

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

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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	8 th Pass	Service
2	EL/S/L2/C002	ESSCI	DAS Set-top-box Installer and Service Technician	Communications Electronics	L2	200	8 th Pass	Service
3	EL/S/L3/C003	ESSCI	Field Technician- Air conditioner	Consumer Electronics	L3	350	10 th Pass	Service
4	EL/S/L3/C004	ESSCI	Installation Technician - Computing and Peripherals	IT Hardware	L3	350	10 th Pass	Service
5	EL/S/L4/C005	ESSCI	Field Engineer - RACW (Refrigerator, AC & Washing Machine)	Consumer Electronics	L4	350	8 th Pass	Service
6	EL/S/L4/C006	ESSCI	Field Technician – Computing and Peripherals	IT Hardware	L4	350	12 th Pass	Service
7	EL/S/L4/C007	ESSCI	Solar Panel Installation Technician	Solar Electronics	L4	350	12 th Pass	Service
8	EL/S/L4/C008	ESSCI	Pick and Place Assembly Operator	PCB Assembly	L4	350	12 th Pass	Service
9	EL/S/L5/C009	ESSCI	Field Technician – Networking and Storage	IT Hardware	L5	400	Diploma	Service
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
12	EL/M/L3/C012	ESSCI	Through Hole Assembly Operator	PCB Assembly	L3	350	10th + ITI or 12th pass	Manufacturing
13	EL/M/L3/C013	ESSCI	Circuit Imaging Operator	PCB Assembly	L3	350	10th pass	Manufacturing
14	EL/S/L3/C014	ESSCI	CCTV Installation technician	IT Hardware	L3	350	10th pass	Service
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	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	250	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
23	NL/S/L3/C003	NIELIT	Repair & Maintenance of Power Supply, Inverter & UPS	Industrial Electronics	L3	350	10th Pass/ITI	Service

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 ECG and 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 12 th Pass	Service
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
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
32	NL/M/L4/C012	NIELIT	Automation Technology-Basic Level	Industrial Automation	L4	For Technical Students : 180 Hrs	Diploma in /Electronics/Instrumentation/ Mechanical/ Electrical – for Technical students. Non Technical Students: 12th pass with science background and affinity towards technical studies	Manufacturing
						Non Technical Students : 240 Hrs		
33	NL/M/L4/C013	NIELIT	Certificate in Robotic Programming & Maintenance	Industrial Automation	L4	325	10th with aptitude in the subject/12th pass	Manufacturing
34	NL/S/L4/C014	NIELIT	Telecom Technician-PC Hardware and Networking	Office Automation, IT & networking	L4	170	10th with strong aptitude in Science / 12th Pass	Service
35	NL/M/L4/C015	NIELIT	Computer Aided Product Design	Electronic Product Design	L4	360	Polytechnic Diploma/ Graduation/ ITI/12th/ 10th	Manufacturing
36	NL/M/ L5/C016	NIELIT	Embedded System Design using 8-Bit Microcontroller	Embedded System & VLSI	L5	400	Diploma or above	Manufacturing
37	NL/M /L5/C017	NIELIT	Post Diploma in VLSI Design, Tools & Technology	Embedded System & VLSI	L5	400	Diploma Holder or BSc. Graduate	Manufacturing
38	NL/M/L5/C018	NIELIT	Automation Technology-Intermediate Level	Industrial Automation	L5	Technical Students – 350 Hrs	Diploma in /Electronics/Instrumentation/ Mechanical/Electrical – for Technical students. Non Technical Students: Students with 12+ with science background and affinity towards technical studies	Manufacturing
						Non-Technical Students – 450 Hrs		

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
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
42	NL/M/L4/C022	NIELIT	Solar-LED Lighting Products (Design and Manufacturing)	Solar Electronics	L4	350 hrs	10th + ITI, 12th pass	Manufacturing
43	NL/S/L5/C023	NIELIT	CHM-‘A’ Level	Office Automation, IT & Networking	L5	470 hrs	12th Pass/ITI/Diploma, graduation or more with CHM-O level	Service
44	TL/S/L3/C001	TSSC	Optical Fiber Splicer	Telecom	L3	250	8 th 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
48	TL/S/L4/C005	TSSC	Optical Fiber Technician	Telecom	L4	350	10+2	Service
49	TL/S/L5/C006	TSSC	Installation Engineer SDH & DWDM	Telecom	L5	400	Diploma(including final year candidate)	Service
50	TL/S/L5/C007	TSSC	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	TSSC	Board Bring Up Engineer	Telecom Electronics	L3	350	10th, Undergoing ITI, Electronic/ Electrical/ Mechanical(including final year candidates)	Manufacturing
53	TL/M/L5/C010	TSSC	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	TSSC	Grass Root telecom Provider	Network Management	L4	350	10th + ITI, 12th pass	Service
58	TL/M/L4/C015	TSSC	IPC acceptability criteria of Telecom PCB assemblies	Telecom Manufacturing	L4	350	ITI / Diploma (electronics) or Bsc.(Electronics)	Manufacturing
59	TL/M/L4/C016	TSSC	SMT process for telecom boards	Telecom Manufacturing	L4	350	ITI / Diploma (electronics) or Bsc.(Electronics)	Manufacturing
60	TL/M/L4/C017	TSSC	Soldering of telecom board assemblies	Telecom Manufacturing	L4	350	ITI / Diploma (electronics) or Bsc.(Electronics)	Manufacturing
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, Instrumentation, Biomedical	Service
64	TL/M/L4/C021	TSSC	Telecom Quality Technician	Telecom Manufacturing	L4	350	ITI / Diploma (Electrical, electronics, Instrumentation)	Manufacturing

2 ELECTRONICS SECTOR SKILLS COUNCIL OF INDIA (ESSCI)

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

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

10th 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, thermistors)
 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)

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

8th Std 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/ 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: Vertical Name:

Course Code: Course Name:

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/N3506 Assemble 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/N3507 Assemble 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

10TH + ITI or 12th Pass, Other non- Science graduate

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, thermistors
- 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: Vertical Name:

Course Code: Course Name:

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)

Minimum Eligibility Criteria

and pre-requisites, if any

--

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: Vertical Name:

Course Code: Course Name:

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)

Minimum Eligibility Criteria

and pre-requisites, if any

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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:

<ol style="list-style-type: none"> 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:

<ol style="list-style-type: none"> 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: Vertical Name:

Course Code: Course Name:

Objective of the Course:

To train the person who is 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 field 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:

- | |
|---|
| <ol style="list-style-type: none">1. Computer, Laptop2. Soldering iron, multimeter, POST cards3. Printer, Scanner |
|---|

Recommended Software:

NA

Text Books:

NA

Reference Books:

NA

ESDM Courses

Course Code:

EL/S/L5/C009

Course Name:

2.3.2 Field Technician – Networking and Storage

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:

- 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. **Networking, Servers and storage 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:	
	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/C004

Course Name:

2.3.3 Installation Technician – Computing and Peripherals

Objective of the Course:

To train the person who is 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

350 hours

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: Vertical Name:

Course Code: Course Name:

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/N4610 Install 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/N4610 Install 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:

- x. **Interpersonal skills**
- xi. **Communication skills**
- xii. **Behavioural skills**
- xiii. **Reading, writing and computer skills**
- xiv. **Teamwork and multitasking**
- xv. **Reflective thinking**
- xvi. **Critical Thinking**
- xvii. **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
	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:	<ol style="list-style-type: none">1. Different types of CCTV Camera2. DVR, Monitor, Key board mouse & their hardware3. Storage device4. Diagonal cutters, screwdrivers, crimp tools, knife for cabling and camera mounting
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Recommended Software:	NA
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Text Books:	NA
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Reference Books:	NA
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ESDM Courses

Level Code: Vertical Name:

Course Code: Course Name:

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/N4617 Install 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:

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Recommended Software:

NA

Text Books:

NA

Reference Books:

NA

ESDM Courses

Level Code: **Vertical Name:**

Course Code: **Course Name:**

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: L1 **Vertical Name:** Photovoltaic Segment (Solar Panel)

Course Code: EL/S/L1/C010 **Course Name:** 2.4.2 Emergency Light & Solar Lantern

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. Emergency lights

Working principle of 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. Solar Lantern

Working principle of 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

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:

<ol style="list-style-type: none"> 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 Dummies by Rik De Gunther

ESDM Courses

Level Code: **Vertical Name:**

Course Code: **Course Name:**

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

Professional Knowledge:

10th +ITI / 12th pass / Other non-science graduates

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	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: **Vertical Name:**

Course Code: **Course Name:**

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 technique, 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 occurring 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
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	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: Vertical Name:

Course Code: Course Name:

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/N5101 Perform 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/N9919 Work 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/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/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

Course Name:

2.5.3 Circuit Imaging Operator

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/N2201 Imprint 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/N9917 Interact 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:

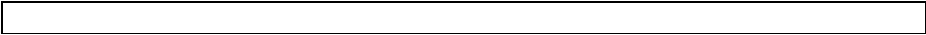
Circuit Imaging Operator

Duration of the Course (in hours)

350 hours

Minimum Eligibility Criteria and pre-requisites, if any

10th 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

NOS # ELE/N9918 - 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. **Reflective Thinking**
- ii. **Operating Machines and Material Handling**
- iii. **Problem solving**
- iv. **Critical Thinking**
- v. **Decision Making**
- vi. **Handling Safety Equipment**

Core Skill:

- | |
|--|
| <ol style="list-style-type: none">1. Reading and Writing Skills2. Team work3. Communication skills4. 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: Vertical Name:

Course Code: Course Name:

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/N9962 Interact 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/N9963 Maintain 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: **Vertical Name:**

Course Code: **Course Name:**

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)

250 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: Vertical Name:

Course Code: Course Name:

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/9201 Assemble 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/N9919 Work 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

10th + ITI, 12th 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:

- | |
|--|
| <ol style="list-style-type: none">1. Reading and Writing Skills2. Team work3. Communication skills4. 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: **Vertical Name:**

Course Code: **Course Name:**

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**

Minimum educational qualification: 10th + ITI /12th pass /other non-science graduates.

