flow
PS 12: Selection of Hydraulic fluid
PS 13: Hydraulic Pumps
PS 14: External and internal gear pumps
PS 15: Pressure Control Valves
PS 16: Types of directional control valves, Spool design, Poppet design
PS 17: Directional control valves
PS 18: Basic & Electro Pneumatics
PS 19: Pneumatics Vs Hydraulics
PS 20: Air compressors
PS 21: Pneumatic Valves and Control Circuits
PS 22: Pressure Control Valves

Core Skill:

The individual on the job needs to know and understand:
CS1. specifications and use of automation system used by the organisation
CS2. licensed software and application tools used for design, their performance
CS3. PLC Programming using Ladder Logic
CS4. Efficient in working with any kind of Hydraulics & Pneumatic Systems
Interpersonal skills
CS5. how to interact with higher officials to understand the work requirement
CS6. how to interact with co employees in order to co-ordinate work processes
Reflective thinking
CS7. to improve work processes
CS8. to reduce repetition of errors

Detailed Syllabus of Course

Module 1 PLC

Overview of Automation System: What is Automation? Different devices used in Automation, Role of PLC in automation system., Scope of Automation field in present and future, Comparison between Automated and Manual Operated Systems.

Overview of Switchgears: What is a Relay and its applications? Introduction to Switching devices like Contactors, Solenoids, MCB's etc., Symbolic representation of different electrical & electronic components in wiring diagram.

Introduction to Different Communication Protocols/Field Buses: Ethernet, RS232, Profibus DP, Canopen, Devicenet, Sercos II & III, Modbus, Profinet, Ethercat, Different types of Signals, Digital Signal, Analog Signal, Overview of Limit Switches, Proximity Switches & Reed switches, Introduction to PLC, Comparison of PLC & PC, What is a PLC?, How does a PLC work? Applications of PLC, Block Diagram of PLC, Processing cycle of PLC, Different types of PLC's available in the market, Programmable Logic Controller, Specifications of PLC, Onboard/Inline/Remote IO's, Memory Allocation in PLC, What is Scan time of PLC? IO handling capacity of different PLC, Remote connectivity in PLC, Internal Structure of PLC, Hardware Details of the PLC, Wiring and Connection Techniques, Safety Measures for handling the PLC, Diagnosis of PLC Status and other hardware connected to PLC.

Network Settings/Communication Settings: Introduction to PLC Software, Overview of Software/Software at a glance, Hardware Configuration Communication Settings for PLC, PLC Programming, Building simple logic in PLC (AND/OR/NOT), Online & Offline Change, Overview of different types of Data types in PLC programming, Standard format for addressing the variables, Standard Time formats, Rules for Declaration of Variable names, Working with Digital Signals/IO's, Relay Logic, Difference between Function & Function Blocks, Introduction to Timer/Counters/Triggers/FlipFlops, Exercises based on Timers, Counters, Flip Flops & Triggers, Usage of Mathematical Operators, Comparators, Conversion Operators, Multiplexers & Logical Gates in the PLC Program, Exercises based on the above operators, Compilation & Downloading the program to PLC, Trouble Shooting the PLC programming errors, Local & Global Variables, Working with Analog Signals/IO's, Developing a program for process control, Declaration in Tabular Format, Display of Address and Comments in Logic, Jump & Return Command, Commands like Run, Stop, Reset, Reset Original, Breakpoint etc, Developing User Defined Function Blocks & Functions in the PLC program, Conditional & Unconditional Calling in PLC Program, Task, Configuration, Visualization, Developing user defined Data Types in PLC program, Password Management, Different Methods to take the PLC Program Backup (Source Code Download/Upload, Archive/Restore & Export/Import), Library Management, Target Settings, Running the PLC program in Simulation Mode, Master/Slave Configuration, Data Exchange between the Master & Slave PLC

PROJECT: Tank Filling Device Simulator, Supervise Equipment, Pump Control 1, Selective Band Switch, Gate Control System, Star Delta Starting Up, Starter Control, Dahlander Pole Changing, Furnace Door Control, Reaction Vessel, Pump Control 2, Roadworks Traffic Lights, Cleaning System, Buffer Store Simulation, Automatic Tablet Filler, Changing Floor.

Practical / Tutorial Hours: 48

Module II

Basic and electrohydraulics

What is Fluid power: Advantages of Fluid power, What is Hydraulics? Definition of industrial Hydraulics, Hydrostatics and Hydrodynamics, Applications of Hydrostatics and Hydrodynamics, Characteristics of Industrial Hydraulics like advantages and its limitations, Comparisons of Drives (Hydraulics Vs Pneumatics, Electrical/Electronics & Mechanical, Applications of Hydraulics.

Force pressure and weight, Pascal's Law, Calculations : Pascal's Law, Application of Pascal's Law, Force Multiplication, Pressure Multiplication, Displacement transmission, Calculations, Units of pressure., What does 1bar mean? Absolute and relative pressure, What is flow rate? Flow law, Calculation, Open, Types of flow : Laminar and turbulent flow, Reynolds's number, Throttling, Graphical Symbols and Circuit Diagrams ISO 1219, Purpose of graphical symbols, Function of symbols, Basic elements, Circuit diagram Commonly used symbols, Circuit symbols., Symbols for energy supply and processing unit (Power Pack), Symbols for Hydraulics energy control units (Pressure, Flow and Direction), Symbols for Energy conversion units (Actuators), Symbols for accessories, Demonstration of Hydraulics circuits, Hydraulic circuit with manual DCV and a cylinder, Hydraulic circuit with manual DCV and a Hydraulic motor, Hydraulic circuit with solenoid DCV and cylinder and a motor, Demonstration of speed and direction changes in Hydraulic circuit, Hydraulic Fluids, Main functions of Hydraulic fluids, Functions, Capacity and Constructions of Tanks, Calculation, Requirements of Hydraulic fluids, Types of Hydraulic Fluids, Viscosity of Hydraulic fluid, Relation between temperature and viscosity, Selection of Hydraulic fluid for an applications, Compressibility of Hydraulic fluids, Thermal expansion of Hydraulic fluids, Fluid Analysis, Hydraulic Pumps, Functions and Operating principle Hydraulic pumps, Differentiate b/w positive and non – positive displacement pumps, Characteristics of standard Hydraulic pumps, Construction and Operating principle following pumps, i. External and internal gear pumps, ii. Vane pumps, iii. Axial piston pumps, iv. Radial piston pumps, Selection criteria of pumps, Flow rate and pump power, Efficiency, Hydraulic Cylinder, Operating Principle, Components of a Hydraulic cylinder, Functions of Hydraulic cylinder, Design and operation, Types of cylinder, Types of design, i. Tie rod cylinders, ii. Mill type cylinders, Technical specification, End positioning cushioning, Cylinder mounting, Hydraulic Motors, Functions of Hydraulic Motors, Characteristics of standard Hydraulic Motors, Selection of Hydraulic motors, Calculations, Efficiency, Pressure Control Valves, Introduction, Function and operating principle of pressure relief valve, direct operated, Pressure relief valve in series and parallel, Pressure relief valve, pilot operated, Function and operating principle of pressure reducing valve, Pressure sequence valve, direct operated, Directional Control Valve, Operation and Function, Special characteristics, Types of directional control valves, Spool design, Poppet design, Types of actuation of spools with symbols, Directional spool valves, direct operated, Directional spool valves, pilot operated, Designation of Directional control valves, Operation of solenoid, Solenoid operated valves and its symbols, Standard spool valve : G spool, E spool, J spool and H spool, Comparison of spool Vs poppet valves, Flow Control Valves, Functions, Throttle valves, Viscosity dependent throttle valves, Types of

mounting, Throttle valve independent of viscosity, Flow control valves, 2-way flow control valves, Upstream pressure compensator, Downstream pressure compensator, Applications of 2-way flow control valve, Meter-in flow control, Meter-out flow control, Check Valves, Operation and function of a simple check valve, Check valve, pilot operated, Double pilot operated check valve, Applications of check valves,

Project: Hydraulic pump, characteristic Curve, Single-rod cylinder, pressure intensification, Single-rod cylinder, flow, Hydraulic motor, 4/3 directional valve, Check valve, Check valve, pilot operated, Throttle valve, adjustable, Throttle check valve, Flow control valve, Pressure relief valve, direct operated, controls, Pressure reducing valve:

Theory / Lecture Hours: 32

Practical / Tutorial Hours: 48

Module III

Basic & Electro Pneumatics

Fluid power, Advantages, Pneumatics, Definition, Characteristics of Industrial Pneumatics, advantages and its limitations, Comparisons of Drives - Pneumatics Vs Hydraulics, Electrical/Electronics & Mechanical, Applications of Pneumatics, Compressed Air Generation and Contamination Control, Compressed Air for transmitting power, Composition of Atmospheric Air, force, weight, pressure, Pascal's Law, Application of Pascal's Law, Force Multiplication, Pressure Multiplication, Displacement transmission, Calculations, Gas Laws, Air compression process, Absolute and relative pressure. Flow rate, Characteristics of compressed air, Graphical Symbols and Circuit Diagrams ISO 1219, Purpose of graphical symbols, Function of symbols, Basic elements, Circuit diagram, Commonly used symbols, Circuit symbols., Symbols for Maintenance unit, Symbols for Pneumatic energy control units (Pressure, Flow and Direction), Symbols for Energy conversion units (Actuators), Symbols for accessories, Demonstration of Pneumatic circuits, Pneumatic circuit with manual DCV and a cylinder, Pneumatic circuit with solenoid DCV and cylinder and a motor, Demonstration of speed and direction changes in Pneumatic circuit, Compressed Air Generation and Contamination Control, A typical Pneumatic system, Air compressors, Classification of Compressors, Terms and Definition : Delivery volume, Pressure, Drive , Cooling and Regulation, Piston Compressor, Screw Compressor, Vane Compressor, Compressor unit, Preparation of compressed Air, Stages of Preparation, Drying of Compressed Air, Distribution of Compressed Air, Pneumatic Actuators, Introduction, Basic Actuator Functioning, Thrust, Cylinder Air Consumption, Cylinder speed and its relation to flow rate, Stroke Length, Piston –rod buckling, Classification of Pneumatic Actuators, Linear Actuators, Single-Acting cylinder, Double-Acting cylinder, Cylinder cushioning,

Classification of cylinders According to Duty, Cylinder with Magnetic Piston, Cylinder with Non-Rotational Guiding, Rodless Cylinder, Tandem Cylinder, Rotary Actuator, Semi-Rotary Actuators, Pneumatic Valves and Control Circuits, Introduction, Classification of valves, Functional Classification of Valves, i. Directional control valves, ii. Pressure control valves, iii. Flow control valves, iv. Non return valves, Graphical Representation, Port Markings, Ports and Positions, Graphical symbols for DC valves, Methods of DC Valve Actuations, 3/2-Directional Control valve, i. NC-type 3/2-DC valves, ii. NO-type 3/2-DC valves, Non-Return Valves, Flow control valves, Throttle valve and Throttle check valves, Pneumatically Actuated 3/2-DC valve, Manually actuated 5/2-DC valve, Pneumatically actuated 5/2-DC valve, Speed control of Double-Acting Cylinder, 5/2-DC Double-Pilot valve, Login Controls, Pneumatic, i. Shuttle valve, ii. Twin pressure valve, iii. Applications of Logic valves, Structure of Pneumatic Circuits, Automatic Control, Roller valve, Quick-Exhaust vavle, Time-Delay valves, Pressure Control Valves, Introduction, Function and operating principle of pressure relief valve, direct operated Pressure regulator

Project: Direct control of a single-acting cylinder, extending, Direct control of a single-acting cylinder, retracting, Indirect control of a single-acting cylinder, Regulating the speed of a single-acting cylinder, Slow-speed extension, rapid retraction of a single-acting cylinder, Direct control of a double-acting cylinder with push-button, Indirect control of a double-acting cylinder, Speed regulation of a double-acting cylinder, Controlling a double-acting cylinder, impulse valve, 2 push-buttons, Displacement-dependent control of a double-acting cylinder, impulse, Controlling a double-acting cylinder, impulse valve, 2 reflex nozzles, Stop control, double-acting cylinder, 5/3 directional control valve, tensile load, Pressure-dependent control of 1 double-acting cylinder, Time-dependent control of 1 double-acting cylinder, Logical control with shuttle and twin-pressure valves, Sequential control 2 double-acting cylinders w/o overlapping signals, Seq. control 2 double-act. cylinders, signal overlapping, idle return rollers, Pilot control of a single-acting cylinder with spring return valve, Pilot control of a double-acting cylinder with spring return valve, Holding-element control of a double-acting cylinder with impulse valve, directly controlled, Holding-element control of a double-acting cylinder with impulse valve, relay, Basic circuit with AND Function, Basic circuit with OR Function

Theory / Lecture Hours: 32

Practical / Tutorial Hours: 48

Total Course Theory / Lecture Hours: 96

Total Course Practical / Tutorial Hours: 144

Total Course Hours: 240

(Training in 100 hrs of Communicative English and 80 hrs of Basic IT Skills also provided, as required)

Recommended Hardware:	State of the art Training system for Hydraulics, Pneumatics, Sensoric and PLC
Recommended Software:	Automation studio, web trainers, Indraworks and indralogic
Text Books:	- Hydraulics. Basic Principles and Components (Bosch Rexroth AG) Volume 1 - The Pneumatic Trainer – Basic Pneumatics Volume 1 (Bosch Rexroth AG) - The Pneumatic Trainer – Volume 2 (Bosch Rexroth AG) - Sensors in Theory and Practice – Textbook (Bosch Rexroth AG) - Basics of Indraworks and Indralogic (Bosch Rexroth AG)
Reference Books:	- Herbert R. Merritt, Hydraulic control systems, John Wiley & Sons, Newyork, 1967 - Dudbey.A.Peace, Basic Fluid Power, Prentice Hall Inc, 1967 - R.Srinivasan Hydraulic and Pneumatic Control published by Vijay Nicole Imprints Private Ltd. - Programmable Logic Controllers by W.Bolton - Dudbey.A.Peace, Basic Fluid Power, Prentice Hall Inc, 1967 - Introduction to Programmable Logic Controllers by Garry Dunning, 2nd edition, Thomson, ISBN:981-240-625-5 - Programmable Logic Controllers by Hugh Jack
Evaluation criteria:	

ESDM Courses

Level Code:	L4	**Vertical Name:**	Industrial Automation
Course Code:	NL/M/L4/C013 EL/M/L4/C026	**Course Name:**	3.5.2 Certificate in robotic programming and maintenance (NIELIT/ESSCI)

Objective of the Course:

- Use the safety devices
- Familiar with necessary safety precautions for working with Industrial Robot.
- Familiarization to industrial robot and its application.
- Skill to programme an Industrial robot.
- Skill to operate an Industrial Robot.
- Familiarization to Robot Maintenance & Safety

Learning Outcomes:

Understanding about Robots ,and to get basic training an industrial Robot (operation, maintenance, safety)

Expected Job Roles:

Industrial robot programmer, Robot operator, Maintenance technician etc, in robotic companies

Duration of the Course (in hours)	325HRS
Minimum Eligibility Criteria	12^{th} pass

and pre-requisites, if any

Professional Knowledge:

- Understanding safety measures in Robotic field
- Robotic components recognition
- Manipulating the robot.
- Identifying the movements of a robotic arm
- Robot programming

Professional Skill:

- Programming of an Industrial Robot
- Operating of an Industrial robot.
- Safety measures and maintenance of an Industrial robot.

