

Syllabi of Courses

for

Roll-out of Skill Development in ESDM sector

By

NIELIT

Under the “Scheme for Financial assistance to select States/UTs for Skill Development in ESDM sector”

of

Department of Electronics and Information Technology

*Ministry of Communications & Information Technology,
Government of India*

INDEX

1.1	Consumer Electronics	3
1.1.1	Diploma in Installation & Repair of Consumer Electronics Products	4
1.2	Electronic Product Design	8
1.2.1	Certificate Course in Electronic Product Testing.....	9
1.3	Industrial Automation	16
1.3.1	Diploma in Repair & Maintenance of Industrial Instrumentation &Automation System	17
1.4	Industrial Electronics	54
1.4.1	Repair & Maintenance of Power Supply, Inverter & UPS	55
1.5	Medical Electronics	63
1.5.1	Repair & Maintenance of Dental equipment	64
1.5.2	Repair & Maintenance of ECG and ICCU Equipment	67
1.5.3	Repair & Maintenance of Imaging Equipment (X-Ray & Ultrasound machine)	70
1.5.4	Post Diploma in Repair & Maintenance of Hospital Equipment	73
1.6	Office Automation, IT & Networking	76
1.6.1	Installation & Maintenance of Photocopiers and Printers.....	77

1 National Institute of Electronics and Information Technology (NIELIT)

1.1 Consumer Electronics

S. No.	Course ID	Name of the Course	Level
1	L4 CE1 GO	Diploma in Installation & Repair of Consumer Electronics Products	L4

National Institute of Electronics and Information Technology

ESDM Courses

Level Code:	L4	Vertical Name:	Consumer Electronics
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Course ID:	L4 CE1 GO	Course Name:	1.1.1 Diploma in Installation & Repair of Consumer Electronics Products
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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)	350 Hours
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Minimum Eligibility Criteria and pre-requisites, if any	ITI or 12 th pass
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Professional Knowledge:

The individual on the job needs to know and understand:

- PK1. Knowledge of spare management and repair & return process for faulty
- PK2. components
 - 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
- PK6. Functionality of hardware components of Consumer Electronics Products
- PK7. Procedure to dismantle and assemble Consumer Electronics Products
 - 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.
- PS18.

Make use of standard OEM specified troubleshooting steps
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
- Time Management Skills**
- CS6. Prioritize and execute tasks in a high-pressure environment
CS7. Use and maintain resources efficiently and effectively
- Analytical Skills**
- CS8. Analyse (and understand) Manufacturing Process based on Company need
CS9. Interpret reports, readings and numerical data
CS10. Keep up to date with new technology and performance issues
- Other Skills**
- CS11. Create and maintain effective working relationships and team environment through collaboration
CS12. Take initiatives and progressively assume increased responsibilities
CS13. Share knowledge with other team members and colleagues
CS14.

Detailed Syllabus of Course

Module. No	Modules	Minimum No. of Hours (Theory/Practical)
1.	LCD-LED TV and Monitor: - Basic Principle, Working and Operation of LCD-LED TV and Monitor, Installation, Repair Maintenance and Serving and Practice, Fault Diagnosis and Error Remover Techniques and Practices	25/80
2.	Cable TV and DTH Services: - Basic Principle, Working and Operation of Cable TV and DTH Services, Installation and Checking, Repair Maintenance, Serving and Practice, Fault Diagnosis and Error Remover Techniques and Practices.	25/70
3.	VCD-DVD Player and Home Theatre System: - Basic Principle, Working and Operation of VCD-DVD Player and Home Theatre System, Installation, Repair, Maintenance, Serving and Practice, Fault Diagnosis and Error Remover Techniques and Practices.	25/50

4.	FM Radio- Cordless Phone-Hair Dryer: - Basic Principle, Working and Operation of FM Radio-Cordless Phone-Hair Dryer, Installation, Repair, Maintenance, 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:

- For a Batch of 50 No's
- Trainer Kits of all Consumer Product as mentioned in Detail Syllabus of Course Content: 10 No's Each
 - For those Consumer Electronics Product whose Trainer Kits are not Available product will be purchased and dismantle by Trainer for individual Practice: 10 No's each.
 - Complete Electronics-Electrical Tool Kit: 10 No's Each

Recommended Software:

As prescribed and provided by Consumer Electronics Product Manufacturer. No need to purchase externally and can be downloaded from respective manufacturer web sites

Text Books:

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

Reference Books:

User Manual as provided by Consumer Electronics Product Manufacturer.

1.2 Electronic Product Design

S. No.	Course ID	Name of the Course	Level
1	L3 EP1 AS	Certificate Course in Electronic Product Testing	L3

National Institute of Electronics and Information Technology

ESDM Courses

Level Code:	L3	Vertical Name:	Electronic Product Design
Course ID:	L3 EP1 AS	Course Name:	1.2.1 Certificate Course in Electronic Product Testing

Objective of the Course:

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

Learning Outcomes:

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

Expected Job Roles:

Technician-In Electronic Products Testing / QA Areas

Duration of the Course (in hours) 360 Hrs

Minimum Eligibility Criteria and pre-requisites, if any 10th / 12th Pass with Science background

Professional Knowledge:

1. Fundamentals of electricity & Electronics
2. Use of Tools and Test and Measuring equipments such as CRO, Multimeter, Signal Generator, LCR meter etc
3. Handling of Different electronics Components and Electrostatic discharge
4. Awareness of Types of Product testing, Safety Standards & Certificates
5. Awareness of Quality standards, Calibration of Equipments etc
6. Specifications of Products and their testing Procedures