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 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/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:

xviii.	Interpersonal skills
xix.	Behavioural skills
xx.	Reflective thinking
xxi.	Critical Thinking
xxii.	Decision Making
xxiii.	Using tools and machines

Core Skill:

9. Using tools and machines
10. Reading, writing and computer skills
11. Teamwork and multitasking
12. Communication skills

Detailed Syllabus of Course:

S.No.	Module. Name	Duration
1	<ul style="list-style-type: none">Engage with customer for installation	
2	<ul style="list-style-type: none">Install and setup the access control system	
3	<ul style="list-style-type: none">Install Intrusion Detection System	
4	<ul style="list-style-type: none">IDS Setup IDS	
5	<ul style="list-style-type: none">Install CCTV camera	
6	<ul style="list-style-type: none">Setup CCTV surveillance system	
7	<ul style="list-style-type: none">FAS Install FAS detector	

8	<ul style="list-style-type: none"> FAS Setup FAS 	
9	<ul style="list-style-type: none"> Install VDP Outdoor Unit and lock 	
10	<ul style="list-style-type: none"> Setup VDP Indoor system 	
11	<ul style="list-style-type: none"> 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:

3. National Institute of Electronics and Information Technology

3.1 Consumer Electronics

ESDM Courses

Level Code: **Vertical Name:**

Course ID: **Course Name:**

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 completion 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)

**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 Servicing 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, Servicing 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, Servicing 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, Servicing 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, Servicing 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:

- | |
|---|
| <p>For a Batch of 50 No's</p> <ul style="list-style-type: none"> • 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
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Text Books:

BPB Publication Books on Installation Repair, Maintenance and Servicing of Consumer Electronic Products in Hindi
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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

Course Name:

3.1.2 Installation, Repair and
Maintenance of Home
Appliances

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**

10th + ITI, 12th 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 <ul style="list-style-type: none"> • 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.	<p>Electronic and Electrical components</p> <ul style="list-style-type: none"> • 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.	<p>Soldering/ de- soldering techniques</p> <ul style="list-style-type: none"> • 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.	<p>Tools and equipment use for Repairing and maintenance of Electrical Equipment</p> <ul style="list-style-type: none"> • 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.	<p>Basic functionality and Installation of washing machine</p> <ul style="list-style-type: none"> • 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 washing machine, 	15/20

	<ul style="list-style-type: none"> • Installation of washing machine, • Demonstration of various functionality of washing machine 	
6.	<p>Fault identification, Repair and Maintenance of Washing machine</p> <ul style="list-style-type: none"> • 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.	<p>Basic functionality and Installation of Microwave oven</p> <ul style="list-style-type: none"> • 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.	<p>Fault identification, Repair and Maintenance of Microwave oven</p> <ul style="list-style-type: none"> • 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.	<p>Basic functionality and Installation of Mixer/Juicer/Grinder</p> <ul style="list-style-type: none"> • 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.	<p>Fault identification, Repair and Maintenance of Mixer/Juicer/Grinder</p> <ul style="list-style-type: none"> • Common occurring faults, identification and repair, 	10/20

	<ul style="list-style-type: none"> • maintenance of Mixer/Juicer/Grinder 	
11.	Basic functionality and Installation of Water purifier <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • identification of problem, possible causes and solution • replacement of parts • Water Filter Maintenance 	10/15
13.	Safety and Security Procedures <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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

Reference Books:

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

ESDM Courses

Level Code: **Vertical Name:**

Course ID: **Course Name:**

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)

Minimum Eligibility Criteria and pre-requisites, if any

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

IT Skills

Module. No	Module Name	Minimum No. of Hours
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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. Name	Minimum No. of Hours
Module 1.	Fundamentals of Electricity and Electronics <ol style="list-style-type: none"> 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
Module 2.	Soldering Practices <ol style="list-style-type: none"> 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 <p>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</p>	20
Module 4.	Testing Procedures(Practical) <p>Testing of Basic Electronic Components</p> <p>Resistor (Parameter to be measured:</p>	90

	<p>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</p> <ol style="list-style-type: none"> 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 	
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	<p>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</p> <p>7. Electronic Ballast (Applicable Standard : IS 13021) Operating Supply Voltage, Total Circuit Power, Circuit Power factor, Supply Current</p> <p>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</p> <p>9. Testing of Electric Iron/Electric Kettle (Applicable Standard : IS 302-2) Ground bond resistance, Touch Current, Temperature (Thermostatic Cut off) Power Consumption.</p> <p>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</p>	
	Internship/ 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:

Students and Faculty Guides prepared by ASAP in association with the Training Service Providers and industries.

Reference Books:

Evaluation criteria:

Training is conducted with industry support in Polytechnic colleges in the State.

MoU signed with ESSCI for the conduct of Course

Evaluation by ESSCI

National Institute of Electronics and Information Technology

ESDM Courses

Level Code: Vertical Name:

Course ID: Course Name:

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)

Minimum Eligibility Criteria and pre-requisites, if any

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 <ul style="list-style-type: none"> ▣ Getting Started with AutoCAD <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> ▣ Drawing Precision in AutoCAD <ul style="list-style-type: none"> o Using Object Snap o Object Snap Overrides ▣ Polar Tracking Settings <ul style="list-style-type: none"> o Object Snap Tracking 	60 Hrs

	<ul style="list-style-type: none"> o Drawing with SNAP and GRID ☑ Making Changes in Your Drawing <ul style="list-style-type: none"> 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	<p>Drawing Organization and Information</p> <ul style="list-style-type: none"> ☑ Layers <ul style="list-style-type: none"> o Creating New Drawings With Templates o What are Layers? o Layer State o Changing an Object's Layer ☑ Advanced Object Types <ul style="list-style-type: none"> o Drawing Arcs o Drawing Polylines o Editing Polylines o Drawing Polygons o Drawing Ellipses ☑ Getting Information From Your Drawing <ul style="list-style-type: none"> o Measuring Objects o Working with Properties 	40 Hrs
➤ Module-IV	<ul style="list-style-type: none"> ☑ Advanced Editing Commands <ul style="list-style-type: none"> o Trimming and Extending o Stretching Objects o Creating Fillets and Chamfers o Offsetting Objects o Creating Arrays of Objects ☑ Blocks <ul style="list-style-type: none"> o What are Blocks? o Inserting Blocks from Tool Palettes o Inserting Blocks using Insert o Inserting Blocks with Design Center 	40 Hrs

<p>➤ Module-V</p>	<ul style="list-style-type: none"> ☑ Annotating Your Drawing Text <ul style="list-style-type: none"> o Working with Annotations o Adding Text in a Drawing o Modifying Multiline Text o Formatting Multiline Text ☑ Hatching <ul style="list-style-type: none"> o Hatching ☑ Adding Dimensions <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> o Setting Up a Layout 	<p>40 Hrs</p>
<p>➤ Module-VI</p>	<ul style="list-style-type: none"> ☑ 3D Foundations <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> o Working with Solid Primitives o Solid Primitive Types o Working with Composite Solids ☑ Working with Mesh Models Creating Solids & Surfaces from 2D Objects <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> o Editing Components of Solids o Editing Faces of Solids o Fillets and Chamfers on Solids ☑ Working Drawings from 3D Models 	<p>80 Hrs</p>

	<ul style="list-style-type: none"> o Creating Multiple Viewports o 2D Views from 3D Solids 	
➤ Module-VII	10. Advanced Layouts and Printing <ul style="list-style-type: none"> ▣ Advanced Layouts <ul style="list-style-type: none"> o Creating and Using Named Views o Creating Additional Viewports o Layer Overrides in Viewports o Additional Annotative Scale Features ▣ DWF Printing and Publishing <ul style="list-style-type: none"> 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 – PRACTICAL – 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:

L5

Vertical Name:

Industrial Automation

Course ID:

NL/S/L5/C009

Course Name:

3.3.1 Diploma in Repair & Maintenance of Industrial Instrumentation & Automation System

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.

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Expected Job Roles:

As Technician in Process Industries.

Duration of the Course (in hours)

400

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.	<p>Fundamentals</p> <p>Plan and perform routine trade activities</p> <ul style="list-style-type: none"> • Examine types of trade related personal protective equipment <ul style="list-style-type: none"> ○ 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 <ul style="list-style-type: none"> ○ Safe housekeeping practices ○ Appropriate recycling and disposal procedures • Use and maintain hand and power tools <ul style="list-style-type: none"> ○ Trade specific hand and power tools • Examine mounting and installation hardware and practices <ul style="list-style-type: none"> ○ Manufacturer instructions ○ Types of mounting hardware (uni-strut, clamps, u-bolts...) ○ Location for installation of mounting hardware <p>Scope of Instrumentation</p> <ul style="list-style-type: none"> • Scope and necessity of Instrumentation • functional block diagram of measurement system 	12

	<ul style="list-style-type: none"> • calibration and calibration standards <ul style="list-style-type: none"> ○ basic, secondary and working standards • the metric system <ul style="list-style-type: none"> ○ base and supplementary units ○ derived units ○ Multiplying factors (milli,micro, nano.....Mega,Giga...). • Instrument Characteristics • Instrument performance terminology <ul style="list-style-type: none"> ○ Repeatability and Accuracy ○ Zero, span and Linearity errors • Types of errors. • Standard Signals • Different number bases <ul style="list-style-type: none"> ○ Binary ○ Octal ○ Hex <p>Explain codes, standards and regulations</p> <ul style="list-style-type: none"> • Examine work-related safety regulations and publications <ul style="list-style-type: none"> ○ 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 	
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	<ul style="list-style-type: none"> ○ Electrical safety ○ Oil and gas industries <p>Identify electrical hazards and apply safe work practices Packaging & Enclosures of Instrumentation System</p> <ul style="list-style-type: none"> ○ Safety Measures <ul style="list-style-type: none"> ▪ Measurement Categories ○ Nature of Environment & Safety Measures <ul style="list-style-type: none"> ▪ Enclosures of electric equipment for Non-Hazardous location <ul style="list-style-type: none"> • International standards ▪ Enclosures of electric equipment for Hazardous location <ul style="list-style-type: none"> • International standards ○ Intrinsically Safe Equipment ○ Design Consideration of Enclosures for Different Market Segments <ul style="list-style-type: none"> • Examine regulations <ul style="list-style-type: none"> ○ Sizing of wire, fuses and circuit breakers ○ Overloads and Inrush current ○ Proper installation and grounding of electrical equipment <p>Use trade related schematics and drawings</p> <ul style="list-style-type: none"> • Examine types of schematics and drawings <ul style="list-style-type: none"> ○ P&ID and Loop wiring diagrams • Examine symbols and conventions <ul style="list-style-type: none"> ○ ISA and SAMA symbols • Use basic schematics and drawings <ul style="list-style-type: none"> ○ P&ID, Loop drawings 	
2.	<p>Installation and Maintenance of Measuring and Indicating Devices</p> <p>Calibrate and service indicating and recording instruments</p> <ul style="list-style-type: none"> • Types of recording devices 	140

	<ul style="list-style-type: none"> ○ Chart recorders <ul style="list-style-type: none"> ▪ Electronic ● Indicating devices <ul style="list-style-type: none"> ○ Digital displays ○ Analog displays ○ Configurable <ul style="list-style-type: none"> ▪ LCD ● Calibrate and service indicating devices <ul style="list-style-type: none"> ○ Gauges ○ Bourdon tube <ul style="list-style-type: none"> ▪ Helical ▪ Spiral ○ Bellows <ul style="list-style-type: none"> ▪ Diaphragm capsule ○ Accessories <ul style="list-style-type: none"> ▪ 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) <ul style="list-style-type: none"> ○ Identification of measuring element and input measurement scale ○ Power supply ○ Troubleshooting procedures (instrument specific - according to manuals) 	
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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