Core Skill:

1. To be able to understand an Industrial production cycle.
2. To be able to understand about the basics of robot.
3. To be able to work with the robot operating and maintenance with greatest safety.
4. To be able to work in robotic industry either in assembly units or in manufacturing.
5. To be able to handle the industrial robot.

Detailed Syllabus of Course

Theory:

Sl.No	TOPICS	Hr
	UNIT -1	
1.0	**Introduction to Robotics-**	**4**

1.1	Evolution of Robots & Robotics, Laws of Robotics,	1
1.2	Progressive advancement in robotics,	1
1.3	Types of Robot, Selection of Robot- Payload, speed, Reach	1
1.4	Major parts of Industrial robot. -	1
	UNIT 2	
2.0	**Robot Anatomy**	**8**
2.1	Links, Joints and Joints Notation Scheme.	1
2.2	Links, Joints and Joints Notation Scheme.	1
2.3	Degrees Of Freedom, Required DOF in a Manipulator	1
2.4	Arm Configuration, Wrist Configuration,	1
2.5	Work Cell, Work Envelope, and Work Volume	1
2.6	Robot End Effectors – Definition, Classification of End Effectors,	1
2.7	Types of Grippers.	1
2.8	General structure of Robot and Specifications of Robots	1
	UNIT 3	
3.0	**Robot motion analysis**	**6**

3.1	Introduction, link description,	1
3.2	Joint link connection description,	1
3.3	Kinematic modeling of manipulator	1
3.4	Direct and Inverse manipulator Kinematics - Basics	1
3.5	Manipulator dynamics- Basics	1
3.6	Trajectory planning – Basics	1
	UNIT 4	
4.0	**Robotic Vision System**	**4**
4.1	Robot Sensors, Function & use of sensors in robotics.	1
4.2	Definition & Concept-Robotic vision system	1
4.3	Aspects of vision systems.	1
4.4	Robot welding with vision system	1
	UNIT 5	
5.0	**Robot Software and Programming**	**4**
5.1	Introduction, Robot software features	1

5.2	Concept of programmability and related languages,	1
5.3	Robot programming languages and Robotic Functions,	1
5.4	Control functions of a Teach box, Jogging of a Robot	1
	UNIT 6	
6.0	**Robotic System Design Aspects**	**2**
6.1	Introduction, Informational requirements	1
6.2	Overall Design, Mechanical design considerations	1
	UNIT 7	
7.0	**Robotic Applications**	**8**
7.1	Introduction	1
7.2	Adapting robots to industrial workstation- Why?	1
7.3	General Conditions for usage of industrial Robot	1
7.4	Robot capabilities	1
7.5	Non- Industrial applications, Industrial applications	1
7.6	Process wise Applications- Material handling, process operation and product inspection,	1
7.7	Machine loading and Unloading.	1
7.8	Spot & Arc welding	1
	UNIT 8	
8.0	Robot Maintenance & Safety	**5**

8.2	Robot Maintenance	1
8.3	Robot Maintenance	1
8.4	Robot Safety systems	1
8.5	Present state of safety technology	1
9.0	Assignment	**4**
10	Theory Test	**4**

Practical Syllabus:

SL. No	**3.5.2.1.1.1.1.1.1 Major topics**	**Time allotted**
1.	Robot component recognition.	8h
2.	Manipulating the robot.	8h
3.	Recording the position	12h
4.	Writing and running robot programs	16h
5.	Joint & XYZ co-ordinate system.	8h
6.	Point-to-Point control	8h
7.	Linear and Circular Interpolation	4h
8	Writing the programs using Loops.	4h
9.	Writing the programs using Delay.	4h

10	Test & Exam	4h
11	Internship	200 h
	Total	276 Hrs.

Total

Course Theory / Lecture Hours: 49

Total Course Practical / Tutorial Hours: 276

Total Course Hours:325

(Training in 100 hrs of Communicative English and 80 hrs of Basic IT Skills also provided, as required)

Recommended Hardware:

- Industrial Robot
- End effecter
- Relevant components for a specific job.

We are providing Robot,

1) Fanuc LR mate200iC
2) Fanuc LR mate200iD
3) Pneumatic Gripper

Recommended Software:

Robot simulator(robo sim)

Text Books:

Robotics and Control- RK Mittal, I J Nagrath

Trainees handbook by NTTF,
Robotics trainers manual by NTTF.

Reference Books:

Industrial Robotics By Michel P Groover, Robotic Engineering By Dr. Surender Kumar,Dr.S K Mukherjee, Robotics and Control – RK Mittal, I.J.Nagrath.

ESDM Courses

Level Code:	L5	**Vertical Name:**	Industrial Automation
Course Code:	NL/M/L5/C018 EL/M/L5/C031	**Course Name:**	3.5.3 Automation Technology – Intermediate Level (NIELIT/ESSCI)

Objective of the Course:

To get an overview of automation technology. With hands on and theoretical knowledge on basics of Hydraulics, Pneumatics, Sensors and PLC

The students are also equipped with good Communicative English Skills, soft Skills and Basic IT skills required for good performance in any job in the modern world .

Learning Outcomes:

At the end of the level one the student will be able to identify basic components of automation technology, gets an idea on the overall working of the system and shall be able to troubleshoot on an intermediate level.
Have Good Communicative English skills, Soft skills & Basic IT Skills

Expected Job Roles:

Aassistants in regular production areas, quality, logistics and maintenance areas

Duration of the Course (in hours)	Technical Students –400 Hrs Non-Technical Students –450 Hrs
Minimum Eligibility Criteria and pre-requisites, if any	Diploma in /Electronics/Instrumentation/ Mechanical/Electrical – for Technical

students. Non Technical Students: Diploma

Professional Knowledge:

To be competent, the user/ individual must be able to: PK1. Understand the overview of automation PK2 Different devices used in Automation, PK3. interact with the technical lead engineer in order to understand the work schedules, PK4. understand the roles and responsibilities of the work PK5. understand broad level activities involved in the Industrial automation PK6. list the various department to interact with for completing the work PK7. interact with higher officials to understand the specifics of work PK8. understand the different Communication Protocols/Field Buses PK9. establish module requirement and constraints PK10. understand Network Settings/Communication Settings PK11. understand the PLC Software PK12. understand the basics of electro hydraulics PK13. define the design flow for the specific system PK14. use agreed language and application as per standards PK15. define the requirement specification of the electro pneumatics PK16. get approval from superior and relevant department on the electro pneumatics PK17. Understand different types of pumps PK18. Understand different types of valves PK19. understand the functionality of the electro pneumatics PK20. assist in system testing, product verification and validation PK 21. understand the functionality of the electro hydraulics PK22. understand the functionality of the HMI

Professional Skill:

PS 1: Overview of Automation System
PS 2: Overview of Switchgears.
PS 3: Different Communication Protocols/Field Buses
PS 4: Introduction to PLC
PS 5: Network Settings/Communication Settings
PS 6: Digital Signals/IO's, Relay Logic
PS 7: Timer/Counters/Triggers/FlipFlops,
PS 8: Trouble Shooting the PLC programming errors
PS 9: Basic and electrohydraulics
PS 10: Force pressure and weight
PS 11: Laminar and turbulent flow
PS 12: Selection of Hydraulic fluid
PS 13: Hydraulic Pumps
PS 14: External and internal gear pumps
PS 15: Pressure Control Valves
PS 16: Types of directional control valves, Spool design, Poppet design
PS 17: Directional control valves
PS 18: Basic & Electro Pneumatics
PS 19: Pneumatics Vs Hydraulics
PS 20: Air compressors
PS 21: Pneumatic Valves and Control Circuits
PS 22: Pressure Control Valves
PS 23: HMI
PS 24: Programming of HMI
PS 25: Downloading and Uploading the program to or from the HMI
PS 26: Hydraulic Accumulator and its Applications
PS 27: Classifications of filters
PS 28: Principles of Electro-Hydraulics, Basics
PS 29: Electro-hydraulic valves
PS 30: Design of Pneumatics systems
PS 31: Maintenance Activities
PS 32: System Malfunctions

Core Skill:

The individual on the job needs to know and understand:
CS1. specifications and use of automation system used by the organisation
CS2. licensed software and application tools used for design, their performance
CS3. PLC Programming using Ladder Logic
CS4. Efficient in working with any kind of Hydraulics & Pneumatic Systems
Interpersonal skills
CS5. how to interact with higher officials to understand the work requirement
CS6. how to interact with co employees in order to co-ordinate work processes
Reflective thinking
CS7. to improve work processes
CS8. to reduce repetition of errors

Detailed Syllabus of Course

Module 1 PLC

Overview of Automation System: What is Automation? Different devices used in Automation, Role of PLC in automation system., Scope of Automation field in present and future, Comparison between Automated and Manual Operated Systems.

Overview of Switchgears: What is a Relay and its applications? Introduction to Switching devices like Contactors, Solenoids, MCB's etc., Symbolic representation of different electrical & electronic components in wiring diagram.

Introduction to Different Communication Protocols/Field Buses: Ethernet, RS232, Profibus DP, Canopen, Devicenet, Sercos II & III, Modbus, Profinet, Ethercat, Different types of Signals, Digital Signal, Analog Signal, Overview of Limit Switches, Proximity Switches & Reed switches, Introduction to PLC, Comparison of PLC & PC, What is a PLC?, How does a PLC work? Applications of PLC, Block Diagram of PLC, Processing cycle of PLC, Different types of PLC's available in the market, Programmable Logic Controller, Specifications of PLC, Onboard/Inline/Remote IO's, Memory Allocation in PLC, What is Scan time of PLC? IO handling capacity of different PLC, Remote connectivity in PLC, Internal Structure of PLC, Hardware Details of the PLC, Wiring and Connection Techniques, Safety Measures for handling the PLC, Diagnosis of PLC Status and other hardware connected to PLC.

Network Settings/Communication Settings: Introduction to PLC Software, Overview of Software/Software at a glance, Hardware Configuration Communication Settings for PLC, PLC Programming, Building simple logic in PLC (AND/OR/NOT), Online & Offline Change, Overview of different types of Data types in PLC programming, Standard format for addressing the variables, Standard Time formats, Rules for Declaration of Variable names, Working with Digital Signals/IO's, Relay Logic, Difference between Function & Function Blocks, Introduction to Timer/Counters/Triggers/FlipFlops, Exercises based on Timers, Counters, Flip Flops & Triggers, Usage of Mathematical Operators, Comparators, Conversion Operators, Multiplexers & Logical Gates in the PLC Program, Exercises based on the above operators, Compilation & Downloading the program to PLC, Trouble Shooting the PLC programming errors, Local & Global Variables, Working with Analog Signals/IO's, Developing a program for process control, Declaration in Tabular Format, Display of Address and Comments in Logic, Jump & Return Command, Commands like Run, Stop, Reset, Reset Original, Breakpoint etc, Developing User Defined Function Blocks & Functions in the PLC program, Conditional & Unconditional Calling in PLC Program, Task, Configuration, Visualization, Developing user defined Data Types in PLC program, Password Management, Different Methods to take the PLC Program Backup (Source Code Download/Upload, Archive/Restore & Export/Import), Library Management, Target Settings, Running the PLC program in Simulation Mode, Master/Slave Configuration, Data Exchange between the Master & Slave PLC.

HMI : Introduction, Applications, Role of HMI in Automation, Interfacing HMI with different devices, Hardware Details of HMI, Technical Specifications of HMI, Wiring and Connection Techniques, Various models of HMI available in market, Editing various display options using the keys, Programming of HMI, Overview of HMI software, Hardware Configuration, Network Settings or Communication Settings, Developing Different Screens on HMI, Writing Plain Text on the screen, Developing Headers & Footers for the Screen, Configuring the function keys of HMI for screen change or for giving inputs, Linking the variables directly on the screen, Password Management (for screen change & for editing the values), Developing user defined text list, Screen Change using PLC variables, Displaying Alarm Messages on the Screen during fault, Configuring Help Screen for Troubleshooting the errors or faults, Downloading and Uploading the program to or from the HMI respectively using bus interface or USB drive.

PROJECT: Tank Filling Device Simulator, Supervise Equipment, Pump Control 1, Selective Band Switch, Gate Control System, Star Delta Starting Up, Starter Control, Dahlander Pole Changing, Furnace Door Control, Reaction Vessel, Pump Control 2, Roadworks Traffic Lights, Cleaning System, Buffer Store Simulation, Automatic Tablet Filler, Changing Floor, Embossing Machine, Bending Tool, Drilling Tool, Pipe Bending Machine, Two Door Access Control System, Mix Equipment, Level Control, Compressed Air Network, Water Level Controlling, A Low-Cost PLC Based Automatic Liquid Filling and Sorting System, Modular Automated Testing Unit Sequencing and Controlling, Low Cost PLC Based Automated Sorting And Pressing By Servo-Pneumatic Pressure Control, Automated Multistorey Car Parking System

There are 3 mixing devices on a processing line A,B,C. After the process begin mixer-A is to start after 7 seconds elapse, next mixer-B is to start 3.6 second after A. Mixer-C is to start 5 seconds after B. All then remain ON until a master enable switch is turned off. Write PLC ladder diagram, timing diagram and realize the same

An indicating light is to go ON when a count reaches 23.The light is then go off when a count of 31 is reached. Design, construct, and test PLC circuits for this process

In certain process control application when the count reaches 25, a paint spray is to run for 40 seconds. Design, construct and test PLC circuits for this process

Three conveyors feed a main conveyor. The count from each feeder conveyor is fed into an input register in the PLC. Construct a PLC program to obtain the total count of parts on the main conveyor. Use a time to update the total every 15 seconds. Design, construct, and test PLC circuits for this process

In certain process control application o/p is ON if the count is less than 34 or more than 41. Implement the same using PLC ladder diagram

A conveyor is supposed to have exactly 45 parts on it. You have three indicating lights to indicate the conveyor count status: less than 45, yellow: exactly 45, green: and more than 45, red. The count of parts on the conveyor is set at 45 each morning by an actual count of parts. There are two sensors on the conveyor, one is actuated by parts entering the conveyor, and the other is actuated by parts leaving. Design a PLC program to carry out this process.

Theory / Lecture Hours: 60

Practical / Tutorial Hours: 90

Module II

Basic and electrohydraulics

What is Fluid power: Advantages of Fluid power, What is Hydraulics? Definition of industrial Hydraulics, Hydrostatics and Hydrodynamics, Applications of Hydrostatics and Hydrodynamics, Characteristics of Industrial Hydraulics like advantages and its limitations, Comparisons of Drives (Hydraulics Vs Pneumatics, Electrical/Electronics & Mechanical, Applications of Hydraulics.

Force pressure and weight, Pascal's Law, Calculations : Pascal's Law, Application of Pascal's Law, Force Multiplication, Pressure Multiplication, Displacement transmission, Calculations, Units of pressure., What does 1bar mean? Absolute and relative pressure, What is flow rate? Flow law, Calculation, Open, Types of flow :

Laminar and turbulent flow, Reynolds's number, Throttling, Graphical Symbols and Circuit Diagrams ISO 1219, Purpose of graphical symbols, Function of symbols, Basic elements, Circuit diagram Commonly used symbols, Circuit symbols., Symbols for energy supply and processing unit (Power Pack), Symbols for Hydraulics energy control units (Pressure, Flow and Direction), Symbols for Energy conversion units (Actuators), Symbols for accessories, Demonstration of Hydraulics circuits, Hydraulic circuit with manual DCV and a cylinder, Hydraulic circuit with manual DCV and a Hydraulic motor, Hydraulic circuit with solenoid DCV and cylinder and a motor, Demonstration of speed and direction changes in Hydraulic circuit, Hydraulic Fluids, Main functions of Hydraulic fluids, Functions, Capacity and Constructions of Tanks, Calculation, Requirements of Hydraulic fluids, Types of Hydraulic Fluids, Viscosity of Hydraulic fluid, Relation between temperature and viscosity, Selection of Hydraulic fluid for an applications, Compressibility of Hydraulic fluids, Thermal expansion of Hydraulic fluids, Fluid Analysis, Hydraulic Pumps, Functions and Operating principle Hydraulic pumps, Differentiate b/w positive and non – positive displacement pumps, Characteristics of standard Hydraulic pumps, Construction and Operating principle following pumps, i. External and internal gear pumps, ii. Vane pumps, iii. Axial piston pumps, iv. Radial piston pumps, Selection criteria of pumps, Flow rate and pump power, Efficiency, Hydraulic Cylinder, Operating Principle, Components of a Hydraulic cylinder, Functions of Hydraulic cylinder, Design and operation, Types of cylinder, Types of design, i. Tie rod cylinders, ii. Mill type cylinders, Technical specification, End positioning cushioning, Cylinder mounting, Hydraulic Motors, Functions of Hydraulic Motors, Characteristics of standard Hydraulic Motors, Selection of Hydraulic motors, Calculations, Efficiency, Pressure Control Valves, Introduction, Function and operating principle of pressure relief valve, direct operated, Pressure relief valve in series and parallel, Pressure relief valve, pilot operated, Function and operating principle of pressure reducing valve, Pressure sequence valve, direct operated, Directional Control Valve, Operation and Function, Special characteristics, Types of directional control valves, Spool design, Poppet design, Types of actuation of spools with symbols, Directional spool valves, direct operated, Directional spool valves, pilot operated, Designation of Directional control valves, Operation of solenoid, Solenoid operated valves and its symbols, Standard spool valve : G spool, E spool, J spool and H spool, Comparison of spool Vs poppet valves, Flow Control Valves, Functions, Throttle valves, Viscosity dependent throttle valves, Types of mounting, Throttle valve independent of viscosity, Flow control valves, 2-way flow control valves, Upstream pressure compensator, Downstream pressure compensator, Applications of 2-way flow control valve, Meter-in flow control, Meter-out flow control, Check Valves, Operation and function of a simple check valve, Check valve, pilot operated, Double pilot operated check valve, Applications of check valves,

Hydraulic Accumulator and its Applications, Functions, Energy storage, Types of Accumulator, Safety regulations, Application of accumulators, Filtration and Filtration Technology, Causes of contamination, Classifications of filters, Suction filter, Pressure line filter, Return line filter, Bypass filter, Filter with clogging indicator, Basic Principles of Electro-Hydraulics, Basics : Electric current, voltage, resistance and power, Basic electric circuits : series and parallel, Measurement of current and voltage, Electro-hydraulic valves, Solenoids, Classifications of solenoids, Function and operating principle of a relay, Relay as a logical switch, Relay Logic Diagram : control and main circuit, Symbols of most important switching elements (NO an NC), Signal storage

concept, Electrical interlocking concept, Momentary-contact limit switches, Categories of limit switches, Pressure switches, Graphical symbols to DIN electrical engineering and electronics.

Project: Hydraulic pump, characteristic Curve, Single-rod cylinder, pressure intensification, Single-rod cylinder, flow, Hydraulic motor, 4/3 directional valve, Check valve, Check valve, pilot operated, Throttle valve, adjustable, Throttle check valve, Flow control valve, Pressure relief valve, direct operated, controls, Pressure reducing valve, Pressure switch, hydraulic accumulator, Regenerative circuit, Rapid speed/creep speed control, Extending a cylinder by operating a push button, Signal storage by electrical self-locking, setting and resetting using a momentary-contact switch, Mechanical locking by means of momentary-contact switch contacts, Electrical locking by means of contactor contacts, Signal storage by means of contactor contacts, Rapid advance circuit, Pressure-dependent reversing, Pressure switches and proximity switches, Advance control with time-dependent intermediate stop, Pressure-dependent sequence control, Sequencing Hydraulic actuators

Theory / Lecture Hours: 60

Practical / Tutorial Hours: 90

Module III

Basic & Electro Pneumatics

Fluid power, Advantages, Pneumatics, Definition, Characteristics of Industrial Pneumatics, advantages and its limitations, Comparisons of Drives - Pneumatics Vs Hydraulics, Electrical/Electronics & Mechanical, Applications of Pneumatics, Compressed Air Generation and Contamination Control, Compressed Air for transmitting power, Composition of Atmospheric Air, force, weight, pressure, Pascal's Law, Application of Pascal's Law, Force Multiplication, Pressure Multiplication, Displacement transmission, Calculations, Gas Laws, Air compression process, Absolute and relative pressure. Flow rate, Characteristics of compressed air, Graphical Symbols and Circuit Diagrams ISO 1219, Purpose of graphical symbols, Function of symbols, Basic elements, Circuit diagram, Commonly used symbols, Circuit symbols., Symbols for Maintenance unit, Symbols for Pneumatic energy control units (Pressure, Flow and Direction), Symbols for Energy conversion units (Actuators), Symbols for accessories, Demonstration of Pneumatic circuits, Pneumatic circuit with manual DCV and a cylinder, Pneumatic circuit with solenoid DCV and cylinder and a motor, Demonstration of speed and direction changes in Pneumatic circuit, Compressed Air Generation and Contamination Control, A typical Pneumatic system, Air compressors, Classification of Compressors, Terms and Definition : Delivery volume, Pressure, Drive , Cooling and Regulation, Piston Compressor, Screw Compressor, Vane Compressor, Compressor unit, Preparation of compressed Air, Stages of Preparation, Drying of Compressed Air, Distribution

of Compressed Air, Pneumatic Actuators, Introduction, Basic Actuator Functioning, Thrust, Cylinder Air Consumption, Cylinder speed and its relation to flow rate, Stroke Length, Piston –rod buckling, Classification of Pneumatic Actuators, Linear Actuators, Single-Acting cylinder, Double-Acting cylinder, Cylinder cushioning, Classification of cylinders According to Duty, Cylinder with Magnetic Piston, Cylinder with Non-Rotational Guiding, Rodless Cylinder, Tandem Cylinder, Rotary Actuator, Semi-Rotary Actuators, Pneumatic Valves and Control Circuits, Introduction, Classification of valves, Functional Classification of Valves, i. Directional control valves, ii. Pressure control valves, iii. Flow control valves, iv. Non return valves, Graphical Representation, Port Markings, Ports and Positions, Graphical symbols for DC valves, Methods of DC Valve Actuations, 3/2-Directional Control valve, i. NC-type 3/2-DC valves, ii. NO-type 3/2-DC valves, Non-Return Valves, Flow control valves, Throttle valve and Throttle check valves, Pneumatically Actuated 3/2-DC valve, Manually actuated 5/2-DC valve, Pneumatically actuated 5/2-DC valve, Speed control of Double-Acting Cylinder, 5/2-DC Double-Pilot valve, Login Controls, Pneumatic, i. Shuttle valve, ii. Twin pressure valve, iii. Applications of Logic valves, Structure of Pneumatic Circuits, Automatic Control, Roller valve, Quick-Exhaust vavle, Time-Delay valves, Pressure Control Valves, Introduction, Function and operating principle of pressure relief valve, direct operated Pressure regulator.

Multiple-Actuator Circuits, Introduction, Representation of a Control Task, i. Text form, ii. Positional Layout, iii. Notational form, iv. Displacement –step diagram, v. Displacement-time diagram, Sequence Control, Circuit design for the sequence of two cylinder and three cylinders, Elimination of signal overlaps, Electro-Pneumatics, Introduction, Integration of Technologies, Solenoid valves, DC solenoids Vs AC Solenoids, 3/2-Way single solenoid valve, Spring return, 5/2-Way single solenoid valve, Spring return, 5/2-Way double solenoid valve, Control devices, Switch and Push button, Terminal Markings, Relay, Logic Controls, Electric, Memory function, Operation of the 'Dominant OFF' Circuit, Operation of the 'Dominant ON' Circuit, Electronic sensors, Limit switch, Reed switch, Proximity Sensors, Time-Delay Relays, Two-hand safety operation, Pressure switch, Electro-Pneumatic Multiple-Actuator Circuits, Pneumatic Application Concepts, Introduction, Selection and Optimization Criteria, i. Type of motion, ii. Stroke and stroke control, iii. Force, iv. Speed and speed control,

Design of Pneumatics systems, Selection of Pneumatic Actuators, Selection of Pneumatic Valves, Maintenance, Troubleshooting, and Safety, Introduction, Requirements of Preventive Maintenance, Definitions of Maintenance Activities, Preventive Maintenance of Pneumatic Systems (General Procedure), System Malfunctions, i. Malfunctions due to contaminants, ii. Malfunctions due to improper mountings, iii. Malfunctions due to inadequate air supply, iv. Malfunctions due to under-lubrication/over lubrication, Maintenance Tips, i. Maintenance of compressor, ii. Maintenance of air receivers, iii. Maintenance of air-mains, iv. Maintenance of air service units (FRL), v. Maintenance of Pneumatic cylinder, vi. Maintenance of Pneumatic valves, Troubleshooting, i. General troubleshooting procedure, ii. Faults in Pneumatic systems, General Malfunctions, i. Malfunction in pneumatic cylinder, ii. Malfunction in Pneumatic valves, iii. Malfunctions in limit switches and reed switches, Safety in Pneumatic Systems, i. Safety hazards, ii. General safety measures.