	<ul style="list-style-type: none"> ○ Relationship between Pressure and Column of Liquid ○ Hydrostatic Head Pressure ○ U-Tube and Well Manometers ○ Bourdon Pressure Gage <ul style="list-style-type: none"> ▪ 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 <ul style="list-style-type: none"> ○ Manufacturers' recommended maintenance procedures <p>Introduction to temperature measurement</p> <ul style="list-style-type: none"> ● Define Temperature, Heat and Energy ● Temperature scales <ul style="list-style-type: none"> ○ Fahrenheit ○ Celsius ○ Kelvin ○ Conversions between scales ● Temperature measuring devices, their operation and Transmitters <ul style="list-style-type: none"> ○ Thermometer ○ Thermocouple ○ Thermocouple tables ○ Resistance Temperature Detectors (RTD) <ul style="list-style-type: none"> ▪ RTD tables ○ Thermistor ○ Liquid in Glass and Filled bulb systems 	
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	<ul style="list-style-type: none"> ○ Pyrometer ○ Semi-conductor mechanical thermal system ○ Infrared radiation ○ Fibre Optic ○ Thermal Expansion Thermometers ○ Temperature Transmitters ● Temperature calibrating instruments <ul style="list-style-type: none"> ○ Thermometers ○ Multimeters ○ Millivolt source ○ Resistance source ○ Temperature baths ○ Dry block calibrators ○ Thermocouple simulators ○ Decade box ● Installs, calibrates and services temperature measuring devices <ul style="list-style-type: none"> ○ Manufacturers' specifications ○ Best Practices for selection /location of measuring device ○ Response time ○ Temperature ranges ○ Resolution ○ Thermo well selection and installation ○ Thermocouples <ul style="list-style-type: none"> ▪ Grounding ▪ Cold junction compensation ▪ Types (J, K...T) ▪ Extension wires ▪ Colour codes (North American and European colour codes) 	
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	<ul style="list-style-type: none"> ○ RTDs <ul style="list-style-type: none"> ▪ Alpha value and Different standards (IEC, DIN etc..) ▪ 2, 3 and 4 wire ▪ 100, 200...1000 ohm ○ Device check / calibration ○ Wheatstone bridge ○ Simulators <ul style="list-style-type: none"> ▪ Decade box ○ Interpretation of calibration results ○ Cause / effect of calibration error ○ Device adjustments ○ Repairing/replacing device components ○ Verification of operation ○ Documenting calibration <p>Introduction to level measurement</p> <ul style="list-style-type: none"> ● Level measuring devices, their operation and Transmitters <ul style="list-style-type: none"> ○ 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 <ul style="list-style-type: none"> ▪ Air Bubbler System 	
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	<ul style="list-style-type: none"> ○ Level Transmitters ● Calibration instruments used on level measuring devices <ul style="list-style-type: none"> ○ Pressure calibrator ○ Laptop / software ○ Handheld programmer ● Install, calibrate and service level measuring devices <ul style="list-style-type: none"> ○ 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 <p>Introduction to density measurement</p> <ul style="list-style-type: none"> ● Density measuring devices and their operation <ul style="list-style-type: none"> ○ Applications and Selection ○ Hydrometer ○ Hydrostatic head ○ Displacers ○ Radiation Densitometers ○ Oscillating Coriolis Densitometer ○ Ultrasonic Sludge and Slurry Densitometers 	
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	<ul style="list-style-type: none"> ○ Gas Densitometers ○ Effect of temperature on density ● Calibration instruments used on density measuring devices <ul style="list-style-type: none"> ○ Pressure calibrator ○ Laptop / software ○ Handheld programmer ● Install, calibrate and service density measuring devices <ul style="list-style-type: none"> ○ 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 <p>Introduction to weight measurement</p> <ul style="list-style-type: none"> ● Weight measuring devices and their operation <ul style="list-style-type: none"> ○ Load cells ○ Scales ○ Strain gauges ● Calibration instruments used on weight measuring devices <ul style="list-style-type: none"> ○ Test weights ○ Wheatstone bridge ○ Laptop / software 	
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	<ul style="list-style-type: none"> ○ Handheld programmer (configurator) ● Install, calibrate and service weight measuring devices <ul style="list-style-type: none"> ○ 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 <p>Introduction to flow measurement (volumetric, mass flow)</p> <ul style="list-style-type: none"> ● Flow measuring devices and their operation <ul style="list-style-type: none"> ○ Types of Flow <ul style="list-style-type: none"> ▪ Reynolds Number ○ Types of flow meters <ul style="list-style-type: none"> ▪ head type ▪ variable area type ▪ quantitative flow meters ▪ mass flow meters ○ Differential Pressure Flowmeters <ul style="list-style-type: none"> ▪ Concentric and Eccentric Orifices ▪ Flow Nozzle ▪ Venturi and Pitot Tubes ○ Target Flowmeter ○ Rotameter or Variable Area Meter 	
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	<ul style="list-style-type: none"> ○ Magnetic, Vortex, Turbine, and Ultrasonic Flowmeters ○ Doppler Effect ○ Flow Tube Vibration and Twist ○ Coriolis ○ Thermal Mass Flowmeters ○ Positive Displacement Flowmeters <ul style="list-style-type: none"> ▪ Rotary Vane, Oval Gear, and Nutating Disc Designs ○ Open Channel Flow Measurement <ul style="list-style-type: none"> ▪ Weirs ○ Parshall Flume ○ Solid flow meters ● Calibration instruments used on flow measuring devices <ul style="list-style-type: none"> ○ Pressure calibrators ○ Temperature calibrator ○ Frequency generator ○ Laptop / software ○ Handheld programmer ● Install, calibrate and service flow measuring devices <ul style="list-style-type: none"> ○ Manufacturers' specifications ○ Selection /Location factors ○ Pressure taps ○ Straight pipe requirements ○ Accuracy requirements ○ Process application ○ Process medium ○ Best practices ○ Verify operation ○ Device check / calibration 	
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	<ul style="list-style-type: none"> ○ Interpretation of calibration results ○ Cause / effect of calibration error ○ Device adjustments ○ Repair/replace device components ○ Documenting calibration 	
3.	<p>Installs & Maintains Safety and Process Monitoring Systems</p> <p>Service ESD (emergency shutdown devices)</p> <ul style="list-style-type: none"> • Types of ESD control systems <ul style="list-style-type: none"> ○ Levels of Shutdown <ul style="list-style-type: none"> ▪ Unit Shutdown ▪ Process Shutdown ▪ Emergency Shutdown ▪ Emergency Depressurize Shutdown ○ Types of ESD <ul style="list-style-type: none"> ▪ Electric ▪ Pneumatic ▪ Hydraulic ▪ Mechanical • Purposes of different types of ESD <ul style="list-style-type: none"> ○ Personnel protection ○ Environmental protection ○ Equipment protection • ESD testing procedures <ul style="list-style-type: none"> ○ Partial Stroke Test ○ Time test ○ Valve integrity ○ Interlock checks (system shut down check) <p>Service and calibrate personal safety systems</p>	10

	<ul style="list-style-type: none"> • Personal gas monitors and standard calibration routines <ul style="list-style-type: none"> ○ Portable personal gas monitor (Cl, SO2, H2S, O2 , CO) ○ Pull tube (Draeger) • Radiation safety devices <ul style="list-style-type: none"> ○ Radiation (gamma) survey meter ○ Personal dosimeter 	
4.	<p>Installs and Maintains Pneumatic Systems</p> <p>Air supply systems</p> <ul style="list-style-type: none"> • Instrument air systems and equipment <ul style="list-style-type: none"> ○ Need for clean, dry air ○ Air compressors ○ Air dryers ○ Air receivers ○ Air filters • Air distribution systems • Use of relative humidity to infer dew point <ul style="list-style-type: none"> ○ Hygrometers ○ Sling psychrometer ○ Digital psychrometer ○ Bulk polymer resistance sensor • Servicing procedures for air supply systems <ul style="list-style-type: none"> ○ Servicing requirements ○ Traps ○ Dessicant ○ Pre and post filters <p>Tubing and fittings</p> <ul style="list-style-type: none"> • Types of tubing and installation procedures 	20

	<ul style="list-style-type: none"> ○ Plastic ○ Stainless steel ○ Copper ○ Rubber ○ Process and pressure requirements ○ Sizes ○ Pressure and Temperature Ratings ● Tube bending techniques <ul style="list-style-type: none"> ○ Calculating dimensions ○ Manual tube benders ○ Hydraulic tube benders ● Install tubing and fittings <ul style="list-style-type: none"> ○ Ferrule fitting ○ Tightening fittings ○ Follow P&ID drawings ○ Select appropriate tubing and fittings <p>Install and service pneumatic instruments</p> <ul style="list-style-type: none"> ● Specifications and hazards of pneumatic equipment <ul style="list-style-type: none"> ○ Compressed air safety ○ Pneumatic signal ranges ● Types of pneumatic equipment <ul style="list-style-type: none"> ○ Transmitters ○ Converters (I/P) ○ Positioners ○ Controllers ○ Relays ● Operating principles of pneumatic equipment 	
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	<ul style="list-style-type: none"> ○ Force balance ○ Motion balance ● Calibrate pneumatic transmitters <ul style="list-style-type: none"> ○ 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.	<p>Installs and Maintains Electrical and Electronic Systems</p> <p>Identification of various Electrical and Electronic components</p> <ul style="list-style-type: none"> ● Active components ● Passive Components ● Switches ● Plugs ● Sockets ● Relays/Solenoids/Contactors ● Inductive proximity switch ● Symbols of electrical components <ul style="list-style-type: none"> ○ Switch ○ Contacts ○ Solenoids ○ Relay ○ LED ● Electrical Ladder Diagram ● Panel controls ● Integrated Circuits 	60