Project: Direct control of a single-acting cylinder, extending, Direct control of a single-acting cylinder, retracting, Indirect control of a single-acting cylinder, Regulating the speed of a single-acting cylinder, Slow-speed extension, rapid retraction of a single-acting cylinder, Direct control of a double-acting cylinder with push-button, Indirect control of a double-acting cylinder, Speed regulation of a double-acting cylinder, Controlling a double-acting cylinder, impulse valve, 2 push-buttons, Displacement-dependent control of a double-acting cylinder, impulse, Controlling a double-acting cylinder, impulse valve, 2 reflex nozzles, Stop control, double-acting cylinder, 5/3 directional control valve, tensile load, Pressure-dependent control of 1 double-acting cylinder, Time-dependent control of 1 double-acting cylinder, Logical control with shuttle and twin-pressure valves, Sequential control 2 double-acting cylinders w/o overlapping signals, Seq. control 2 double-act. cylinders, signal overlapping, idle return rollers, Pilot control of a single-acting cylinder with spring return valve, Pilot control of a double-acting cylinder with spring return valve, Holding-element control of a double-acting cylinder with impulse valve, directly controlled, Holding-element control of a double-acting cylinder with impulse valve, relay, Basic circuit with AND Function, Basic circuit with OR Function. Basic circuit with electric latching circuits, Displacement-dependent control of a double-acting cylinder with 1 electric limit switch, Displacement-dependent control of a double acting cylinder, impulse valve, cylinder switch, Displacement-dependent control of a double-acting cylinder with spring return valve, cylinder switch, Stop control of a double-acting cylinder with a 5/3 directional control valve in closed mid-position, Time-dependent control of a double-acting cylinder with switch-on time delay, Time-dependent control of a double-acting cylinder with switch-off time delay, Pressure-dependent control of a double-acting cylinder, Two-hand safety control, electric, Sequential control of 2 double-acting cylinders with impulse valve, Sequential control of 2 double-acting cylinders with impulse valves and signal overlapping, Sequential control of 2 double-acting cylinders with spring return valves and step sequence, Sequential control of 3 double-acting cylinders with impulse valves and step sequence, Sequential control of 3 double-acting cylinders with spring return valves and step sequence, Multiple actuator sequence, Two cylinder sequence, Three cylinder sequence.

Theory / Lecture Hours: 60

Practical / Tutorial Hours: 90

Total Course Theory / Lecture Hours: 180

Total course Practical / Tutorial Hours: 270

Total course Hours: 450

Recommended Hardware:	State of the art Training system for Hydraulics, Pneumatics, Sensoric and PLC
Recommended Software:	Automation studio, web trainers, Indraworks and indralogic
Text Books:	- Hydraulics. Basic Principles and Components (Bosch Rexroth AG) Volume 1 - The Pneumatic Trainer – Basic Pneumatics Volume 1 (Bosch Rexroth AG) - The Pneumatic Trainer – Volume 2 (Bosch Rexroth AG) - Sensors in Theory and Practice – Textbook (Bosch Rexroth AG) - Basics of Indraworks and Indralogic (Bosch Rexroth AG)
Reference Books:	- Herbert R. Merritt, Hydraulic control systems, John Wiley & Sons, Newyork, 1967 - Dudbey.A.Peace, Basic Fluid Power, Prentice Hall Inc, 1967 - R.Srinivasan Hydraulic and Pneumatic Control published by Vijay Nicole Imprints Private Ltd. - Programmable Logic Controllers by W.Bolton - Dudbey.A.Peace, Basic Fluid Power, Prentice Hall Inc, 1967 - Introduction to Programmable Logic Controllers by Garry Dunning, 2nd edition, Thomson, ISBN:981-240-625-5 - Programmable Logic Controllers by Hugh Jack
Evaluation criteria:	The training is conducted with the industrial support of **Bosch Rexroth,Germany. MOU Signed with them** . Bosch has supplied all equipments and set up the state of the art lab facilities in two engineering colleges in the state.. They have trained our faculty. Evaluation & Certification by Bosch Rexroth. ESSCI has also agreed to do Assessment and Certification**.**

ESDM Courses

Level Code:	L5	**Vertical Name:**	Industrial Automation
Course Code:	NL/M/L5/C019 EL/M/L5/C032	**Course Name:**	3.5.4 Automation Technology – Advanced level (NIELIT/ESSCI)

Objective of the Course:

To get an overview of automation technology. With hands on and theoretical knowledge on advanced of Hydraulics, Pneumatics, Sensors, PLC, Electric drives and Mechatronics (Optional Robotics).
The students are also equipped with good Communicative English Skills, soft Skills and Basic IT skills required for good performance in any job in the modern world .

Learning Outcomes:

At the end of the level one the student will be able to identify components of automation technology, gets complete knowledge on understanding the automated systems and design circuits and develop programs for given automation tasks.
Have Good Communicative English Skills, Soft Skills and Basic IT Skills

Expected Job Roles:

Assistants in regular production areas, quality, logistics, maintenance areas, design, Application, Service and R&D

Duration of the Course (in hours)	520 Hrs
Minimum Eligibility Criteria and pre-requisites, if any	Diploma in Electronics/Instrumentation/ Mechanical/Electrical / Graduates, with

science background and affinity towards technical studies

Professional Knowledge:

To be competent, the user/ individual must be able to:

PK1. Understand the overview of automation
PK2 Different devices used in Automation,
PK3. interact with the technical lead engineer in order to understand the work schedules,
PK4. understand the roles and responsibilities of the work
PK5. understand broad level activities involved in the Industrial automation
PK6. list the various department to interact with for completing the work
PK7. interact with higher officials to understand the specifics of work
PK8. understand the different Communication Protocols/Field Buses
PK9. establish module requirement and constraints
PK10. understand Network Settings/Communication Settings
PK11. understand the PLC Software
PK12. understand the basics of electro hydraulics
PK13. define the design flow for the specific system
PK14. use agreed language and application as per standards
PK15. define the requirement specification of the electro pneumatics
PK16. get approval from superior and relevant department on the electro pneumatics
PK17. Understand different types of pumps
PK18. Understand different types of valves
PK19. understand the functionality of the electro pneumatics
PK20. assist in system testing, product verification and validation
PK 21. understand the functionality of the electro hydraulics
PK22. understand the functionality of the HMI
PK23. understand Proportional Hydraulics
PK24. definition of Proportional valve
PK25. understand LVDT
PK26. understand different types of amplifiers
PK27. understand proportional direction control valves
PK28. Introduction to control system
PK23. understand Proportional & Closed loop

Professional Skill:

PS 1: Overview of Automation System
PS 2: Overview of Switchgears.
PS 3: Different Communication Protocols/Field Buses
PS 4: Introduction to PLC
PS 5: Network Settings/Communication Settings
PS 6: Digital Signals/IO's, Relay Logic
PS 7: Timer/Counters/Triggers/FlipFlops,
PS 8: Trouble Shooting the PLC programming errors
PS 9: Basic and electrohydraulics
PS 10: Force pressure and weight
PS 11: Laminar and turbulent flow
PS 12: Selection of Hydraulic fluid
PS 13: Hydraulic Pumps
PS 14: External and internal gear pumps
PS 15: Pressure Control Valves
PS 16: Types of directional control valves, Spool design, Poppet design
PS 17: Directional control valves
PS 18: Basic & Electro Pneumatics
PS 19: Pneumatics Vs Hydraulics
PS 20: Air compressors
PS 21: Pneumatic Valves and Control Circuits
PS 22: Pressure Control Valves
PS 23: HMI
PS 24: Programming of HMI
PS 25: Downloading and Uploading the program to or from the HMI
PS 26: Hydraulic Accumulator and its Applications
PS 27: Classifications of filters
PS 28: Principles of Electro-Hydraulics, Basics
PS 29: Electro-hydraulic valves
PS 30: Design of Pneumatics systems
PS 31: Maintenance Activities
PS 32: System Malfunctions
PS 33: Proportional Hydraulics
PS 34: Definition of Proportional valve
PS 35: LVDT
PS 36: Types of amplifiers
PS 37: Proportional direction control valves
PS 38: Introduction to control system
PS 39: Proportional & Closed loop

Core Skill:

The individual on the job needs to know and understand:
CS1. specifications and use of automation system used by the organisation
CS2. licensed software and application tools used for design, their performance
CS3. PLC Programming using Ladder Logic
CS4. Efficient in working with any kind of Hydraulics & Pneumatic Systems
Interpersonal skills
CS5. how to interact with higher officials to understand the work requirement
CS6. how to interact with co employees in order to co-ordinate work processes
Reflective thinking
CS7. to improve work processes
CS8. to reduce repetition of errors

Detailed Syllabus of Course

Module 1 PLC

Overview of Automation System: What is Automation? Different devices used in Automation, Role of PLC in automation system., Scope of Automation field in present and future, Comparison between Automated and Manual Operated Systems.

Overview of Switchgears: What is a Relay and its applications? Introduction to Switching devices like Contactors, Solenoids, MCB's etc., Symbolic representation of different electrical & electronic components in wiring diagram.

Introduction to Different Communication Protocols/Field Buses: Ethernet, RS232, Profibus DP, Canopen, Devicenet, Sercos

II & III, Modbus, Profinet, Ethercat, Different types of Signals, Digital Signal, Analog Signal, Overview of Limit Switches, Proximity Switches & Reed switches, Introduction to PLC, Comparison of PLC & PC, What is a PLC?, How does a PLC work? Applications of PLC, Block Diagram of PLC, Processing cycle of PLC, Different types of PLC's available in the market, Programmable Logic Controller, Specifications of PLC, Onboard/Inline/Remote IO's, Memory Allocation in PLC, What is Scan time of PLC? IO handling capacity of different PLC, Remote connectivity in PLC, Internal Structure of PLC, Hardware Details of the PLC, Wiring and Connection Techniques, Safety Measures for handling the PLC, Diagnosis of PLC Status and other hardware connected to PLC.

Network Settings/Communication Settings: Introduction to PLC Software, Overview of Software/Software at a glance, Hardware Configuration Communication Settings for PLC, PLC Programming, Building simple logic in PLC (AND/OR/NOT), Online & Offline Change, Overview of different types of Data types in PLC programming, Standard format for addressing the variables, Standard Time formats, Rules for Declaration of Variable names, Working with Digital Signals/IO's, Relay Logic, Difference between Function & Function Blocks, Introduction to Timer/Counters/Triggers/FlipFlops, Exercises based on Timers, Counters, Flip Flops & Triggers, Usage of Mathematical Operators, Comparators, Conversion Operators, Multiplexers & Logical Gates in the PLC Program, Exercises based on the above operators, Compilation & Downloading the program to PLC, Trouble Shooting the PLC programming errors, Local & Global Variables, Working with Analog Signals/IO's, Developing a program for process control, Declaration in Tabular Format, Display of Address and Comments in Logic, Jump & Return Command, Commands like Run, Stop, Reset, Reset Original, Breakpoint etc, Developing User Defined Function Blocks & Functions in the PLC program, Conditional & Unconditional Calling in PLC Program, Task, Configuration, Visualization, Developing user defined Data Types in PLC program, Password Management, Different Methods to take the PLC Program Backup (Source Code Download/Upload, Archive/Restore & Export/Import), Library Management, Target Settings, Running the PLC program in Simulation Mode, Master/Slave Configuration, Data Exchange between the Master & Slave PLC.

HMI : Introduction, Applications, Role of HMI in Automation, Interfacing HMI with different devices, Hardware Details of HMI, Technical Specifications of HMI, Wiring and Connection Techniques, Various models of HMI available in market, Editing various display options using the keys, Programming of HMI, Overview of HMI software, Hardware Configuration, Network Settings or Communication Settings, Developing Different Screens on HMI, Writing Plain Text on the screen, Developing Headers & Footers for the Screen, Configuring the function keys of HMI for screen change or for giving inputs, Linking the variables directly on the screen, Password Management (for screen change & for editing the values), Developing user defined text list, Screen Change using PLC variables, Displaying Alarm Messages on the Screen during fault, Configuring Help Screen for Troubleshooting the errors or faults, Downloading and Uploading the program to or from the HMI respectively using bus interface or USB drive.

PROJECT: Tank Filling Device Simulator, Supervise Equipment, Pump Control 1, Selective Band Switch, Gate Control System, Star Delta Starting Up, Starter Control, Dahlander Pole Changing, Furnace Door Control, Reaction Vessel, Pump Control 2, Roadworks Traffic Lights, Cleaning System, Buffer Store Simulation, Automatic Tablet Filler, Changing Floor, Embossing Machine, Bending Tool, Drilling Tool, Pipe Bending Machine, Two Door Access Control System, Mix Equipment, Level Control, Compressed Air Network, Water Level Controlling, A Low-Cost PLC Based Automatic Liquid Filling and Sorting System, Modular Automated Testing Unit Sequencing and Controlling, Low Cost PLC Based Automated Sorting And Pressing By Servo-Pneumatic Pressure Control, Automated Multistorey Car Parking System

There are 3 mixing devices on a processing line A,B,C. After the process begin mixer-A is to start after 7 seconds elapse, next mixer-B is to start 3.6 second after A. Mixer-C is to start 5 seconds after B. All then remain ON until a master enable switch is turned off. Write PLC ladder diagram, timing diagram and realize the same

An indicating light is to go ON when a count reaches 23.The light is then go off when a count of 31 is reached. Design, construct, and test PLC circuits for this process

In certain process control application when the count reaches 25, a paint spray is to run for 40 seconds. Design, construct and test PLC circuits for this process

Three conveyors feed a main conveyor. The count from each feeder conveyor is fed into an input register in the PLC. Construct a PLC program to obtain the total count of parts on the main conveyor. Use a time to update the total every 15 seconds. Design, construct, and test PLC circuits for this process

In certain process control application o/p is ON if the count is less than 34 or more than 41. Implement the same using PLC ladder diagram

A conveyor is supposed to have exactly 45 parts on it. You have three indicating lights to indicate the conveyor count status: less than 45, yellow: exactly 45, green: and more than 45, red. The count of parts on the conveyor is set at 45 each morning by an actual count of parts. There are two sensors on the conveyor, one is actuated by parts entering the conveyor, and the other is actuated by parts leaving. Design a PLC program to carry out this process.

Theory / Lecture Hours: 65

Practical / Tutorial Hours: 105

Module II

Basic and electrohydraulics

What is Fluid power: Advantages of Fluid power, What is Hydraulics? Definition of industrial Hydraulics, Hydrostatics and Hydrodynamics, Applications of Hydrostatics and Hydrodynamics, Characteristics of Industrial Hydraulics like advantages and its limitations, Comparisons of Drives (Hydraulics Vs Pneumatics, Electrical/Electronics & Mechanical, Applications of Hydraulics.

Force pressure and weight, Pascal's Law, Calculations : Pascal's Law, Application of Pascal's Law, Force Multiplication, Pressure Multiplication, Displacement transmission, Calculations, Units of pressure., What does 1bar mean? Absolute and relative pressure, What is flow rate? Flow law, Calculation, Open, Types of flow :

Laminar and turbulent flow, Reynolds's number, Throttling, Graphical Symbols and Circuit Diagrams ISO 1219, Purpose of graphical symbols, Function of symbols, Basic elements, Circuit diagram Commonly used symbols, Circuit symbols., Symbols for energy supply and processing unit (Power Pack), Symbols for Hydraulics energy control units (Pressure, Flow and Direction), Symbols for Energy conversion units (Actuators), Symbols for accessories, Demonstration of Hydraulics circuits, Hydraulic circuit with manual DCV and a cylinder, Hydraulic circuit with manual DCV and a Hydraulic motor, Hydraulic circuit with solenoid DCV and cylinder and a motor, Demonstration of speed and direction changes in Hydraulic circuit, Hydraulic Fluids, Main functions of Hydraulic fluids, Functions, Capacity and Constructions of Tanks, Calculation, Requirements of Hydraulic fluids, Types of Hydraulic Fluids, Viscosity of Hydraulic fluid, Relation between temperature and viscosity, Selection of Hydraulic fluid for an applications, Compressibility of Hydraulic fluids, Thermal expansion of Hydraulic fluids, Fluid Analysis, Hydraulic Pumps, Functions and Operating principle Hydraulic pumps, Differentiate b/w positive and non – positive displacement pumps, Characteristics of standard Hydraulic pumps, Construction and Operating principle following pumps, i. External and internal gear pumps, ii. Vane pumps, iii. Axial piston pumps, iv. Radial piston pumps, Selection criteria of pumps, Flow rate and pump power, Efficiency, Hydraulic Cylinder, Operating Principle, Components of a Hydraulic cylinder, Functions of Hydraulic cylinder, Design and operation, Types of cylinder, Types of design, i. Tie rod cylinders, ii. Mill type cylinders, Technical specification, End positioning cushioning, Cylinder mounting, Hydraulic Motors, Functions of Hydraulic Motors, Characteristics of standard Hydraulic Motors, Selection of Hydraulic motors, Calculations, Efficiency, Pressure Control Valves, Introduction, Function and operating principle of pressure relief valve, direct operated, Pressure relief valve in series and parallel, Pressure relief valve, pilot operated, Function and operating principle of pressure reducing valve, Pressure sequence valve, direct operated, Directional Control Valve, Operation and Function, Special characteristics, Types of directional control valves, Spool design, Poppet design, Types of actuation of spools with symbols, Directional spool valves, direct operated, Directional spool valves, pilot operated, Designation of Directional control valves, Operation of solenoid, Solenoid operated valves and its symbols, Standard spool valve : G spool, E spool, J spool and H spool, Comparison of spool Vs poppet valves, Flow Control Valves, Functions, Throttle valves, Viscosity dependent throttle valves, Types of mounting, Throttle valve independent of viscosity, Flow control valves, 2-way flow control valves, Upstream pressure compensator, Downstream pressure compensator, Applications of 2-way flow control valve, Meter-in flow control, Meter-out flow control, Check Valves, Operation and function of a simple check valve, Check valve, pilot operated, Double pilot operated check valve, Applications of check valves,

Hydraulic Accumulator and its Applications, Functions, Energy storage, Types of Accumulator, Safety regulations, Application of accumulators, Filtration and Filtration Technology, Causes of contamination, Classifications of filters, Suction filter, Pressure line filter, Return line filter, Bypass filter, Filter with clogging indicator, Basic Principles of Electro-Hydraulics, Basics : Electric current, voltage, resistance and power, Basic electric circuits : series and parallel, Measurement of current and voltage, Electro-hydraulic valves, Solenoids, Classifications of solenoids, Function and operating principle of a relay, Relay as a logical switch, Relay Logic Diagram : control and main circuit, Symbols of most important switching elements (NO an NC), Signal storage

concept, Electrical interlocking concept, Momentary-contact limit switches, Categories of limit switches, Pressure switches, Graphical symbols to DIN electrical engineering and electronics.

Proportional Hydraulics: Control Engineering, Open loop control, Closed loop control, Ohms Law, Introduction to Proportional Technology, Why proportional valves, Definition of Proportional valve, Components of proportional technology, Possible functions of proportional valve, Solenoids, Construction, Characteristics, Difference between conventional and proportional solenoid, Types of proportional solenoid, Force controlled solenoid, Stroke controlled solenoid.

LVDT, Construction, Working principle, Proportional Terminology, Hysterisis, Pressure Differential, Reversal Error, Response Sensitivity, Reliability, Control range / Resolution, Control Spool, Construction, Geometry of metering notches, Spool overlap, Positive overlap, Negative overlap, Zero overlap, Amplifiers, Types of amplifiers, Functions of amplifiers, Enable, Internal command value, Zero adjustment, Gain adjustment, Biasing current, Dither current, Differential input, cable break detection, Ramp generator, Pulsed output stage, Step generator, Inverter, Summator, Call up command, 4 Quadrant Ramps, Overview of industrial hydraulics, Flow curve characteristics, Pressure curve characteristics, Time spool characteristics, Frequency response, Amplitude response, Bode plot, Proportional direction control valves, Direct operated proportional direction control valve, Construction, Working principle, Characteristics, Pilot operated direction control valve, Construction, Working principle, Characteristics, Proportional pressure control valves, Direct operated proportional pressure relief valve, Construction, Working principle, Characteristics, Pilot operated proportional pressure relief valve, Construction, Working principle, Characteristics, Direct operated proportional pressure reducing valve, Construction, Working principle, Characteristics, Pilot operated proportional pressure reducing valve, Construction, Working principle, Characteristics, Proportional Flow control valve, Direct operated proportional flow control valve, Construction, Working principle, Characteristics, Pilot operated proportional flow control valve, Construction, Working principle, Characteristics, Application of Proportional valves, Introduction to control system, Advantages of Open loop and Closed loop control System, Terminologies, Control response, Non-continuous action controllers, continuous action controllers, Control range / Resolution, Practical Implementation, Static data, Dynamic data, Components of closed loop technology,

Project: Hydraulic pump, characteristic Curve, Single-rod cylinder, pressure intensification, Single-rod cylinder, flow, Hydraulic motor, 4/3 directional valve, Check valve, Check valve, pilot operated, Throttle valve, adjustable, Throttle check valve, Flow control valve, Pressure relief valve, direct operated, controls, Pressure reducing valve, Pressure switch, hydraulic accumulator, Regenerative circuit, Rapid speed/creep speed control, Extending a cylinder by operating a push button, Signal storage by electrical self-locking, setting and resetting using a momentary-contact switch, Mechanical locking by means of momentary-contact switch contacts, Electrical locking by means of contactor contacts, Signal storage by means of contactor contacts, Rapid advance circuit, Pressure-dependent reversing, Pressure switches and proximity switches, Advance control with time-dependent intermediate stop, Pressure-dependent sequence control, Sequencing Hydraulic

actuators. Moving a cylinder with the help of an external potentiometer for the provision of a command value. Traversing a cylinder with command value module SWMA1 as command value source. Adjusting command value module SWMA1 with 4 command values. Adjusting command value module SWMA1 with 4 command values and ramps, Adjusting a braking distance following a proximity switch signal. Pressures of the proportional valve and their influence on velocity and braking distance. Adjusting a motion sequence with 4-quadrant ramps, Adjusting a sequence with 2 proximity switches, Three different speeds in single stroke using proximity switches. Adjustment of an automatic sequence with 3 proximity switches. Setting position with 4/3 directional valve. Setting position with proportional servo valve. Position control

Theory / Lecture Hours: 65

Practical / Tutorial Hours: 105

Module III

Basic & Electro Pneumatics

Fluid power, Advantages, Pneumatics, Definition, Characteristics of Industrial Pneumatics, advantages and its limitations, Comparisons of Drives - Pneumatics Vs Hydraulics, Electrical/Electronics & Mechanical, Applications of Pneumatics, Compressed Air Generation and Contamination Control, Compressed Air for transmitting power, Composition of Atmospheric Air, force, weight, pressure, Pascal's Law, Application of Pascal's Law, Force Multiplication, Pressure Multiplication, Displacement transmission, Calculations, Gas Laws, Air compression process, Absolute and relative pressure. Flow rate, Characteristics of compressed air, Graphical Symbols and Circuit Diagrams ISO 1219, Purpose of graphical symbols, Function of symbols, Basic elements, Circuit diagram, Commonly used symbols, Circuit symbols., Symbols for Maintenance unit, Symbols for Pneumatic energy control units (Pressure, Flow and Direction), Symbols for Energy conversion units (Actuators), Symbols for accessories, Demonstration of Pneumatic circuits, Pneumatic circuit with manual DCV and a cylinder, Pneumatic circuit with solenoid DCV and cylinder and a motor, Demonstration of speed and direction changes in Pneumatic circuit, Compressed Air Generation and Contamination Control, A typical Pneumatic system, Air compressors, Classification of Compressors, Terms and Definition : Delivery volume, Pressure, Drive , Cooling and Regulation, Piston Compressor, Screw Compressor, Vane Compressor, Compressor unit, Preparation of compressed Air, Stages of Preparation, Drying of Compressed Air, Distribution of Compressed Air, Pneumatic Actuators, Introduction, Basic Actuator Functioning, Thrust, Cylinder Air Consumption, Cylinder speed and its relation to flow rate, Stroke Length, Piston –rod buckling, Classification of Pneumatic Actuators, Linear Actuators, Single-Acting cylinder, Double-Acting cylinder, Cylinder cushioning, Classification of cylinders According to Duty, Cylinder with Magnetic Piston, Cylinder with Non-Rotational Guiding, Rodless Cylinder, Tandem Cylinder, Rotary Actuator, Semi-Rotary Actuators, Pneumatic Valves and Control Circuits, Introduction, Classification of valves, Functional Classification of Valves, i. Directional control valves, ii. Pressure control valves, iii. Flow control valves, iv. Non return valves, Graphical Representation, Port

Markings, Ports and Positions, Graphical symbols for DC valves, Methods of DC Valve Actuations, 3/2-Directional Control valve, i. NC-type 3/2-DC valves, ii. NO-type 3/2-DC valves, Non-Return Valves, Flow control valves, Throttle valve and Throttle check valves, Pneumatically Actuated 3/2-DC valve, Manually actuated 5/2-DC valve, Pneumatically actuated 5/2-DC valve, Speed control of Double-Acting Cylinder, 5/2-DC Double-Pilot valve, Login Controls, Pneumatic, i. Shuttle valve, ii. Twin pressure valve, iii. Applications of Logic valves, Structure of Pneumatic Circuits, Automatic Control, Roller valve, Quick-Exhaust vavle, Time-Delay valves, Pressure Control Valves, Introduction, Function and operating principle of pressure relief valve, direct operated Pressure regulator.

Multiple-Actuator Circuits, Introduction, Representation of a Control Task, i. Text form, ii. Positional Layout, iii. Notational form, iv. Displacement –step diagram, v. Displacement-time diagram, Sequence Control, Circuit design for the sequence of two cylinder and three cylinders, Elimination of signal overlaps, Electro-Pneumatics, Introduction, Integration of Technologies, Solenoid valves, DC solenoids Vs AC Solenoids, 3/2-Way single solenoid valve, Spring return, 5/2-Way single solenoid valve, Spring return, 5/2-Way double solenoid valve, Control devices, Switch and Push button, Terminal Markings, Relay, Logic Controls, Electric, Memory function, Operation of the 'Dominant OFF' Circuit, Operation of the 'Dominant ON' Circuit, Electronic sensors, Limit switch, Reed switch, Proximity Sensors, Time-Delay Relays, Two-hand safety operation, Pressure switch, Electro-Pneumatic Multiple-Actuator Circuits, Pneumatic Application Concepts, Introduction, Selection and Optimization Criteria, i. Type of motion, ii. Stroke and stroke control, iii. Force, iv. Speed and speed control,

Design of Pneumatics systems, Selection of Pneumatic Actuators, Selection of Pneumatic Valves, Maintenance, Troubleshooting, and Safety, Introduction, Requirements of Preventive Maintenance, Definitions of Maintenance Activities, Preventive Maintenance of Pneumatic Systems (General Procedure), System Malfunctions, i. Malfunctions due to contaminants, ii. Malfunctions due to improper mountings, iii. Malfunctions due to inadequate air supply, iv. Malfunctions due to under-lubrication/over lubrication, Maintenance Tips, i. Maintenance of compressor, ii. Maintenance of air receivers, iii. Maintenance of air-mains, iv. Maintenance of air service units (FRL), v. Maintenance of Pneumatic cylinder, vi. Maintenance of Pneumatic valves, Troubleshooting, i. General troubleshooting procedure, ii. Faults in Pneumatic systems, General Malfunctions, i. Malfunction in pneumatic cylinder, ii. Malfunction in Pneumatic valves, iii. Malfunctions in limit switches and reed switches, Safety in Pneumatic Systems, i. Safety hazards, ii. General safety measures.