	<ul style="list-style-type: none"> ○ Pin identification and numbering convention ○ IC handling and installation • Safety <ul style="list-style-type: none"> ○ Need for Electrostatic Discharge Protection <p>Apply basic principles of DC electricity</p> <ul style="list-style-type: none"> • operation and applications of various batteries <ul style="list-style-type: none"> ○ Lead acid ○ NiCad ○ NiMh • Measure electrical current, voltage and resistance <ul style="list-style-type: none"> ○ Analog multimeters ○ Digital Multimeters • Calculate currents, voltages and resistance using Ohm's law <ul style="list-style-type: none"> ○ Series circuits ○ Parallel and combination circuits ○ Formula $E = I \times R$ • Define and reference voltage measurement to circuit common <ul style="list-style-type: none"> ○ Difference between ground and circuit common ○ Multimeter ○ Oscilloscope and scope meter ○ Frequency generator ○ Circuit schematic • Calculate electrical power in watts <ul style="list-style-type: none"> ○ Apply Watt's Law to define power rating of appliances ○ $Watts = E \times I$ • Examine resistors, potentiometers and rheostats <ul style="list-style-type: none"> ○ Differences ○ Power ratings 	
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	<ul style="list-style-type: none"> ○ Applications ○ Colour codes <p>Apply basic principles of AC electricity</p> <ul style="list-style-type: none"> ● Define AC electricity <ul style="list-style-type: none"> ○ Generation ○ Polarity and waveform analysis <ul style="list-style-type: none"> ▪ Peak/RMS voltages ● various types of transformers <ul style="list-style-type: none"> ○ Step up ○ Step down ○ Autotransformer ○ Isolation ○ Three phase transformer ● Examine the use of capacitors and inductors in AC circuits <ul style="list-style-type: none"> ○ Applications ○ Filtering ○ Regulating voltage ○ Power factor correction ● Size electrical components for various circuits <ul style="list-style-type: none"> ○ Capacitors ○ Inductors ○ Resistors ○ Wire ○ Fuses ● Build and test circuits <ul style="list-style-type: none"> ○ Understand various components in circuits <ul style="list-style-type: none"> ▪ Electromagnetism 	
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	<ul style="list-style-type: none">▪ 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○ Measuring techniques and equipments• Types of AC circuits<ul style="list-style-type: none">○ Different classes (based on different standards)• installation procedures for AC equipment<ul style="list-style-type: none">○ Wiring methods○ Support○ Grounding○ Shielding• Apply proper circuit connection techniques<ul style="list-style-type: none">○ Soldering○ Crimping <p>Introduction to Power Electronics (Only Block diagrams)</p> <ul style="list-style-type: none">• SMPS• Convertor• Inverter• UPS• DC and AC Drives	
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6.	<p>Installs and Maintains Final Control Elements</p> <p>Service regulators and examine relief valves</p> <ul style="list-style-type: none"> • Examine regulators <ul style="list-style-type: none"> ○ Purpose ○ Pressure drops ○ Types <ul style="list-style-type: none"> ▪ Relieving ▪ Non- Relieving ▪ Pilot operated ○ Definitions <ul style="list-style-type: none"> ▪ Droop ▪ Turndown ○ Applications <ul style="list-style-type: none"> ▪ Pressure reducing ▪ Pressure relieving • Examine operation and applications of regulators <ul style="list-style-type: none"> ○ Air ○ Water ○ Steam ○ Oil ○ Gas ○ Differential • Service and maintain regulators <ul style="list-style-type: none"> ○ Components <ul style="list-style-type: none"> ▪ Diaphragms ▪ Bolts ▪ Springs ▪ Seats 	50
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	<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Gaskets ○ Disassembling <ul style="list-style-type: none"> ▪ Spring compression ○ Reassemble ○ Test • Examine relief valves <ul style="list-style-type: none"> ○ Applications ○ Safety Device ○ Reset Differential ○ Certification and testing <p>Service, size and install control valves and actuators</p> <ul style="list-style-type: none"> • Examine actuators <ul style="list-style-type: none"> ○ Types <ul style="list-style-type: none"> ▪ Pneumatic ▪ Hydraulic ▪ Electric ○ Applications <ul style="list-style-type: none"> ▪ Fail open ▪ Fail close ▪ Fail last ○ Actions <ul style="list-style-type: none"> ▪ Spring return ▪ Double-acting ○ Components <ul style="list-style-type: none"> ▪ Diaphragms ▪ Plates ▪ Stem connector (coupling) ▪ Bushings 	
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	<ul style="list-style-type: none">▪ O-rings▪ Pistons▪ Motors▪ Springs○ Required Operating Environment• Examine control valves<ul style="list-style-type: none">○ Process applications○ Seal / shut off requirements○ Flow Characteristics<ul style="list-style-type: none">▪ Quick opening▪ Linear▪ Equal percentage○ Body Types○ Valve sizing○ Sliding stem<ul style="list-style-type: none">▪ Globe▪ Bar stock▪ Pinch valve○ Rotary<ul style="list-style-type: none">▪ Butterfly▪ E-Disc▪ Segmented ball▪ Through-bore ball▪ Restricted trim○ Components<ul style="list-style-type: none">▪ Cages▪ Plugs▪ Seats	
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	<ul style="list-style-type: none"> ▪ Stems ▪ Packing <ul style="list-style-type: none"> • Types and applications of valve packing <ul style="list-style-type: none"> ○ Teflon ○ Graphite ○ Rope <ul style="list-style-type: none"> • Install and service control valves <ul style="list-style-type: none"> ○ Gaskets ○ Sealants ○ Positioning valve in process ○ Securing valve using appropriate process <ul style="list-style-type: none"> ▪ Flanged ▪ Screwed ▪ Wafered / Flangeless ○ Isolation of valve from process ○ Testing procedures ○ Stroke to ensure proper operation ○ Leak testing ○ Possible faults <ul style="list-style-type: none"> ▪ Leaking packing ▪ Valve passing ▪ Damaged parts ▪ Incorrect travel ○ Cleaning / lubricating ○ Repairing / Rebuilding • Install and service actuators <ul style="list-style-type: none"> ○ Matching to valve 	
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	<ul style="list-style-type: none">○ Connecting to valve○ Valve travel○ Bench set○ Verifying operation○ Correct air supply pressure○ Function testing○ Possible faults<ul style="list-style-type: none">▪ Leaking diaphragms▪ Broken springs▪ Damaged/worn O-rings○ Removing /replacing components○ Cleaning/lubricating components○ Assembling/disassembling<ul style="list-style-type: none">▪ Spring compression○ Loading on stem connector <p>Install and service valve positioners</p> <ul style="list-style-type: none">● Valve positioners<ul style="list-style-type: none">○ Types<ul style="list-style-type: none">▪ Pneumatic▪ Electronic▪ Digital▪ Electro hydraulic▪ Electro mechanical○ Applications○ Single Acting	
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	<ul style="list-style-type: none">○ Double Acting○ Components<ul style="list-style-type: none">▪ Levers▪ Nozzles▪ Flappers▪ Relays▪ Auxiliaries▪ Locks▪ Boosters▪ Speed controls○ Relation to actuator type / application● Install and service valve positioners<ul style="list-style-type: none">○ Mounting○ Connecting to actuator○ Connecting to process control system○ Configuring○ Set stroke○ Set pressures○ Match to actuator○ Auto tune○ Calibrating	
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	<ul style="list-style-type: none"> ○ Connecting calibration instruments ○ Calibration parameters ○ Interpretation of calibration results ○ Cause/effect of calibration errors ○ Component maintenance 	
7.	<p>Installs and Maintains Communications, Networking and Signal Transmission Systems</p> <p>Install wiring in accordance with different standards</p> <ul style="list-style-type: none"> ● Examine wiring requirements <ul style="list-style-type: none"> ○ Materials ○ Connections <ul style="list-style-type: none"> ▪ Crimping ▪ Terminal blocks ▪ Marrettes ▪ Soldering ▪ Protection (heat shrink, taping etc.) ○ Shielding ○ Grounding ○ Grounding loops ● Install wiring <ul style="list-style-type: none"> ○ Sizing wire ○ Routing of wiring runs ○ Stripping wire ○ Labeling / colour-coding wire ○ Connecting wire <p>Trends in control technologies</p> <ul style="list-style-type: none"> ● Smart Components 	28

	<ul style="list-style-type: none">○ Typical smart DP Transmitter○ Smart temperature transmitter○ Benefits <p>Service supervisory control and data acquisition (SCADA) systems</p> <ul style="list-style-type: none">● types of SCADA protocols and configurations<ul style="list-style-type: none">○ Applications○ Online history○ Remote equipment operation○ Network layout○ Protocols○ Host○ Field○ Addressing methods● types of SCADA equipment and servers for data acquisition and storage<ul style="list-style-type: none">○ Radio Telemetry Units (RTU)○ Wireless Communications systems○ Cellular○ Satellite <p>communication systems</p> <ul style="list-style-type: none">● types of signal transmission systems<ul style="list-style-type: none">○ Fibre optics○ Armoured cable○ Non armoured cable○ Multimode / single mode transmission○ Wired○ Coax○ UTP○ Wireless	
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	<ul style="list-style-type: none"> ○ Satellite ○ Blue tooth ○ RF ○ IR ○ IEEE standards ● features and limitations of communication protocols <ul style="list-style-type: none"> ○ 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.	<p>Installs and Maintains Control Systems</p> <p>Stand alone Controllers</p> <ul style="list-style-type: none"> ● Electronic Controllers ● Single loop controllers <p>Programmable Logic Controllers (PLCs)</p> <ul style="list-style-type: none"> ● Examine types of PLCs <ul style="list-style-type: none"> ○ Hardware Architecture 	80

	<ul style="list-style-type: none"> ○ Control Capabilities <ul style="list-style-type: none"> ▪ Discrete control ▪ Analog control ○ Compatibility with other process systems ○ Networks ○ Protocols ● PLC languages and symbols <ul style="list-style-type: none"> ○ Structured Text ○ Instruction list ○ Ladder Logic ○ Function block ○ Sequential function chart ● PLC components <ul style="list-style-type: none"> ○ CPU ○ Memory organization ○ Input interface ○ Output interface ○ Power supply ○ Programming/Monitoring interface ○ Data Table ○ User Program <p>fundamental theories of process operation and equipment</p> <ul style="list-style-type: none"> ● Common industrial processes <ul style="list-style-type: none"> ○ Continuous Process ○ Batch process <p>Introduction to control theory</p>	
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	<ul style="list-style-type: none"> • Basic control theory <ul style="list-style-type: none"> ○ Set point / process variable / manipulated variable ○ Relation of output to input ○ Steady state value and dynamic component ○ Control loop gains / loop stability • Control modes <ul style="list-style-type: none"> ○ On / Off control ○ Differential Gap ○ Proportional only ○ Integral only ○ Proportional plus Integral ○ PID -Proportional, Integral, Derivative <ul style="list-style-type: none"> ▪ Reset rate / Reset time ▪ Series / parallel ○ Interactive / non-interactive / rate on PV • Controller action <ul style="list-style-type: none"> ○ Direct acting ○ Reverse acting • Controller operating modes <ul style="list-style-type: none"> ○ Automatic ○ Manual ○ Remote ○ Local ○ Supervisory <p>Introduction to process control techniques and strategies</p> <ul style="list-style-type: none"> • Control techniques <ul style="list-style-type: none"> ○ Loop tuning ○ Zeigler Nicholls 	
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	<ul style="list-style-type: none"> ○ Lambda ○ Tuning from manual output changes ● Basic control strategies <ul style="list-style-type: none"> ○ Feedback control <ul style="list-style-type: none"> ▪ Process Dynamics <ul style="list-style-type: none"> ● Lags ● Dead Time ○ Feed forward control ○ Cascade control ○ Ratio Control ○ Gap action control ○ Multi variable control <p>Implement process control strategies</p> <ul style="list-style-type: none"> ● Implement process control strategies <ul style="list-style-type: none"> ○ 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

Reference :

- 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.com
- 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
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ESDM Courses

Level Code: L4 **Vertical Name:** Industrial Automation

Course Code: NL/M/L4/C012 **Course Name:** 3.3.2 Automation Technology – Basic Level –L4

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 perform 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 : 180 Hrs
Non Technical Students : 240 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.

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, Logic Controls, Pneumatic, i. Shuttle valve, ii. Twin pressure valve, iii. Applications of Logic valves, Structure of Pneumatic Circuits, Automatic Control, Roller valve, Quick-Exhaust valve, 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
- Durbey.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
- Durbey.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/C0018 **Course Name:** 3.3.3 Automation Technology – Intermediate Level

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:

Assistants in regular production areas, quality, logistics and maintenance areas

Duration of the Course (in hours)

Technical Students –350 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: Students with 12+ 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

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 and 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, Logic Controls, Pneumatic, i. Shuttle valve, ii. Twin pressure valve, iii. Applications of Logic valves, Structure of Pneumatic Circuits, Automatic Control, Roller valve, Quick-Exhaust valve, 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
- Dubbey.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
- Dubbey.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: **Vertical Name:**

Course Code: **Course Name:**

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 and 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, Hysteresis, 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, Logic Controls, Pneumatic, i. Shuttle valve, ii. Twin pressure valve, iii. Applications of Logic valves, Structure of Pneumatic Circuits, Automatic Control, Roller valve, Quick-Exhaust valve, 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 - Pneumatic 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
- Dubbey.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, 2nd edition, Thomson, ISBN:981-240-625-5
- Instrumentation Engineers Hand Book - Process Control, Bela G Liptak, Chilton book company, Pennsylvania
- A.E. Fitzgerald, 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

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: **Vertical Name:**

Course Code: **Course Name:**

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 and pre-requisites, if any

10th with aptitude in the subject/12th pass

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	3.3.5.1.1.1.1.1.1 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 effector
 - 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.

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Assessment & Certification by NTTF.(Nettur Technical Training Foundation)

For Theory:

There will be two intermediate assessments for theory.

First intermediate will be off line(Written examination)- 25 marks

The second intermediate will be online.(25 Marks)

File submission (written document- for 10 Marks)

Sessional marks will be arrived from the above two test and the file mark.

Sessional mark will be computed out of 30

Sessional minimum required to qualify for the final examination is 10 out of 30.

Final examination (Written) will be conducted for 70 marks.

Total marks will be computed as $T=S+W$ (Were T= Total mark, S= Sessional, W= Final written marks)

Pass criteria is 40 out of 100.