Project: Direct control of a single-acting cylinder, extending, Direct control of a single-acting cylinder, retracting, Indirect control of a single-acting cylinder, Regulating the speed of a single-acting cylinder, Slow-speed extension, rapid retraction of a single-acting cylinder, Direct control of a double-acting cylinder with push-button, Indirect control of a double-acting cylinder, Speed regulation of a double-acting cylinder, Controlling a double-acting cylinder, impulse valve, 2 push-buttons, Displacement-dependent control of a double-acting cylinder, impulse, Controlling a double-acting cylinder, impulse valve, 2 reflex nozzles, Stop

control, double-acting cylinder, 5/3 directional control valve, tensile load, Pressure-dependent control of 1 double-acting cylinder, Time-dependent control of 1 double-acting cylinder, Logical control with shuttle and twin-pressure valves, Sequential control 2 double-acting cylinders w/o overlapping signals, Seq. control 2 double-act. cylinders, signal overlapping, idle return rollers, Pilot control of a single-acting cylinder with spring return valve, Pilot control of a double-acting cylinder with spring return valve, Holding-element control of a double-acting cylinder with impulse valve, directly controlled, Holding-element control of a double-acting cylinder with impulse valve, relay, Basic circuit with AND Function, Basic circuit with OR Function. Basic circuit with electric latching circuits, Displacement-dependent control of a double-acting cylinder with 1 electric limit switch, Displacement-dependent control of a double acting cylinder, impulse valve, cylinder switch, Displacement-dependent control of a double-acting cylinder with spring return valve, cylinder switch, Stop control of a double-acting cylinder with a 5/3 directional control valve in closed mid-position, Time-dependent control of a double-acting cylinder with switch-on time delay, Time-dependent control of a double-acting cylinder with switch-off time delay, Pressure-dependent control of a double-acting cylinder, Two-hand safety control, electric, Sequential control of 2 double-acting cylinders with impulse valve, Sequential control of 2 double-acting cylinders with impulse valves and signal overlapping, Sequential control of 2 double-acting cylinders with spring return valves and step sequence, Sequential control of 3 double-acting cylinders with impulse valves and step sequence, Sequential control of 3 double-acting cylinders with spring return valves and step sequence, Multiple actuator sequence, Two cylinder sequence, Three cylinder sequence.

Proportional & Closed loop: Introduction to closed loop technology in Pneumatics, Applications, Electropneumatic

Theory / Lecture Hours: 70

Practical / Tutorial Hours: 105

Total Course Theory / Lecture Hours: 205

Total Course Practical / Tutorial Hours: 315

Total Hours: 520

Recommended Hardware:

State of the art Training Lab for Hydraulics, Pneumatics, Sensoric , PLC and Robotics

Recommended Software:	Automation studio, web trainers, Indraworks and indralogic

Text Books:

- Proportional and Servo Valve Technology (Bosch Rexroth AG) Volume 2
- The Pneumatic Trainer – Basic Pneumatics Volume 1 & 2 (Bosch Rexroth AG)
- Sensors in Theory and Practice – Textbook (Bosch Rexroth AG)
- Basics of Indraworks and Indralogic (Bosch Rexroth AG)
- Mechatronics Theory (Bosch Rexroth AG)

Reference Books:

- Andrew Parr, Hydraulics and Pneumatics, Butterworth – Heineamann
- Andrew Parr, Industrial drives, Butterworth – Heineamann
- S.R. Majumdar - Pnematic Systems, TMH.1995
- G.K.Dubey.Fundamentals of electrical drives
- Programmable Logic Controllers by W.Bolton
- Mechatronics - W. Bolton, Pearson Edition
- Herbert R. Merritt, Hydraulic control systems, John Wiley & Sons, Newyork, 1967
- Dudbey.A.Peace, Basic Fluid Power, Prentice Hall Inc, 1967
- R.Srinivasan Hydraulic and Pneumatic Control published by Vijay Nicole Imprints Private Ltd.
- Servo Pneumatics D.Scholz.A.Zimmermann
- Peter Rohner, Fluid Power logic circuit design. The Macmillan Press Ltd., London, 1979
- Peter Rohner, Fluid Power Logic Circuit Design, Mcmelan Prem, 1994
- Introduction to Programmable Logic Controllers by Garry Dunning, 2ndedition, Thomson, ISBN:981-240-625-5
- Instrumentation Engineers Hand Book - Process Control, Bela G Liptak, Chilton book company, Pennsylvania
- A.E. Fitzerald ,C.Kingsley and S.D Umans, Electric Machinery - Mc Graw Hill Int. Student edition
- S.K.Pillai. A First course on electric drives –Wiley Eastern 1990
- Programmable Logic Controllers by Hugh Jack
- Mechatronics - Mahalik, TMH
- Mechatronics - HMT, TMH

ESDM Courses

Level Code:	L2	**Vertical Name:**	Telecom Electronic
Course Code:	TL/M/L2/C008	**Course Name:**	3.6.1 Telecom Test Technician (TSSC)

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 hours)	200 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	24 Hours

	○ Wi-Fi, ZigBee - Digital and AnalogTelecomm Electronics	
4	Process - Safety Awareness - Maintenance Awareness - Production and process - Quality Control Practices & Measurements - Definition of test criteria - Workplace essentials	10 Hours
5	Failure analysis ○ Failure Analysis Methods ○ Common Failure Analysis Techniques ○ Implementing FMEA ○ FMEA Procedure ○ Fault Tree Analysis (FTA) ○ Identifying TO events ○ 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	15 Hours

	- 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	

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

7	RF
	- Introduction to RF Fundamentals
	- 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
		30 Hours

	○ Spectrum Analyzers ○ Signal Generators ○ Power Meters ○ Oscilloscopes ○ Function and Arbitrary Waveform Generators ○ Spread spectrum systems – DSSS / FHSS / Frequency Agility - RF Toolkits ○ LTE & NLOS Environment ○ Timing and Synchronization for LTE Networks ○ Test Execution and Data Management ○ Trigger Synchronization and Phase Alignment ○ Advanced RF Calibration Using Power Meter ○ Applications for Cellular Test ○ Testing methods	
	Maintain Telecom Test Equipment - Care and maintenance - Failure Reporting ○ Collecting data ○ Reporting Equipment Failure ○ Reporting Software Problems ○ Logging Data - Analysis	6 Hours

	○ Failure Analysis ○ Failure review ○ Failed Equipment Procurement - Cleaning, disinfection and sterilization - Disposal of waste	
8	Communication skills ○ Level of communication ○ Total communication process ○ Barriers in communication ○ Basic reasons we Do Not Listen ○ Level of listening ○ Improve listening skills ○ Body Language and types ○ Most common way to communicate	12 Hours
7	- SMT, TELECOM PCBs ○ TELECOM PCB Basics and Surface Finishes like HASL and ENIG ○ Surface Finishes OSP, Immersion Tin, Immersion Silver ○ Paste, stencils, printing and how they are interrelated ○ Types of TELECOM PCB ○ SMT Materials Component Placement ○ SMT Components Reflow Soldering ○ Line Balancing (Downtime, line design) ○ Component placement with a focus on equipment	10 Hours

	○ Performance calculations for pick and place machines ○ Reflow soldering, component damage, profile shapes, vapor phase, and oven calculations ○ Wave soldering, selective soldering, and dispensing ○ Testing, defects, and inspection	
8	ESD ○ Introduction ○ Basics of ESD controls ○ Sevens Sins of ESD Control ○ Static Electricity ○ ESD Mathematics ○ Static Charge Generation ○ Triboelectric Series Chart ○ Discharge Times ○ IC upsets from ESD EMI ○ Storage and Handling ○ Humidity and ESD Control ○ Ray's ESD Prevention Secrets ○ ESD Protection	20 Hours
	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
Reference Books:	www.daytonastate.edu/cbi/files/Certified%20Production%20Technician%20Flyer.pdf 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** **EL/M/L3/C037**	**Course Name:**	3.6.2 Board Bring Up Engineer (TSSC/ESSCI)

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	50

	• Antenna Topologies • Basic introduction to MCU Testing	
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

Recommended Hardware:	**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 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** **EL/M/L4/C038**	**Course Name:**	3.6.3 Telecom Embedded Hardware Developer (TSSC/ESSCI)

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**

ESDM Courses

Level Code:	L4	**Vertical Name:**	Telecom Manufacturing
Course Code:	TL/M/L4/C013	**Course Name:**	3.7.1 Electrical Testing of Telecom Assemblies (TSSC)

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 Methods, Data & Fixture Preparation, Combined Testing Methods	10	35
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	40

	• 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	
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 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
		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 EL/M/L4/C040	**Course Name:**	3.7.2 IPC (Institute of Printed Circuits) Acceptability Criteria of Telecom PCB (Printed Circuit Boards)Assemblies (TSSC/ESSCI)

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** Gold Surface Contact Area, Laminate conditions, Conductors / Lands, Flexible	16

	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 • 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
13	**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
14	**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	30

	• 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 EL/M/L4/C041	**Course Name:**	3.7.3 SMT (Surface Mount Technology) Process for Telecom Boards (TSSC/ESSCI)

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 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 of chip components. Marking of chip of components.	10	35
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 followed by the company.	8	17
	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	30	

	• 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	
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 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
7	**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	
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 EL/M/L4/C042	**Course Name:**	3.7.4 Soldering of Telecom Board Assemblies (TSSC/ESSCI)

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	15	45

	control common soldering defects observed during reflow soldering.		
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 • 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	
	Safety, Reporting and Documentation • Ensure appropriate disposal of the cut fibers, sleeves and	40	

	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	
	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 • 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	

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 EL/M/L4/C043	**Course Name:**	3.7.5 Telecom Quality Technician (TSSC/ESSCI)

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	ITI / Diploma (Electrical , Electronics, 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 • Risk- sustainability	5 Hrs
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	30 Hours

	• Introduction to reflow soldering, wave soldering	
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 • Fire Safety Smoke detector and fire alarm Threats to fire safety • Classification of fire • Types of fire extinguishers	30 hrs

	• 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 coordinate with third party vendors, supervisor and peers filling technical forms, activity logs in required format	50 hrs

	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

Level Code:	L5	**Vertical Name:**	Telecom Manufacturing
Course Code:	TL/M/L5/C039	**Course Name:**	3.7.6 Line Repair Technician (TSSC)

Objective of the Course:

1. The course is designed for trainees to upgrade and take up key roles of Quality Inspector and supervisor role of a specific manufacturing line.
2. Focus on work-readiness skills.

Learning Outcomes:

At the end of the course the trainee should have

1. PCB Rework, SOP & Work Instructions
2. Knowledge of various Functional tests in mobile phones
3. Identification, categorisation and analysis of faults
4. Basic understanding of Manufacturing processes
5. Basic knowledge of Quality Standards
6. Good knowledge of manufacturing processes
7. Basic knowledge of Inventory management
8. Knowledge of First Aid and handling of emergency situations
9. Good Communication
10. Health and Safety

Expected Job Roles:

1. Quality Inspector
2. Line Supervisor

Duration of the Course (in hours)	630 hr

Minimum Eligibility Criteria and pre-requisites, if any	12th Pass and Certified in Line Assembler L4 course.

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1	PCB Rework, SOP & Work Instructions	60
2	Introduction to MS Office for computing	10
3	Introduction of communication system	20
4	Basic of Mobile Communication	20
5	Introduction to Smartphone and Applications	40
6	Various functional tests in mobile phones	35
7	Basic understanding of manufacturing process	12
8	Categorisation and Analysis of Faults	30
9	Communication Skill – Soft Skills	10
10	Health & Safety	15
	Total Theory / Lecture Hours:	252
	Total Practical (Shop Floor Training) / Tutorial Hours:	378
	Total Hours:	630

Recommended Hardware:	PCB Board, Tools required for repairing handset on shop floor, Soldering kit, SMD component

Recommended Software:	
Text Books:	Content attached
Reference Books:	

Level Code:	L4	**Vertical Name:**	Telecom Manufacturing
Course Code:	TL/M/L4/C040	**Course Name:**	3.7.7 Line Assembler (TSSC)

Objective of the Course:

1. This course is designed to train the student in effectively taking up roles at the Manufacturing assembly line with special focus on Mobile manufacturing and repairing of mobile phones on manufacturing line.
2. Focus on work-readiness skills.