For Practical:

1. There will be only one intermediate practical test for maximum 20 Marks.

2. Lab record submission (Written document- For 10 Marks)

3. Sessional marks will be arrived from the intermediate practical test and File marks, and it carry maximum of 30 marks. (20+10)

4. final test will be conduct maximum of 70 marks,

5. Total marks will be computed as $T=S+W$ (100=30+ 70)

6. Pass criteria 50 out of 100.

Course ID:

NL/S/L3/C003

Course Name:

3.4.1 Repair & Maintenance of Power Supply, Inverter & UPS

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

10th 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.	<p>Electronic and Electrical components</p> <p>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</p>	15 / 15
3.	<p>Soldering/ de- soldering techniques</p> <p>Soldering Iron, Soldering wire, Soldering Flux, Soldering method, Zero defect soldering Desoldering pump, Temperature controlled soldering station, Hands-on-practices of Soldering)</p>	10 / 10
4.	<p>Tools and equipment use for Repairing and maintenance of Electrical Equipment</p> <p>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.</p>	10 / 10
5.	<p>Stabilizer and CVT</p> <p>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</p>	20 / 30
6.	<p>Inverter and UPS</p> <p>Introduction to Inverter, Block diagram of Inverter</p>	20 / 30

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

National Institute of Electronics and Information Technology

ESDM Courses

Level Code: **Vertical Name:**

Course ID: **Course Name:**

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)

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

10TH 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/C006 **Course Name:** 3.5.2 Repair & Maintenance of ECG and ICCU Equipment

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, resistors
- 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, measurement 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 , ICU 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 , ICU 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:

L3

Vertical Name:

Medical Electronics

Course ID:

NL/S/L3/C005

Course Name:

3.5.3 Repair & Maintenance of Imaging Equipment (X-Ray & Ultrasound machine)

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
and pre-requisites, if any**

10th 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 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:

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**Recommended
Software:**

Text Books:

Reference Books:

ESDM Courses

Level Code:

L5

Vertical Name:

Medical Electronics

Course ID:

NL/S/L5/C009

Course Name:

3.5.4 Post Diploma in Repair & Maintenance of Hospital Equipment

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 and pre-requisites, if any

ITI/Diploma/B.Sc

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
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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: **Vertical Name:**

Course ID: **Course Name:**

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)

**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

	<p>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</p>	
3.	<p>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</p>	10 / 10
4.	<p>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.</p>	10 /10
5.	<p>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.</p>	20 / 20
6.	<p>Printers Printers and their types.</p>	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

Level Code: L4 **Vertical Name:** Office Automation, IT & networking

Course Code: NL/S/L4/C014 **Course Name:** 3.6.2 Telecom Technician - PC Hardware and Networking

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) 170 hrs

Minimum Eligibility Criteria and pre-requisites, if any 10th with strong aptitude in Science / 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

	<ol style="list-style-type: none"> 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, Servers and trouble shooting 	
2	<p>PC Hardware Practical</p> <ol style="list-style-type: none"> 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	<p>Computer Networking</p> <ol style="list-style-type: none"> 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

	<ol style="list-style-type: none"> 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	<p>Computer Networking Practical</p> <ol style="list-style-type: none"> 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

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

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Text Books:

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Reference Books:

Material prepared by BSNL.

Evaluation criteria:

Course conducted in Industry (BSNL). MoU Signed with BSNL Evaluation & Certification by BSNL. ESSCI has also agreed to do Assessment and Certification.
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ESDM Courses

Level Code:	L4	Vertical Name:	Office Automation, IT & Networking
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Course ID:	NL/S/L4/C020	Course Name:	3.6.3 CHM-O Level
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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

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
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		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:	3.6.4 CHM-A Level

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

Minimum Eligibility Criteria and pre-requisites, if any

12th Pass/ITI/Diploma, graduation or more with CHM-O level

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

3.7 Telecom Segment

ESDM Courses

Level Code:

L2

Vertical Name:

Telecom Segment

Course Code:

NL/S/L2/C011

Course Name:

3.7.1 Installation/Repair &
Maintenance of EPABX
System

Objective of the Course:

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

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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: <ul style="list-style-type: none">• 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 and pre-requisites, if any

9 th Pass

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
 FAMILIARISATION 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 FAMILIARISATION 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

1. Manual of EPABX/ Digital Exchange

Reference Books:

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ESDM Courses

Level Code: Vertical Name:

Course ID: Course Name:

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 Reboling 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

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 Pentium-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 Disordersing Station
- Oscilloscope 25-100 Mhz
- 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:	L5	Vertical Name:	Embedded systems & VLSI
Course ID:	NL/M/L5/C017	Course Name:	3.9.1 Post Diploma in VLSI Design, Tools and Technology

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 (6 Months)

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	<p><u>INTRODUCTION</u></p> <p>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</p>	25
2	<p>Programmable Logic Devices (PLDs)</p> <p>Introduction, PLDs Types-Simple PLDs (SPLDs), Complex PLDs (CPLDs) and Field Programmable Gate Array (FPGA), their 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.</p>	35
3	<p>System Verilog Code Structure and FPGA Implementation</p> <p>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.</p>	100
4	<p>VLSI Technology</p> <p>Basic MOS Transistor Operations and Electrical Properties, Fabrication Process, Passive Component Fabrication Process, Gyration 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,</p>	40
5	<p>VLSI Design- Part 1</p> <p>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 .</p>	40
6	<p>SPICE Modelling for VLSI Design-Part 2</p> <p>SPICE Tutorials and Commands, Sources and Passive Components, CMOS Inverter Transient</p>	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
- Synopsis/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, 2010 by [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:

Embedded Systems & VLSI

Course ID:

NL/M/L5/C016

Course Name:

3.9.2 Embedded system Design using 8-bit
Microcontrollers

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 or above Manufacturing

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 <ul style="list-style-type: none"> • Introduction to 'C' programming • Embedded C Programming with KEIL 	15 /25
2.	8051 Architecture - Theory <ul style="list-style-type: none"> • Architecture of 8051 Family of Microcontrollers 	10/0
3.	8051 Peripherals - Theory <ul style="list-style-type: none"> • Timers • Interrupts • Serial Port 	15/60
4.	Interfacing 8051 to peripheral devices –Theory <ul style="list-style-type: none"> • LCD • Key board • Stepper Motor 	15/60
5.	Embedded C with PIC – Theory <ul style="list-style-type: none"> • Embedded C Programming with MPLab 	15/25
6.	PIC Architecture – Theory <ul style="list-style-type: none"> • Architecture of PIC Microcontrollers 	10/0
7.	PIC Peripherals - Theory <ul style="list-style-type: none"> • Timers • Interrupts • ADC • Serial Port 	15/60

8.	Interfacing PIC to peripheral devices –Theory <ul style="list-style-type: none"> • 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.

1. Programming and Customizing The 8051 Microcontroller, Predko, Myke, Tata

Reference Books:

- Mgh, New Delhi
2. Programming and Customizing the PIC Microcontroller, Predko, Myke, Tata Mgh, New Delhi

ESDM Courses

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

Course Code: NL/M/L4/C022 **Course Name:** 3.10.1 Solar-LED Lighting Products (Design and Manufacturing)

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

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

350 hrs

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

10th + ITI, 12th 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 <ul style="list-style-type: none">• Light sources, characteristics of light sources, introduction to light	15/15

	units- candela, lux & nits	
2	<p>Comparative study of LED and other light sources</p> <ul style="list-style-type: none"> • 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	<p>Basic Principle , Design and Assembly of LED based products</p> <ul style="list-style-type: none"> • 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	<p>Introduction of Renewable Energy & Study of Characteristics of SPV Cells</p> <ul style="list-style-type: none"> • 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 & 	30/30

	Autonomy of SPV system	
5	<p>Installation and maintenance of solar panel</p> <ul style="list-style-type: none"> • 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	<p>Project Work- PCB designing</p> <ul style="list-style-type: none"> • Introduction to PCB Designing and future scope <ul style="list-style-type: none"> ○ Different techniques to implement circuit ○ Advantages of PCB based products ○ Advantages of designing with CAD softwares • Designing circuits in schematic <ul style="list-style-type: none"> ○ To capture the circuit to make a PCB ○ Different techniques of modelling of design ○ Top down and Bottom up methodology for design ○ Creating Netlist of design and producing files for layout • Designing layout of circuits and generating output <ul style="list-style-type: none"> ○ Creating a layout of board using layout tool ○ Auto-routing and manual routing of a board ○ Making footprints of different components ○ 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:

4. TELECOM SECTOR SKILL COUNCIL (TSSC)

4.1 Telecom (Passive Infrastructure)

ESDM Courses

Level Code: **Vertical Name:**

Course Code: **Course Name:**

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:

Duration of the Course (in 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: **Vertical Name:**

Course Code:

TL/S/L2/C011

Course Name:

4.1.2 Telecommunications Installation and Repair Worker

Objective of the Course:

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

Learning Outcomes:

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

Expected Job Roles:

Communication Equipment installers and repairers

Duration of the Course (in hours)

200 Hours

Minimum Eligibility Criteria and pre-requisites, if any

Class 10+2 / ITI

Detailed Syllabus of Course

Module.	Module. Name	Minimum No. of
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No		Hours
1.	Introduction to Telecom equipment used in corporate offices and Residential customer premises.	10 Hr
2	<p>Installation and Commissioning of telecom equipment hardware</p> <ul style="list-style-type: none"> • 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. <p>Switch network installers and repairers perform some or all of the following duties:</p> <ul style="list-style-type: none"> • 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 • Diagnose and locate equipment faults, and adjust, replace or repair telecommunications equipment. 	60 Hr
3	Service Testing of the telecom equipment	30 Hr

	<ul style="list-style-type: none"> • 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. 	
4	<p>Communication Skills</p> <ul style="list-style-type: none"> • Effective Communication • Verbal and Non-Verbal Communication • Body Language • Listening Skills 	10 Hr
5	<p>Health and Safety</p> <ul style="list-style-type: none"> • 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 and approved procedures • Ensure co-ordination is carried out for the infra technicians and other third party vendor. • Ensure proper earthing of the equipment. • Ensure that Personal protection equipment like anti-static bands appropriately used as required • Ensure compliance to health and safety guidelines both contractually and onsite by the third party vendors and infra technician. 	10Hr

	• Ensure availability of first aid box at site	
	Total Theory / Lecture Hours:	120 Hr
	Total Practical / Tutorial Hours:	80 Hr
	Total Hours:	200 Hr

Recommended Hardware:

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

Recommended Software:

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

Text Books:

ESDM Courses

Level Code: L4 **Vertical Name:** Passive Infra

Course Code: TL/S/L4/C018 **Course Name:** 4.1.3 Telecommunications Tower Equipment Installer and Integrator

Objective of the Course:

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

Learning Outcomes:

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

Expected Job Roles:

Tower Equipment Installer and Integrator

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

350 Hours

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

10+2 pass / ITI

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1	Introduction to telecom tower equipment installation <ul style="list-style-type: none">- 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	<ul style="list-style-type: none">• 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

	<ul style="list-style-type: none"> - 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	<p>Site Maintenance/Management</p> <ul style="list-style-type: none"> - 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

	<p>filled</p> <ul style="list-style-type: none"> - interact with site owners w.r.t. rent, access issues etc. 	
3	<p>Communication Skills</p> <ul style="list-style-type: none"> • Effective Communication • Verbal and Non-Verbal Communication • Body Language • Listening Skills • Coordination — adjusting actions in relation to others' actions. 	10 Hours
4	<p>Health and Safety</p> <ul style="list-style-type: none"> • 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 <p>Ensure escalation of safety incidents to relevant authorities as per guidelines</p>	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:

4.2 Telecom (Handset)

ESDM Courses

Level Code: **Vertical Name:**

Course Code: **Course Name:**

Objective of the Course:

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

Learning Outcomes:

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

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

Expected Job Roles:

Handset Repair Engineer (Level II)

Duration of the Course (in hours)

350

Minimum Eligibility Criteria and pre-requisites, if any

10+2 / ITI(Including final year candidate)

Professional Knowledge:

Functionality / features of handset, specific operating system (OS), hardware components like chipsets, processor etc., basic knowledge of GSM / CDMA, Windows & Android OS.