Learning Outcomes:

At the end of the course the student should be able to

1. Understand Basic Concepts of Electricity
2. Identify Components and Tools
3. Understand SOP & Work Instructions
4. Understand Basic Concepts of Electronics
5. Understand Basics of Mobile Communication
6. Solder & Desolder basic components
7. Solder & Desolder SMD components
8. Importance and usage of ESD Clothing
9. Assemble & Disassemble Mobile phones
10. Have knowledge of troubleshooting steps
11. Rework on the PCB
12. Knowledge of Basic English
13. Know Basics of Communication

Expected Job Roles:

1. Line Assembler in mobile Manufacturing Unit

Duration of the Course (in hours)	630 hr.
Minimum Eligibility Criteria and pre-requisites, if any	12th Pass

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1.1	Basic Electricity, Cells & Batteries	30
1.2	Identification of Components, Tools, SOP & Work Instructions	20
1.3	Soldering & De soldering of Basic and SMD Components	30
1.4	ESD clothing, Assemble modules to complete product, Factory Rules & Clean Room Environment	40
1.5	Basic Electronics	30
1.8	Desoldering and re-soldering of surface-mounted electronic components (SMD)	40
1.9	English I & II	20
2.0	Communication Skills I & II	20
2.1	Health and Safety	20
	Total Theory / Lecture Hours:	250
	Total Practical (Shop Floor Training) / Tutorial Hours:	380
	Total Hours:	630

Recommended Hardware:	PCB Board, Tools required for repairing handset on shop floor, Soldering kit, SMD components
Recommended Software:	
Text Books:	Contents attached.
Reference Books:	

ESDM Courses

Level Code:	L4	**Vertical Name:**	LED Lighting

Course Code:	EL/M/L4/C016	**Course Name:**	3.8.1 LED Mechanical Assembly Operator (ESSCI)

Objective of the Course:

Mechanical Assembly Operator: The Mechanical Assembly Operator assembles all parts of LED luminary to complete the product.

Brief Job Description: The individual at work fits together different electronic, electrical and mechanical parts and connects them to make the final LED luminary as per product design.

Personal Attributes: The job requires the individual to have: attention to details, safety and hazards orientation, willingness to wear protective gears and the stamina for long hours of work.

Learning Outcomes:

NOS # ELE/9201Assemble LED Luminary

1. Complete base assembly
2. Complete heat sink assembly
3. Join base assembly with heat sink assembly
4. Fix glass shell and pack the final product
5. Achieve productivity and quality of standards
6.

NOS # ELE/N9919Work with superiors and colleagues

1. Interact with supervisor or superior
2. Coordinate with colleagues

ELE/N9921- Follow safety standards

1. Understand potential sources of accidents
2. Use safety gear to avoid accidents
3. Understand the safety procedures followed by the company

Entrepreneurship

Expected Job Roles:

LED Mechanical Assembly Operator

Duration of the Course (in hours)	350 hours
Minimum Eligibility Criteria and pre-requisites, if any	10^{th} + ITI, 12^{th} Pass, Other non-Science graduates

Professional Knowledge:

NOS # ELE/9201 Assemble LED Luminary

KA1. company's policies on: incentives, delivery standards and personnel management
KA2. company's standard operating procedures and processes related to product assembly
KA3. importance of the individual's role in the workflow
KA4. reporting structure
KA5. safety and quality standards followed in the organization

KB1. the operation and significance of various electronic, electrical and mechanical components of LED luminary
KB2. product designing basics and significance of optics
KB3. how to handle LEDs and PCBs during assembly and packaging
KB4. IP rating and CREE standards

KB5. special ESD and work safety precautions to be taken during assembling
KB6. 5S standards (sorting, setting, standardise, sustain, shining)

NOS # ELE/N9919 Work with superiors and colleagues

KA1. company's policies on: incentives, delivery standards, and personnel management
KA2. work flow involved in company's process
KA3. importance of the individual's role in the workflow
KA4. reporting structure

KB1. how to communicate effectively
KB2. how to build team coordination

NOS # ELE/N9921 - Follow safety standards

KA1. company's policies on handling: harmful chemicals and sharp tools, safety and hazards of machines, fire safety/drill, first aid and, disposal of harmful chemicals and materials, quality standards
KA2. company occupational safety and health policy followed
KA3. company emergency evacuation procedure
KA4. company's medical policy

KB1. how to maintain the work area safe and secure
KB2. how to handle hazardous material
KB3. how to follow safety procedures while operating hazardous tools and equipment
KB4. emergency procedures to be followed such as fire accidents and fire safety education
KB5. how to use machines and tools without causing bodily harm
KB6. first aid execution
KB7. disposal of hazardous chemicals, tools and materials by following prescribed environmental norms or as per company policy

Professional Skill:

i. **Planning**
ii. **Using tools**
iii. Problem solving
iv. **Reflective thinking**
v. Critical Thinking
vi. **Decision Making**
vii. **Handling Safety Equipment**

Core Skill:

1. **Reading and Writing Skills**
2. **Team work**
3. **Communication skills**
4. **Multitasking**

Detailed Syllabus of Course

Module. No	**Module. Name**	**Minimum No. of Hours**
	Assemble LED Luminary	
	Work with superiors and colleagues	
	Follow safety standards	
	Total Theory / Lecture Hours:	150
	Total Practical / Tutorial Hours:	200
	Total Hours:	350

Recommended Hardware:	
Recommended Software:	NA
Text Books:	NA
Reference Books:	NA

ESDM Courses

Level Code:	L4	**Vertical Name:**	LED & Photovoltaic
Course Code:	EL/M/L4/C018	**Course Name:**	3.8.2 Certificate Course in LED Light Mechanical Assembly (ESSCI)

Objective of the Course:

To train & teach individuals how to assemble different electronics, electrical and mechanical parts and connect them to make the final LED luminary to complete the product.

Learning Outcomes:

After completing the training, one will be able to complete the heat sink assembly, complete base assembly, join base assembly with heat sink assembly, fix glass shell and pack final product as per LED Assembly quality standard.

Expected Job Roles:

LED Light Mechanical Assembly Operator

Duration of the Course (in hours)	350 Hrs
Minimum Eligibility Criteria and pre-requisites, if any	12th Pass

Professional Knowledge:

1. The operation and significance of various electronic, electrical and mechanical components of LED luminary.
2. LED product design basics and significance of optics.
3. LED Technical Basics, array configuration, thermal management,
4. How to handle LEDs and PCBs during assembly and packaging.
5. Ingress protection rating requirement for different LED Lighting products.
6. Special ESD and work safety precautions to be taken during assembling.
7. 5S standards (Sorting, setting, shining, standardise, sustain).
8. LED Driver selection
9. Safety and environmental norms to be followed

Professional Skills:

1. To plan for receiving the material for assembly, keeping them at work station to assemble luminaries in minimum possible time.
2. To operate screw driver, allen key set, wire stripper, soldering station, potting machine, press, weighting machine.
3. To use magnifying lens for visual inspection.
4. To use tools necessary for packaging of LED luminaries.
5. To use multimeter, DC power source, power analyser.
6. Ability to understand standard operating procedures and processes related to product assembly.
7. To identify defects in input raw materials.
8. To spot process disruptions and delays in processes
9. Ability to improve work processes
10. To troubleshoot and reduce machine down time

Core Skills:

0. Able to read company's SOP and work instructions.
1. Able to maintain day to day operational records as per company policy.
2. To maintain pace of the throughput as per production requirement.
3. To effectively communicate with supervisor about work requirements.
4. To be able to write reports in log books.

5. To co-ordinate with other team members in order to collect inputs and deliver output to the next process
6. To share knowledge with team members for smooth work flow.
7. To work as a team to meet the daily target of LED luminary assembly.

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1	Awareness electronics components, pick & place process, reflow soldering, wave soldering and manual soldering. LED Basics: CCT, CRI, Operating voltage & Current, Thermal Management, Array configuration.	36 Hours
2	All the aspects related to LED Luminary assembly. LED Driver Selection	72 Hours
3	Importance of thermal simulation and introduction to thermal simulation software. ESD prevention with respect to LED and LED product safety. Importance of 5S on productivity & Management	21 Hours
4	Importance of better communication, co-ordination and maintaining good relationship among co-workers. Understand Safety procedure followed by the company & preventive measures taken to prevent accidents.	21 Hours
5	Internship / Practical	100 Hrs
	Total	250 Hrs

Total Course Theory / Lecture Hours: 65

Total Course Practical / Tutorial Hours: 185

Total Course Hours: 250

(Training in 100 hrs of Communicative English and 80 hrs of Basic IT Skills also provided, as required)

Recommended Hardware:	Assembly Equipments, tools and test equipment required for LED Light Mechanical Assembly
Recommended Software:	Nil
Text Books:	Students and Faculty Guides prepared by ASAP in association with the Training Service Providers and industries.
Reference Books:	
Evaluation criteria:	**Training is Provided by Sahasra Sambhav Pvt. LTD Noida.** **Assessment and Evaluation by ESSCI**

ESDM Courses

Level Code:	L5	**Vertical Name:**	Embedded Systems & VLSI
Course ID:	**NL/M/L5/C016** **TL/M/L5/C037** **EL/M/L5/C029**	**Course Name:**	3.9.1 Embedded system Design using 8-bit Microcontrollers (NIELIT/TSSC/ESSCI)

Objective of the Course:

To train students on programming of microcontroller, Interfacing of external peripherals to microcontroller and troubleshooting of microcontroller based Embedded electronic systems/products.

Learning Outcomes :

Participant shall learn

- Architecture of 8051 Microcontroller
- Programming of 8051 microcontroller
- Peripheral interfacing to 8051 microcontroller
- Trouble shooting 8051 microcontroller based systems
- Architecture of PIC Microcontroller
- Programming of PIC microcontroller
- Peripheral interfacing to PIC microcontroller
- Trouble shooting PIC microcontroller based systems

Expected Job Roles:

1. Microcontroller Technician - Trouble shooting of Microcontroller based electronic systems/products
2. Entrepreneur - Development of small electronic gadgets based on Microcontroller

Duration of the Course (in hours)	400 hrs
Minimum Eligibility Criteria and pre-requisites, if any	Diploma

Professional Knowledge:

The participant shall know and understand

- Development of embedded systems with 8051 and PIC Microcontrollers
- Electronic System Design with 8051 Microcontrollers
- Electronic System Design with PIC Microcontrollers
- Embedded Coding with 8051 Microcontrollers
- Embedded Coding with PIC Microcontrollers

Professional Skill:

Reading and writing skills

- How to read and comprehend the data sheet of various 8051 and PIC based Microcontrollers
- To document the completed work
- To read the standard operating procedures for different types of Microcontroller based Electronic systems

Tool Usage

- To work with Embedded Systems Tools such as compiler, assembler, linker and debugger

Core Skill:

- Trouble shooting of Microcontroller based electronic systems/products
- Development of small electronic gadgets based on Microcontroller

Detailed Syllabus of Course

Module No	Module Name	No. of Hours
		Theory / Practical
1.	Embedded C with 8051 - Theory • Introduction to 'C' programming • Embedded C Programming with KEIL	15 /25
2.	8051 Architecture - Theory • Architecture of 8051 Family of Microcontrollers	10/0
3.	8051 Peripherals - Theory • Timers • Interrupts • Serial Port	15/60
4.	Interfacing 8051 to peripheral devices –Theory • LCD • Key board • Stepper Motor	15/60
5.	Embedded C with PIC – Theory • Embedded C Programming with MPLab	15/25
6.	PIC Architecture – Theory • Architecture of PIC Microcontrollers	10/0

7.	PIC Peripherals - Theory • Timers • Interrupts • ADC • Serial Port	15/60
8.	Interfacing PIC to peripheral devices –Theory • LCD • Key board • Stepper Motor	15/60
	Theory / Lecture Hours:	110 hrs
	Practical / Tutorial Hours:	290 hrs
	Total Hours:	400 hrs

Recommended Hardware:

1. 8051 Microcontroller kits
2. PIC Development kit
3. PC
4. Interfacing boards
5. Electronic Components for Mini project as per requirement

Recommended Software:

1. Kiel 'C' or similar Embedded C Compiler for 8051
2. MP Lab with PIC –C Compiler/any other appropriate compiler

Text Books:

1. Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems using Assembly and C", 2nd Edition, Prentice Hall
2. Design with PIC Microcontrollers, Peatman, John B , Pearson Education PTE. Ltd.

Reference Books:

1. Programming and Customizing The 8051 Microcontroller, Predko, Myke, Tata Mgh, New Delhi
2. Programming and Customizing the PIC Microcontroller, Predko, Myke, Tata Mgh, New Delhi

ESDM Courses

Level Code:	L5	**Vertical Name:**	Embedded systems & VLSI
Course ID:	**NL/M/L5/C017** **EL/M/L5/C030**	**Course Name:**	3.9.2 Post Diploma in VLSI Design, Tools and Technology (NIELIT/ESSCI)

Objective of the Course:

To develop skill of handling VLSI Tools for Designing mixed signal circuits, its verifications and to develop concept of VLSI Fabrication Technology, handling of EDA-VLSI Hardware-Software Tools, Custom-Semi Custom Design, FPGA Implementation etc.

Learning Outcomes:

Participants successfully completing this course will:

- Have the ability to design and specify Analog-Digital systems using the System Verilog and SPICE at the structural/RTL/MOS level.
- Have the ability to design and specify analog-digital systems using the CMOS
- Have the ability of Design Verification
- Have ability to design & simulate digital systems described with CMOS-VLSI Design Technology.
- Have the ability to design digital systems using Verilog and Xilinx FPGA.

Expected Job Roles:

To full-fill the need of Industry for skilled and trained manpower to design and verify Analog, Digital & Mixed VLSI Integrated circuits, as a policy of “Ready to Observe Man Power” for VLSI Manufacturing Industry.