Test equipments

Handset repairing process, procedures

Troubleshooting techniques (software, fault finding)

Professional Skill:

Equipment operating Skills

Handset Repairing Skills

Handset/Component Handling skills

Troubleshooting Skills

Software Skills

Tablet Repairing Skills

Tablet Handling Skills

Core Skill:

Reading, Writing and Communication Skills

Time Management Skills

Analytical Skills

Interpersonal Skills

Oral Communication (Listening & Speaking Skills)

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1.	Introduction and Job role overview	10
2.	Communication Skills	6
3.	Procedures / processes for repair	15
4.	Problem solving, Fiber testing and splicing	76
5.	Health and Safety & Reporting and Documentation	9
Total Theory / Lecture Hours:		54
Total Practical / Tutorial Hours:		66
Total Hours:		120

Recommended Hardware:

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

Recommended Software:

NIL

Text Books:

Training material for students supported through affiliated training partners.

Reference Books:

NIL

4.3 Telecom (Network Managed Services)

ESDM Courses

Level Code: **Vertical Name:**

Course Code: **Course Name:**

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)

Minimum Eligibility Criteria and pre-requisites, if any

8th

Professional Knowledge:

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

Professional Skill:

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

Core Skill:

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

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1.	Introduction and Job Role Overview	

2.	Communication, Reading & Writing Skills	
3.	Details of Fiber splicing, Cable Laying	
4.	Health and Safety & Reporting and Documentation	
Total Theory / Lecture Hours:		
Total Practical / Tutorial Hours:		
Total Hours:		250 Hours

Recommended Hardware:

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

Recommended Software:

NIL

Text Books:

Training material for students supported through affiliated Training Providers.

Reference Books:

NIL

ESDM Courses

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

Course Code: TL/S/L4/C005 **Course Name:** 4.3.2 Optical Fiber Technician

Objective of the Course:

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

Learning Outcomes:

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

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

Expected Job Roles:

Optical Fiber Technician

Duration of the Course (in hours)

350 Hours

Minimum Eligibility Criteria and pre-requisites, if any

10+2

Professional Knowledge:

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

Professional Skill:

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

Core Skill:

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

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
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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:** 4.3.3 Installation Engineer – SDH & DWDM

Objective of the Course:

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

Learning Outcomes:

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

Installation of Equipment
Acceptance Testing of Equipment
Commissioning of Equipment

Expected Job Roles:

Installation Engineer
Testing & Commissioning Engineer

Duration of the Course (in hours) 400 Hrs

Minimum Eligibility Criteria Diploma (including final year candidate)

and pre-requisites, if any

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	Course Name:	4.3.4 Installation Engineer –Networking Layer2 & Layer3

Objective of the Course:

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

Learning Outcomes:

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

Installation of Equipment
Acceptance Testing of Equipment
Commissioning of Equipment

Expected Job Roles:

Installation Engineer
Testing & Commissioning Engineer

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

Diploma

Professional Knowledge:

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

Professional Skill:

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

Core Skill:

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

Detailed Syllabus of Course

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

Recommended Hardware:

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

Recommended Software:

System Software <will be bundled with equipment>

Text Books:

Training material for students supported through affiliated Training Providers.

Reference Books:

NIL

4.4 Service Providers

ESDM Courses

Level Code: L4 **Vertical Name:** 4.4 Telecome

Course Code: TL/S/L4/C004 **Course Name:** 4.4.1 Broadband Technician

Objective of the Course:

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

Learning Outcomes:

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

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

Expected Job Roles:

Broadband Technician

Duration of the Course (in hours)

350 Hours approx.

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
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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: L2 **Vertical Name:** Telecom Electronic

Course Code: TL/M/L2/C008 **Course Name:** 4.5.1 Telecom Test Technician

Objective of the Course:

Train Test Technician

Learning Outcomes:

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

Expected Job Roles:

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

Duration of the Course (in 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 <ul style="list-style-type: none">- Components- Products- Systems- Results analysis, presenting&Documentation	10 Hours
3	Hands on Electronic and Telecommunication <ul style="list-style-type: none">- Computer operating systems- Schematics readability and traceability- Telecommunication Fundamentals- Wireless communication<ul style="list-style-type: none">o Bluetootho GSM	24 Hours

	<ul style="list-style-type: none"> ○ WCDMA ○ Wi-Fi, ZigBee - Digital and Analog Telecomm Electronics 	
4	<p>Process</p> <ul style="list-style-type: none"> - Safety Awareness - Maintenance Awareness - Production and process - Quality Control Practices & Measurements - Definition of test criteria - Workplace essentials 	10 Hours
5	<p>Failure analysis</p> <ul style="list-style-type: none"> ○ Failure Analysis Methods ○ Common Failure Analysis Techniques ○ Implementing FMEA ○ FMEA Procedure ○ Fault Tree Analysis (FTA) ○ Identifying TO events ○ FTA vs. FMEA 	20 Hours
5	<p>Test Program Generation and Handling</p> <ul style="list-style-type: none"> - Manual Tests - Automated Tests 	24 Hours

	<ul style="list-style-type: none"> - Automated Test Vs. Manual Tests - Best Practices 	
6	<p>Basic Computer Knowledge</p> <ul style="list-style-type: none"> - Basic Computer Concepts <ul style="list-style-type: none"> o What is a computer o Software and Hardware o Operating System Software o Software Applications o Hardware Accessories - Computer Troubleshooting and Repair Basics 	15 Hours
6	<p>MS Office</p> <ul style="list-style-type: none"> - MS Word - MS Excel - MS Power Point - MS Access 	9 Hours
7	<p>RF</p> <ul style="list-style-type: none"> - Introduction to RF Fundamentals - Basic Building Blocks of an RF System <ul style="list-style-type: none"> o Available frequency bands o RF communication systems o Modulation and demodulation 	30 Hours

	<ul style="list-style-type: none"> ○ Basic building blocks of an RF system – components ○ Extending range ○ Key RF parameters - RF Parameters and RF Measurement Equipment <ul style="list-style-type: none"> ○ Vector Network Analyzers ○ Spectrum Analyzers ○ Signal Generators ○ Power Meters ○ Oscilloscopes ○ Function and Arbitrary Waveform Generators ○ Spread spectrum systems – DSSS / FHSS / Frequency Agility - RF Toolkits <ul style="list-style-type: none"> ○ 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	6 Hours

	<ul style="list-style-type: none"> - Care and maintenance - Failure Reporting <ul style="list-style-type: none"> o Collecting data o Reporting Equipment Failure o Reporting Software Problems o Logging Data - Analysis <ul style="list-style-type: none"> o Failure Analysis o Failure review o Failed Equipment Procurement - Cleaning, disinfection and sterilization - Disposal of waste 	
8	<p>Communication skills</p> <ul style="list-style-type: none"> o Level of communication o Total communication process o Barriers in communication o Basic reasons we Do Not Listen o Level of listening o Improve listening skills o Body Language and types o Most common way to communicate 	12 Hours
7	- SMT, TELECOM PCBs	10 Hours

	<ul style="list-style-type: none"> ○ 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 ○ 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	<p>ESD</p> <ul style="list-style-type: none"> ○ Introduction ○ Basics of ESD controls ○ Sevens Sins of ESD Control ○ Static Electricity ○ ESD Mathematics ○ Static Charge Generation ○ Triboelectric Series Chart ○ Discharge Times 	20 Hours

	<ul style="list-style-type: none"> ○ IC upsets from ESD EMI ○ Storage and Handling ○ Humidity and ESD Control ○ Ray's ESD Prevention Secrets ○ ESD Protection 	
	Total Theory / Lecture Hours:	120
	Total Practical / Tutorial Hours:	80
	Total Hours:	200

Recommended Hardware:

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

Recommended Software:

MS Office

Text Books:

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

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

Reference Books:

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

ESDM Courses

Level Code:

L3

Vertical Name:

Telecom Electronics

Course Code:

TL/M/L3/C009

Course Name:

4.5.2 Board Bring Up Engineer

Objective of the Course:

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

Learning Outcomes:

Participants successfully completing this course will:

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

Expected Job Roles:

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

Duration of the Course (in hours)

350 Hours

Minimum Eligibility Criteria and pre-requisites, if any

10th, Undergoing ITI, Electronic/Electrical/Mechanical (Including final year candidates)

Professional Knowledge:

An individual on the job needs to know and understand:

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

Professional Skill:

<p>An individual should have following Professional Skills</p> <ul style="list-style-type: none">• Ability to work with Test & 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:

<p>An individual on the job should have following Core Skill</p> <ul style="list-style-type: none">• 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: <ul style="list-style-type: none">• Multimeter, LCR Meter, Function Generator	

	<ul style="list-style-type: none"> • CRO, Logic Analyzer, IR Thermometer • Power Supplies 	20
3.	<p>Bare Board Testing</p> <ul style="list-style-type: none"> • 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.	<p>Electronic Design Overview</p> <p>Understanding the coding standards, failure modes, specifications and measurement parameters of electronic components:</p> <ul style="list-style-type: none"> • Passive Components • Active Components • Sensors • Cables & Connectors • Batteries • Antenna Topologies • Basic introduction to MCU Testing 	50
5.	<p>Circuits & Design Sections</p> <p>Understanding operation, failure modes, specifications and measurement parameters of commonly used circuits and design sections:</p> <ul style="list-style-type: none"> • 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.	<p>PCB Assembly & Testing</p> <p>Introduction to PCB Assembly tools, techniques and industry practices</p> <ul style="list-style-type: none"> • PCB Workbench • Soldering/De-soldering Tools & Techniques • Section wise Assembly 	

	<ul style="list-style-type: none"> • Section wise Testing • Common Assembly Defects & Their Fixes • Troubleshooting & Debug 	50
7.	MCU Related Testing <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Functional Testing • Stress Testing • Parametric Testing • Use Case Testing 	20
9.	Design Enablement <ul style="list-style-type: none"> • Readying Board for Commissioning • System Integration • Maintenance • HOT state Debug, Troubleshooting 	40
10.	Communication Skills, soft skills, Life skills	10
11.	Health and Safety (including electrical safety) & Reporting and Documentation	10
	Practical	200
	Theory	150
	Total Hours	350

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

Recommended Hardware:

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Recommended

Express PCB

Software:

R8C 1A/1B / PIC IDE, Debugger, Emulator

Text Books:

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

ESDM Courses

Level Code:

L4

Vertical Name:

Telecom Electronics

Course Code:

TL/M/L4/C010

Course Name:

4.5.3 Telecom Embedded Hardware Developer

Objective of the Course:

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

Learning Outcomes:

Participant shall learn

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

Expected Job Roles:

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

Duration of the Course (in hours)

350 hrs

Minimum Eligibility Criteria and pre-requisites, if any

Diploma (Including final year candidate)

Professional Knowledge (Acquired):

The participant shall know and understand

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

Professional Skill (Acquired):

Reading and writing skills

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

Tool Usage

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

Core Skill:

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

Detailed Syllabus of Course

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

•	Overview of Telecom Embedded Hardware Design from Concept to Commercialization	10/10
•	<p>Introduction to key electronic and electrical components found in a typical Telecom Device/Equipment to cover:</p> <ul style="list-style-type: none"> • 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
•	<p>Embedded C</p> <ul style="list-style-type: none"> • Introduction to Embedded C programming • Data Structures • Generating Function Calls & SW Routines Embedded C Programming with HEW 	25/50
•	<p>Industrial Grade Microcontroller Architecture</p> <ul style="list-style-type: none"> • Architecture of 16/32-bit MCUs used in Telecom Networking Equipment, Consumer Devices & Products • Choosing a MCU for your Telecom application 	10/20
•	<p>Introduction to Development & Debug Tool Suites:</p> <ul style="list-style-type: none"> • Introduction to IDE • Introduction to Emulators • Introduction to MCU Programmers 	10/20

•	Working with & developing basic firmware blocks of Application Software <ul style="list-style-type: none"> • 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**

4.6 Telecom Industry Engineer

ESDM Courses

Level Code:	L3	Vertical Name:	Telecom Industry Engineer
Course Code:	TL/S/L3/C012	Course Name:	4.6.1 Telecom Industry Network Security Technician

Objective of the Course:

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

Learning Outcomes:

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

Expected Job Roles:

- Telecom Network Administrator

- Telecom Network L1 Engineer

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

350 Hours

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

ITI / Diploma

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1	<p>Operation of IP Data Networks</p> <ul style="list-style-type: none"> • 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	<p>LAN Switching Technologies</p> <ul style="list-style-type: none"> • Determine the technology and media access control method for Ethernet networks • Identify basic switching concepts and the operation of switches 	20 Hours

	<ul style="list-style-type: none"> • Configure and verify initial switch configuration including remote access management <ul style="list-style-type: none"> - A hostname - Managing IP address - IP default-gateway - Local user and password - Enable secret password - Console and VTY logins - Exec-timeout - Service password encryption - Copy run start • Verify network status and switch operation using basic utilities <p>Describe how VLANs create logically separate networks and the need for routing between them</p> <ul style="list-style-type: none"> • Explain network segmentation and basic traffic management concepts <p>Configure and verify VLANs</p> <p>Configure and verify trunking on switches</p> <ul style="list-style-type: none"> • dtp (topic) • auto-negotiation <p>Identify enhanced switching technologies</p> <ul style="list-style-type: none"> • RSTP • PVSTP • Ether channels <p>Configure and verify PVSTP operation</p> <ul style="list-style-type: none"> • Describe root bridge election • Spanning tree mode 	
3	<p>IP Addressing (IPv4/IPv6)</p> <p>Describe the operation and necessity of using private and public IP addresses for IPv4 addressing</p> <p>Identify the appropriate IPv6 addressing scheme to satisfy addressing requirements in a LAN/WAN environment</p> <p>Identify the appropriate IPv4 addressing scheme using VLSM and summarization to satisfy addressing requirements in a LAN/WAN environment.</p> <p>Describe the technological requirements for running IPv6 in</p>	20 Hours

	<p>conjunction with IPv4 Describe IPv6 addresses</p>	
4	<p>IP Routing Technologies Describe basic routing concepts Configure and verify utilizing the CLI to set basic Router configuration Configure and verify operation status of a device interface Verify router configuration and network connectivity using Configure and verify routing configuration for a static or default route given specific routing requirements Differentiate methods of routing and routing protocols Configure and verify OSPF Configure and verify interVLAN routing (Router on a stick)</p> <ul style="list-style-type: none"> • sub interfaces • upstream routing • encapsulation <p>Configure SVI interfaces Manage IOS Files Configure and verify EIGRP (single AS)</p>	25 Hours
5	<p>IP Services Configure and verify DHCP (IOS Router)</p> <ul style="list-style-type: none"> • Configuring router interfaces to use DHCP • DHCP options (basic overview and functionality) • Excluded addresses • Lease time <p>Describe the types, features, and applications of ACLs</p> <ul style="list-style-type: none"> • Standard (editing and sequence numbers) • Extended • Named • Numbered • Log option <p>Configure and verify ACLs in a network environment</p> <p>Describe SNMP v2 and v3</p>	25 Hours
6	<p>Network Device Security Configure and verify network device security features Configure and verify Switch Port Security Configure and verify ACLs to filter network traffic</p>	10 Hours

	Configure and verify ACLs to limit telnet and SSH access to the router	
7	<p>Troubleshooting</p> <p>Troubleshoot and correct common problems associated with IP addressing and host configurations</p> <p>Troubleshoot and resolve VLAN problems</p> <p>trunking problems on switches</p> <p>ACL issues</p> <p>Troubleshoot and resolve Layer 1 problems</p> <p>Identify and correct common network problems</p> <p>Troubleshoot and resolve spanning tree operation issues</p> <p>Troubleshoot and resolve routing issues</p> <p>Troubleshoot and resolve OSPF problems</p> <p>Troubleshoot and resolve EIGRP problems</p> <p>Troubleshoot and resolve interVLAN routing problems</p> <p>Troubleshoot and resolve WAN implementation issues</p> <p>Monitor Net Flow statistics</p> <p>TS Ether Channel problems</p>	20 Hours
8	<p>WAN Technologies</p> <p>Identify different WAN technologies</p> <p>Configure and verify a basic WAN serial connection</p> <p>Configure and verify a PPP connection between routers</p> <p>Configure and verify Frame Relay on routers</p> <p>Implement and troubleshoot PPPoE</p>	20 Hours
9.	<p>Health and Safety & Reporting and Documentation</p> <ul style="list-style-type: none"> • 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 	50 hours

	<p>helmets, knee pads, safety boots, safety glasses and trench guards are appropriately used as required</p> <ul style="list-style-type: none"> • Ensure adherence to emergency plans in case of safety incidents • Ensure escalation of safety incidents to relevant authorities • Ensure cable id/ make and drum numbers are recorded for future fault localization 	
	Total Theory / Lecture Hours:	200
	Total Practical / Tutorial Hours:	150
	Total Hours:	350

Recommended Hardware:

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

Recommended Software:

ACIT/GNS3 Simulators

Text Books:

ACIT E-Learning Workbooks

Reference Books:

4.7 Telecom Manufacturing

ESDM Courses

Level Code:	L4	Vertical Name:	Telecom Manufacturing
Course Code:	TL/M/L4/C013	Course Name:	4.7.1 Electrical Testing of Telecom Assemblies

Objective of the Course:

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

Learning Outcomes:

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

Expected Job Roles:

1. Telecom BBT Operator / Supervisor
2. Telecom In-circuit Tester Operator / Supervisor

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

350 Hours

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

ITI / Diploma in Electronics , Telecom or B.Sc. in Electronics

Professional Knowledge:

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

Professional Skill:

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

Core Skill:

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

Detailed Syllabus of Course

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

	Methods, Data & Fixture Preparation, Combined Testing Methods		
3	Bare Board Test Equipments Introduction, System Alternatives, Universal Grid Systems, Flying Probe/ Moving Probe Systems, Verification & Repair, Test Department Planning and Management	12	38
4	Design for Testing Introduction, AD-HOC Design for Testability, Structured Design for Testability, Standard Based Testing	10	35
5	Telecom Assembled Board Testing Introduction, The Process of Testing, Testing Approaches, In-circuit Test Techniques, Alternate to conventional Electrical Tests, Tester Comparisons	12	38
	Sub Total	48	152
6	Safety, Health & Environment <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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 		30

	<ul style="list-style-type: none"> • Fuel Management System, Cell Site Audit • House Keeping & Scrap Management <p>Earthing: Earth resistance < 2 ohms, Measurement of Earth electrode resistance, Periodic maintenance of earth system in cell sites</p>	
7	<p>Safety, Reporting and Documentation</p> <ul style="list-style-type: none"> • 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 <p>Ensure cable id/ make and drum numbers are recorded for future fault localization</p>	40
8	<p>Communication, Reading & Writing Skills</p> <ul style="list-style-type: none"> • Demonstrate effective communication Skills to liaise and coordinate with third party vendors, supervisor and peers <p>filling technical forms, activity logs in required format</p>	50
9	<p>Maintaining Reports and Records</p> <ul style="list-style-type: none"> • Document site acceptance testing as per AT specified 	

	<p>format</p> <ul style="list-style-type: none"> • 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 <p>Core Skills/Generic Skills</p> <ul style="list-style-type: none"> • 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 **Course Name:** 4.7.2 IPC Acceptability Criteria of Telecom PCB Assemblies

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	<p>Telecom Printed Circuit Boards related Defects</p> <p>Gold Surface Contact Area, Laminate conditions, Conductors / Lands, Flexible and Rigid –Flex Printed Circuitry, Marking, Cleanliness, Solder Mask Coating, Conformal Coating & Encapsulation</p>	16
10	<p>Discrete Wiring in Telecom</p> <p>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</p>	6
11	<p>Safety, Health & Environment</p> <ul style="list-style-type: none"> • 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 <p>Smoke detector and fire alarm</p> <p>Threats to fire safety</p> <ul style="list-style-type: none"> • 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 <p>Earthing: Earth resistance < 2 ohms, Measurement of Earth electrode resistance, Periodic maintenance of earth system in cell sites</p>	30

12	<p>Safety, Reporting and Documentation</p> <ul style="list-style-type: none"> • 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 <p>Ensure cable id/ make and drum numbers are recorded for future fault localization</p>	40
13	<p>Communication, Reading & Writing Skills</p> <ul style="list-style-type: none"> • Demonstrate effective communication Skills to liaise and coordinate with third party vendors, supervisor and peers <p>filling technical forms, activity logs in required format</p>	50
14	<p>Maintaining Reports and Records</p> <ul style="list-style-type: none"> • 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 	30

	<p>instruction</p> <p>Core Skills/Generic Skills</p> <ul style="list-style-type: none"> • Write acceptance testing report as per the specified report format • Reporting: Test script/cases, Recommendations and risk strategy, Test input and output information, used and created by conducting the tests, Test results, both detailed and summary • Resources 	
	Total	270

Total Course Theory / Lecture Hours: 270 Hours

Total Course Practical / Tutorial Hours: 80 Hours

Total Course Hours: 350 Hours

Recommended Hardware:

None

Recommended Software:

None

Text Books:

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

Reference Books:

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

Evaluation criteria:

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

ESDM Courses

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

Course Code: TL/M/L4/C016 **Course Name:** 4.7.3 SMT Process for Telecom Boards

Objective of the Course:

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

Learning Outcomes:

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

Expected Job Roles:

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

Duration of the Course (in hours) 350 Hours

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

Professional Knowledge:

1. Complete knowledge about Telecom SMT process used for telecom assemblies such as solder paste printing, pick & place machine programming, process of pick & place machine, Reflow soldering process and AOI.
2. Basic raw materials and chemicals used for Telecom SMT process.
3. Different test equipments, tools, machines and process used for Telecom SMT process.
4. Critical process parameters and acceptability quality requirement of Telecom SMT assemblies.
5. Awareness about surface mount devices used in Telecom telecom assemblies
6. Safety and environmental norms to be followed during SMT process.
7. Advantage of SMT components over through 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	<p>Module 1: Basics of Telecom SMD Components</p> <p>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.</p>	10	35
2	<p>Module 2: Telecom SMT Process</p> <p>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.</p>	25	85
3	<p>Module 3: Safety Guidelines in Telecom - Pick & Place Assembly Process :</p> <p>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.</p>	5	15

4	<p>Module 4: Soft Skills</p> <p>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.</p>	8	17
	Sub- Total	48	152
5	<p>Safety, Health & Environment</p> <ul style="list-style-type: none"> • 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 <p>Smoke detector and fire alarm</p> <p>Threats to fire safety</p> <ul style="list-style-type: none"> • 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 	30	

	<ul style="list-style-type: none"> • Fuel Management System, Cell Site Audit • House Keeping & Scrap Management <p>Earthing: Earth resistance < 2 ohms, Measurement of Earth electrode resistance, Periodic maintenance of earth system in cell sites</p>	
6	<p>Safety, Reporting and Documentation</p> <ul style="list-style-type: none"> • 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 <p>Ensure cable id/ make and drum numbers are recorded for future fault localization</p>	40
7	<p>Communication, Reading & Writing Skills</p> <ul style="list-style-type: none"> • Demonstrate effective communication Skills to liaise and coordinate with third party vendors, supervisor and peers <p>filling technical forms, activity logs in required format</p>	50
8	<p>Maintaining Reports and Records</p> <ul style="list-style-type: none"> • Document site acceptance testing as per AT specified 	

	<p>format</p> <ul style="list-style-type: none"> • 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 <p>Core Skills/Generic Skills</p> <ul style="list-style-type: none"> • 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
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Total Course Theory / Lecture Hours: 198 Hours

Total Course Practical / Tutorial Hours: 152 Hours

Total Course Hours: 350 Hours

Recommended Hardware:

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

Recommended Software:

CAM350 software for editing pick & place machine program.