Duration of the Course (in hours)	400 Hours
Minimum Eligibility Criteria and pre-requisites, if any	Diploma Holder or BSc. Graduate

Professional Knowledge:

An individual on the job needs to know and understand:

- Company's products product and its production
- To be able to understand designed functional Analog and digital system
- To perform synthesis, place, and route of a Mixed signal design into a target FPGA.
- To display knowledge of good digital design practices in the context of the target hardware.
- To learn advanced VLSI design using EDA Tools
- To introduce a bottom-up and top-down design approaches
- Relevant reference sheets, manuals and documents regarding e-waste
- Relevant tools, hardware's and peripherals required for recycling of e-waste
- Knowledge of Govt. rules and regulations regarding e-waste

Professional Skill:

An individual should have following Professional Skill

- Handling of EDA tools Hardware and Software for development of VLSI Circuitry.
- Handling of prototype and pre-production VLSI product for various electronic system and liaise with supplier for production implementations.
- Able to specify components and equipment required for product development.
- Creation of product specifications, Statement of Work, from customer requirements.
- Support for sales and technical staff.
- Support to areas such as post-design, production & QA.
- Quality standards required for designing good product.

Core Skill:

An individual on the job should have following Core Skill

- Providing support for VLSI Design Group
- Able to give support and advice whenever necessary to all stakeholders involved.
- Over the whole product life cycle, Ensure that the products meet the quality standards

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1	**NTRODUCTION** VLSI Design Flow and Y-Chart, Front-Back End VLSI Design Example, Fully Custom and Semi-Custom VLSI Design Process, VLSI-EDA Hardware-Software tools available, comparisons and their applications, VLSI-EDA Hardware-Software tools used in Industries, Why Verilog, Its Types-Verilog, Verilog-A and System Verilog and Simple Logic Gates Coding, Compilation and Execution in System Verilog, High level Synthesis, RTL Design, Logic Optimization, Verification and Test Planning	25
2	**Programmable Logic Devices (PLDs)** Introduction, PLDs Types-Simple PLDs (SPLDs), Complex PLDs (CPLDs) and Field Programmable Gate Array (FPGA), there Architecture Details and Comparison w.r.t. Logic Blocks (CLBs), Logic Cells, System Gates, I/O Pins, Flip-Flops, Max Internal Frequency, Supply Voltage, Interconnects, Technology Used, SRAM Bits (Block RAM) etc.	35
3	**System Verilog Code Structure and FPGA Implementation** Module Declaration, Lexical Conventions, Data Types, Analog Block Statements, Mathematical Functions and Operators, Analog Operators, Filters and Events, System Verilog Pre-processor, Verilog-FPGA Interfacing and Simulation Techniques, System Task and Input Output Functions, Simple Analog and Mixed System Design Practices.	100
4	**VLSI Technology** Basic MOS Transistor Operations and Electrical Properties, Fabrication Process, Passive Component Fabrication Process, Gyrator Circuit Fabrication for Inductor, Development in Technology and Equipment's for Oxidation, Diffusion, ION Implantation, Etching, Photo-Lithography etc. Moore's Law and Nano-Meter VLSI Technology Comparison,	40
5	**VLSI Design- Part 1** VLSI Design Style, Why CMOS, CMOS Fabrication and Electrical Properties, Dynamic, Clocked, Domino CMOS Logic VLSI Design Style, Pass Transistor Logic, Development in CMOS Design Style, Simple CMOS VLSI Design Examples, Comparison with respect to Speed, Area, Power Dissipation and Cost .	40
6	**SPICE Modelling for VLSI Design-Part 2** SPICE Tutorials and Commands, Sources and Passive Components, CMOS Inverter Transient	100

	Analysis, Level-1, Level-2 and Level-3 Models, BSIM Models, Diffusion Capacitance Models, SPICE Modelling for I-V Characteristics, Threshold Voltage, Gate Capacitance, Parasitic Capacitance, Effective Resistance, path Simulation, DC Transfer Characteristics, Logical efforts, Power and Energy Calculation, Monte Carlo Simulation, Simple Design Examples.	
7	**File Interchange Format for VLSI Design** Need for File Inter Change, GDS2 Stream, Caltech Intermediate Format (CIF), Library Exchange Format (LEF), Design Exchange Format (DEF), Standard Delay Format (SDF), DSPF and SPEF, Advance Library Format (ALE), Waves Waveform and Vector Exchange Specification, Physical Design Exchange Format, Open Access	30
8	**Design Verification** Functional and Test Bench Verification using System, Verification Methodology-OVM, UVM, AVM and ABV Verilog, Coverage Driven Verification, RTL Design Verification of Industry Standard Interface IP and Protocols, Layout Vs Schematic Comparison.	30
	Total Vocational/Practical / Tutorial / Lecture Hours	400hrs

Recommended Hardware:

- Xilinx Vertex Series FPGA Board 10 No's for a group of 20 Students
- 10 no's High End PCs

Recommended Software:

- Model Sim 6.6PE or advance Version. 10 User License
- Xilinx ISE Software. 25 User License
- Synposis/Cadence/Tanner EDA Design ISE Software supporting FINFET at 45 nm Node Technology. 10 User License

Text Books:

1. "Verilog HDL: Digital Design and Modelling", Joseph Cavanagh, Publisher: CRC Press, Taylor and Francis Group
2. " Digital VLSI Design with Verilog-A text book from Silicon Polytechnic", John Michael Williams, Publisher: Springer
3. "Verilog HDL: A Guide to Digital Design and Synthesis", Samir Palnitkar, Publisher: Prentice Hall Professional
4. "Design through Verilog HDL", T. R. Padmanabhan, B. Bala, Tripura Sundari, Publisher: Willey India (P) Ltd.
5. CMOS VLSI DESIGN-A Circuit and Systems Perspective, Neil H. E. Weste, David Harris and Ayan Banerjee 3rd Edition, Pearson Education.
6. CMOS ANALOG CIRCUIT DESIGN, Philip E. Allen and Douglas R. Holberg International 2nd Edition 3rd Edition, Pearson Education.
7. "VLSI Technology" Wai-Kai Chen, Editor-in-Chief, CRC-Press, 2003

Reference Books:

1. **System Verilog for Design Second Edition: A Guide to Using System Verilog for Hardware Design and Modeling Paperback** –October 12, 2010by Stuart Sutherland (Author), Simon Davidmann (Author), Peter Flake (Author), P. Moorby (Foreword)
2. **SystemVerilog For Verification:** A Guide to Learning the Testbench Language Features by Chris Spear
3. NPTEL Online Course Material
4. http://svovm.weebly.com/uploads/1/3/8/3/13830308/ovm_cookbook.pdf UVM cookbook (Online reference)
5. Online Methodology Documentation from the Mentor Graphics Verification Methodology Team
6. http://www.scribd.com/doc/193965916/Uvm-Cookbook-Complete-Verification-Academy

ESDM Courses

Level Code:	L5	**Vertical Name:**	Digital Fabrication
Course ID:	**NL/M/L5/C024** **EL/M/L5/C044**	**Course Name:**	3.10.1 Additive Manufacturing/3 D Printing (NIELIT/ESSCI)

Objective of the Course:

The aim of the course is to create skilled professionals who can efficiently design and 3D Print objects and devices by leveraging the freedom offered by 3D Printing technologies and open source electronics.

Learning Outcomes:

Participants successfully completing this course will be able to:

1. Select and use correct CAD formats to manufacture a 3D printed part.
2. Design & prototype products
3. Operate and maintain a 3D Printer

Expected Job Roles:

3D Printer System Operator, 3D CAD Design Engineer, Product Developer, Prototyping Engineer

Duration of the Course (in hours)	400 hours (6 months)
Minimum Eligibility Criteria and pre-requisites, if any	Diploma Holder or B Sc Graduate and not less than 18 Years of age

Professional Knowledge:

An individual on the job needs to know and understand:

- Products and its production process.
- To be able to understand design constraints specific to the company.
- To learn slicing tools.
- To introduce a bottom-up and top-down design approaches.
- Relevant reference sheets, manuals and documents regarding prototyping.

Professional Skill:

An individual on the job needs to know and understand:

- Explain current and emerging 3D printing applications in a variety of industries
- Describe the advantages and limitations of each 3D printing technology
- Evaluate real-life scenarios and recommend the appropriate use of 3D printing technology
- Identify opportunities to apply 3D printing technology for time and cost savings
- Discuss the economic implications of 3D printing including its impact on start-up businesses and supply chains
- Design and print objects containing moving parts without assembly
- Identify and recommend the right material based on the application need

Core Skill:

An individual on the job should have following:

- Providing support for production and design team
- Able to give support and advice whenever necessary to all stakeholders involved.
- Over the whole product development life cycle, intervene with 3D Printing technologies to optimize the process, reduce production cost, and ease the prototyping activities.

Module. No	Module. Name	Minimum No. of Hours
E1	***Introduction to 3D Printing*** Origin of 3D Printing, Unique advantages, Comparison of AM and traditional manufacturing processes	**30**
E2	***Additive Manufacturing Technologies and 3D Printing*** Fused Deposition Modelling, Selective Laser Sintering Polyjet, Materials for Additive Manufacturing & 3D Printing	**100**
E3	***3D Modelling for 3D Printing*** Designing, Slicing, Reverse Engineering and 3D Scanning, Preparing STLs for 3D Printing, Data formats	**100**
E4	***Applications of 3D Printing*** Aerospace, Automotive, Construction & Architecture Product Prototyping, Art, Jewellery, Medical	**100**
E5	***Integrated Product Design and Post Processing*** Principles of Product Development, Basic Electronics Structural Electronics, Vapour Smoothing, Sand Papering	**70**

	Vinyl Pasting	
	Total Theory / Lecture Hours:	240
	Total Practical / Tutorial Hours:	160
	Total Hours:	400

Recommended Hardware:	3D Printer: Desktop FDM System/Prototype FDM System/Industrial FDM System 3D Scanner: Kinect Laser Scanner/White Light Scanner/Blue Light Scanner CNC Router: Drill CNC Routing System/3 Axis Metal CNC Machining/5 Axis Multi-Material CNC Machining High-spec PC
Recommended Software:	Autodesk 123D, CATIA CNC Modelling: MultiCNC, GrabCAD
Text Books:	• The New world of 3 D Printing by Hod Lipson • Practical 3 D Printer by Brain Evans • 3 D Printing: The next Industrial revolution by Christopher
Reference Books:	• A beginner's Guide to 3D Printing – Mike Rigsby • Blender 3D Printing essentials – Gorden Fisher

ESDM Courses

Level Code:	L5	**Vertical Name:**	Digital Fabrication
Course ID:	**NL/M/L5/C025**	**Course Name:**	3.10.2 3 D Scanning and CNC routing (NIELIT)

Objective of the Course:

The aim of the course is to create skilled professionals who can efficiently operate 3D Scanner and handle CNC routing.

Learning Outcomes:

After undergoing this course, the student will be able to:

1. Operate 3 D Scanner and CNC
2. Do post processing of 3D files
3. Maintain 3 D Scanner and CNC

Expected Job Roles:

3D Scanner Operator, CNC Operator

Duration of the Course (in hours)	400 hours

Minimum Eligibility Criteria and pre-requisites, if any	Diploma Holder or B Sc Graduate and not less than 18 Years of age

Professional Knowledge:

An individual on the job needs to know and understand:

- Principles of 3 D Scannining
- Principles of CNC routing
- To be able to understand design constraints specific to the company.
- Scanning tools
- Working of CNC

Professional Skill:

An individual on the job needs to know and understand:

- Explain current and emerging 3D Scanning requirement of various Industries
- Describe the advantages and limitations of each 3D Scanning technology
- Understand CNC routing
- Identify opportunities to apply 3D Scanning technology for time and cost savings

Core Skill:

An individual on the job should have following:

- Providing support for production and design team in the Company.
- Able to give support and advice whenever necessary to all stakeholders involved.
- Over the whole product development life cycle, intervene with 3D Scanning and CNC routing technologies to optimize the process, reduce production cost, and ease the prototyping activities.

Detailed Syllabus of Course

3D Scanning & CNC Routing

Module. No	Module. Name	Minimum No. of Hours
F1	***Introduction to 3D Scanning*** Origin of 3D Scanning, 3D Scanning Applications, Principles of 3D Scanning	**25**
F2	***Factors in 3D Scanning*** Factors Affecting 3D Scanning, Atmospheric Conditions, Reflectance	**60**
F3	***Applications of 3D Scanning*** Aerospace, Automotive, Cultural Preservation, Consumer Products, Manufacturing, Medical	**100**
F4	***Operation of 3D Scanners*** Working of a 3D Scanner, Major Components in a 3D Scanner, Effective 3D Scanning, Post Processing of a 3D Scan File, Meshing, Stitching, Removal of Unnecessary Scan Data, Ensuring Water-tight model, STL Creation	**100**
F5	***CNC Routing*** Origin of CNC Technology, Create a design for CNC, Tool path generation, Conversion to GCode, Preview design file, Fabricating the final product	**80**
F6	***Case Studies*** Design visualization, 3D Gear assembly, Life style goods, Assembly integration, End of arm tools/Exo-	**35**

	Skeleton/Robotic arm, Geneva Mechanism, UAV And others	
	Total Theory / Lecture Hours:	240
	Total Practical / Tutorial Hours:	160
	Total Hours:	400

Recommended Hardware:	3D Scanner: Kinect Laser Scanner/White Light Scanner/Blue Light Scanner CNC Router: Drill CNC Routing System/3 Axis Metal CNC Machining/5 Axis Multi-Material CNC Machining High-spec PC
Recommended Software:	Autodesk 123D, CATIA CNC Modelling: MultiCNC, GrabCAD
Text Books:	• 3 D Scanning Technology by Nesi Linda • Validation of numerical simulation by 3D Scanning by Samir Leme • An introduction to CNC by S Vishal • C NC machines by P Radhakrishnan
Reference Books:	• 3 D Scanning Technology by Tongbo Chen • CNC Machine and automation by KhusdeepGoyal