Text Books:

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

Reference Books:

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

Evaluation criteria:

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

ESDM Courses

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

Course Code: TL/M/L4/C017 **Course Name:** 4.7.4 Soldering of Telecom Board Assemblies

Objective of the Course:

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

Learning Outcomes:

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

Expected Job Roles:

- Telecom Wave Soldering Machine operator
- Telecom Wave Soldering Machine Process Supervisor
- Telecom Hot Air Reflow Soldering Machine Operator
- Telecom Hot Air Reflow Soldering Process Supervisor

Duration of the Course (in hours) 350 Hours

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

Professional Knowledge:

- Complete knowledge about soldering process used for telecom assemblies such as Telecom wave soldering, hot air reflow soldering and manual soldering.
- Basic raw materials and chemicals used for soldering process.
- Different test Telecom equipments, tools, machines and process used for PCB soldering process.
- Critical process parameters and acceptability quality requirement of Telecom PCB's assemblies
- Awareness about through hole and surface mount devices used in telecom assemblies
- Safety and environmental norms to be followed during soldering process.
- Advantage of SMT components over through 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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Ensure appropriate disposal of the cut fibers, sleeves and 	40	

	<p>cable pieces</p> <ul style="list-style-type: none"> • 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 <p>Ensure cable id/ make and drum numbers are recorded for future fault localization</p>	
	<p>Communication, Reading & Writing Skills</p> <ul style="list-style-type: none"> • Demonstrate effective communication Skills to liaise and coordinate with third party vendors, supervisor and peers <p>filling technical forms, activity logs in required format</p>	50
	<p>Maintaining Reports and Records</p> <ul style="list-style-type: none"> • 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

	<p>Core Skills/Generic Skills</p> <ul style="list-style-type: none"> • 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 	
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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

http://en.wikipedia.org/wiki/Wave_soldering

Reference Books:

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

Evaluation criteria:

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

ESDM Courses

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

Course Code: TL/M/L4/C021 **Course Name:** 4.7.5 Telecom Quality Technician

Objective of the Course:

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

Learning Outcomes:

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

Expected Job Roles:

- Telecom QC Technician
- Process Telecom QC Technician
- Final Telecom QC Technician

Duration of the Course (in hours) 350 Hours

Minimum Eligibility Diploma in Telecom ,Electronics, electrical, Instrumentation

Criteria and pre-requisites, if any

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Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
QT 001	7QC tools for Telecom , FMEA, Mitigation/Control plans, Review <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 7 QC tools, their usage and examples • Introduction to KAIZEN techniques, case study 	15 Hours
QT 003	Risk Analysis <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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 	30 Hours

	<ul style="list-style-type: none"> • Various steps used in SMT • Types of mass soldering techniques • Introduction to reflow soldering, wave soldering 	
QT 004	<p>Knowledge of ESD, MSD for Telecom</p> <ul style="list-style-type: none"> • 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	<p>Team Management and Communication, System Log - Telecom</p> <ul style="list-style-type: none"> • 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
	<p>Safety, Health & Environment</p> <ul style="list-style-type: none"> • 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 <p>Smoke detector and fire alarm</p> <p>Threats to fire safety</p> <ul style="list-style-type: none"> • Classification of fire 	30 hrs

	<ul style="list-style-type: none"> • 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 <p>Earthing: Earth resistance < 2 ohms, Measurement of Earth electrode resistance, Periodic maintenance of earth system in cell sites</p>	
	<p>Safety, Reporting and Documentation</p> <ul style="list-style-type: none"> • 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 <p>Ensure cable id/ make and drum numbers are recorded for future fault localization</p>	40 hrs
	<p>Communication, Reading & Writing Skills</p> <ul style="list-style-type: none"> • Demonstrate effective communication Skills to liaise and coordinate with third party vendors, supervisor and peers 	50 hrs

	filling technical forms, activity logs in required format	
	<p>Maintaining Reports and Records</p> <ul style="list-style-type: none"> • 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 <p>Core Skills/Generic Skills</p> <ul style="list-style-type: none"> • Write acceptance testing report as per the specified report format • Reporting: Test script/cases, Recommendations and risk strategy, Test input and output information, used and created by conducting the tests, Test results, both detailed and summary • Resources 	30 hrs
	Total Theory / Lecture Hours:	260
	Total Practical / Tutorial Hours:	90 Hours
	Total Hours:	350 Hours

Recommended Hardware:

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

Recommended Software:

System used like ERP, ISO 9001

Text Books:

- Telecom Quality Control on the shop floor by Krishnamuthy
- Guide to Quality control- Ishikawa
- Learn to Solder by Brian Jepson
- Reflow soldering process by Nin-Cheng Lee

Reference Books:

- Telecom Statistical methods for Quality Improvement- Hitoshi Kume
- The QC problem solving approach- by Katsuya Hosotani
- Electronics Quality Mgt Handbook by Marsha Ludwig Becker
- Handbook of Machine soldering by Ralph Woodgate

ESDM Courses

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

Course Code: TL/S/L4/C014 **Course Name:** 4.8.1 Grass Root Telecom Provider

Objective of the Course:

To develop skills that allow an individual to keep ONT site operational, maintenance of hardware & repair of first level basic faults, promote use of devices among local population and provide services.

The individual will have working knowledge of following;

1. Functioning of E terminals, smart phones, CCU, SPV, TJB, Battery bank & fire extinguisher.
2. Troubleshooting for problems in equipment and carrying out basic repairs.
3. Preventive Maintenance of equipment at ONT site.

Learning Outcomes:

By participating & successfully completing this course,

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

Expected Job Roles:

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

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

350 hours

**Minimum Eligibility
Criteria and pre-
requisites, if any**10th + ITI, 12th pass**Detailed Syllabus of Course**

S.No.	Module. Name	Duration
1	Fundamentals & functions of computer <ul style="list-style-type: none">• Understanding different component of a computer• Basic Function of computer• Hardware part of the computer	5 Hr.
2	Installation ,connections & Basic operation of computer <ul style="list-style-type: none">• 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	10 Hr

	<ul style="list-style-type: none"> • Typing skills/Unicode multi language typing • Understanding and Handling of Laptop computer 	
4	<p>Networking, LAN/WAN & Internet connectivity</p> <ul style="list-style-type: none"> • Understanding the networking LAN/WAN and internet Connectivity. • Handling of Modems • Implement and troubleshoot switch administration • Layer- 2 WAN circuit technologies 	10 Hr.
5	<p>Functioning of modem, Routers & UPS</p> <ul style="list-style-type: none"> • Understanding the connection of modem, router and UPS • Function and troubleshooting of modem, router and UPS 	10 Hr.
6	<p>Termination of OFC, Functionality of ONT, CCU, SPV, TJB, Battery Pack & fire extinguishers</p> <ul style="list-style-type: none"> • Understanding the functionality of various equipments • Safe handling and use of each equipment 	25 Hr
7	<p>Basic electrical wiring patch cord & pigtails</p> <ul style="list-style-type: none"> • Basic electrical connection, wiring of equipments. 	10 Hr.
8	<p>Installation of software, anti-virus programmes and Applications</p> <ul style="list-style-type: none"> • Learning the method of how to install and uninstall a program of various types. 	15 Hr
9	<p>Introduction to MS Office & practical applications</p> <ul style="list-style-type: none"> • Introduction to MS Office • Practical learning on MS – Word, Excel, Powerpoint 	20 Hr
10	<p>Preventive Maintenance-Need & objective</p>	5 Hr.
10 (a)	<p>Handling of variety of Land-line/ cordless phones, Mobile phones, Smart phones and their Battery Packs,</p>	10 Hr

	Download of applications, use of SMS and MMS	
11	Guidelines & schedules for preventive Maintenance for CCU,SPV,TJB, Battery Bank <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Effective Communication ; Verbal and Non-Verbal Communication; Body Language; Listening Skills 	5 Hr.
15`	Trouble shooting for faults <ul style="list-style-type: none"> • UPS, Router, SMPS, Modem, CPU system installation etc. 	15 Hr.
4.	Health and Safety & Reporting and Documentation <ul style="list-style-type: none"> • 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 	50 Hr

	<ul style="list-style-type: none"> • Ensure escalation of safety incidents to relevant authorities • Ensure cable id/ make and drum numbers are recorded for future fault localization 	
	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:

4.9 Network Operation & Maintenance

ESDM Courses

Level Code: **Vertical Name:**

Course Code: **Course Name:**

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	<p>Basic knowledge of Networking</p> <p>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. Identify applications handled and used in the network Identify internet connectivity pattern Ensure NOC is notified prior to undertaking the maintenance or change activity.</p>	20 hrs
2	<p>Layer 2 Technologies</p> <p>LAN switching technologies Layer 2 Multicast Layer 2 WAN circuit technologies Troubleshooting layer 2 technologies</p>	50 Hours
3	<p>Layer 3 Technologies</p> <ul style="list-style-type: none"> - Addressing technologies - Layer 3 Multicast - Fundamental routing concept - RIP v2 - EIGRP [for IPv4 and IPv6] - OSPF [v2 and v3] - BGP - Troubleshooting layer 3 technologies 	150 Hours
4	<p>VPN Technologies</p> <ul style="list-style-type: none"> - Tunnelling - Encryption 	100 Hours

	- Troubleshooting VPN technologies	
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

ESDM Courses

Level Code: L4 **Vertical Name:** Service

Course Code: TL/S/L4/C020 **Course Name:** 4.10.1 Tele-health technician

Objective of the Course:

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

Learning Outcomes:

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

Expected Job Titles:

Telehealth technician
Telehealth Biomedical Technician
Telehealth Instrumentation Technician
Telehealth administrator
Telehealth co-ordinator

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

350 Hours

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

10th Pass + ITI / Diploma (Electronics, Instrumentation, Biomedical)

Detailed Syllabus of Course

Module. No	Module. Name	Minimum No. of Hours
1.	History , Definition and Current Applications <ul style="list-style-type: none">• 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,	20

	<p>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</p> <ul style="list-style-type: none"> • Video conferencing room requirements 	
2.	<p>Tele health peripherals – integration</p> <ul style="list-style-type: none"> - Examination Cameras Medical Scopes & Camera/ Illumination Systems Stethoscopes Vital Signs Monitors ECGs, Spirometers, and Holters Retinal Camera Ultrasound Probes Pulse Oximeter 	40
3.	<p>Telecommunication Technologies in Health care</p> <ul style="list-style-type: none"> • 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.	<p>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):</p>	30
5.	<p>Computerization of Medical Records and E- Health Services</p> <ul style="list-style-type: none"> - Method of generating computerised medical reports - E health Services - Payment Gateways 	10

6.	Telecom equipments – interoperability and integration Interoperability Standards : UHID, HL7, DICOM, SNOMED-CT, RxNORM, CCD, CDA, ICD 10, LOINC, CPT, WHO-ICD-PCS, NIC/ NOC/ NANDA, OPCS4, UK, DSM,CD2,CFR10, Meta-data and data standards for health domain	20
7.	Privacy, Confidentiality, Security, Data Integrity HIPPA , Contraception and Medico Legal Case (MLC),Legal Aspects – PNDDT 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 –
Telestethoscope, 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>