7. Basic knowledge of working principle of Different Electronic Products
8. Understanding of internal modules and major components used in the Product
9. Testing of Electronic Components
9. Safety rules, policies and procedures

Professional Skill:

1. Systematic Approach to Testing of Products
2. Use of Tools and Test and Measuring equipments such as CRO, Multimeter, Signal Generator, LCR meter etc
3. Fault Diagnosing skills- Detect basic electrical faults such as improper earthing, defective power chord, connector or wiring defects, loose connections etc.,
4. Good Soldering & de-soldering Skills
5. Use oscilloscope for diagnosing faults
6. Sound Judgement based on quality Standards and Company Policy

Core Skill:

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

Detailed Syllabus of Course

Communication and Soft skills

Module. No	Module Name	Minimum No. of Hours
Module 1.	Personal Skills Knowing Oneself, Confidence Building, Defining Strengths, Thinking Creatively, Personal Values, Time and Stress Management	10 hrs

Module 2.	Social Skills Appropriate and Contextual Use of Language, Nonverbal Communication, Interpersonal Skills, Problem Solving, Understanding Media, Public Speaking	30 hrs
Module 3.	Professional Skills Organizational Skills, Team Work, Business/Technical Communication, Job Oriented Skills, Professional Etiquette	30 hrs
Module 4.	Training for Language Proficiency Tests Integrated Skills, Integrated Skills, Integrated Skills, Practice Exercises, Practice Tests	20 hrs
Module 5.	Preparing and Presenting a Project Brainstorming, Gathering, Selecting, Processing, Cohesive and Coherent Organization, Drafting and Revising, Presentation of the Project	10 hrs

Theory / Lecture Hours: 100

IT Skills

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

Practical / Tutorial Hours: 80

	Module. 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

<p>Module 4.</p>	<p>Testing Procedures(Practical)</p> <p>Testing of Basic Electronic Components Resistor (Parameter to be measured: Resistance Value), Capacitor(Parameter to be measured: Capacitance Value, IR at rated Voltage), Inductor(Parameter to be measured: Inductance Value, DC Resistance), Diode(Parameter to be measured: Resistance in forward direction and reverse direction), Transistors-PNP and NPN (Parameter to be measured: Each PN Junction shall be tested as in diode testing), Transformer basics, ICs, Thyristors and IGBT testing, Pin configuration of some important ICs used in SMPS,UPS and Inverters, testing of Induction cookers</p> <p>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)</p> <p>3. Tubular Batteries (Applicable standard : IS 1651) Test for Capacity, Test for voltage during discharge</p> <p>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</p>	<p>90</p>
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	<p>Power Supply variations)</p> <p>5. Invertor (Applicable Standard : IS 13314) Visual Inspection, High Voltage Test, Insulation Resistance Test, No –Load Test, Output Test</p> <p>6. UPS (Applicable Standard : IEC 62040-3) Steady State Input Voltage Tolerance, Output-Normal Mode – No Load, Output-Normal Mode – Full Load, Output- Stored Energy Mode – No Load, Output- Stored Energy Mode – Full Load, Output-Normal Mode – Over Load, Output- Stored Energy Mode – Over Load Output- Normal Mode – Short Circuit, Output- Stored Energy Mode – Short Circuit, Efficiency and Input Power factor</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 Appliance (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</p>	
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	power levels, Response to various inputs sources like DVD player, IPOD, CD player, etc., audio output power, Power Consumption, Voltage range test, Touch Current	
	Intership/ Practical training	30

Total Course Theory / Lecture Hours: 160

Total Course Practical / Tutorial Hours: 200

Total Course Hours: 360

Recommended Hardware:

Electronics lab in Polytechnic Colleges

Recommended Software:

Nil

Text Books:

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

Reference Books:

1.3 Industrial Automation

S. No.	Course ID	Name of the Course	Level
1	L4 IA1 CA	Diploma in Repair & Maintenance Industrial Instrumentation & Automation System	L5

National Institute of Electronics and Information Technology
ESDM Courses

Level Code:	L5	Vertical Name:	Industrial Automation
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Course ID:	L 5 IA1 CA	Course Name:	1.3.1 Diploma in Repair & Maintenance of Industrial Instrumentation &Automation System
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Objective of the Course:

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

Learning Outcomes :

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

Expected Job Roles:

As Technician in Process Industries.

Duration of the Course (in hours)

400

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
- PK3. Have basic knowledge of electrical and electronic components
- PK4. Standard fault-finding techniques
- PK5. Standard repairing process
- PK5. Range of tools and testing equipments available and their functionality
- PK6. Principle of operation and features/working of instruments
- PK7. Knowledge to dismantle and assemble the faulty instrument
- PK8. Basic computer knowledge to be able to run diagnostic tools in case of smart instruments
- PK9. Range of instrument related problems and their possible solutions
- PK10. Knowledge of spare management and repair
- PK11. Vendor specific configuration and user interfaces
- PK12. Functionality of hardware components and software applications.

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

- 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 higher officials**
- CS5. Respond appropriately to queries**
- CS6. Communicate with other team members to understand instrument performance issues**
- CS7. Communicate in the local language**
- CS8. Convey proposed solution to the customers and higher officials if necessary**

CS9. Time Management Skills

- CS10. Prioritize and execute tasks in a high-pressure environment**
Use and maintain resources efficiently and effectively

CS11. Analytical Skills

- CS12. Analyse (and understand) performance issues of the instrument**

CS13. Interpret reports, readings and numerical data

Keep up to date with new technology and performance issues

CS14. Other Skills

Create and maintain effective working relationships and team environment

- CS15. through collaboration**

CS16. Take initiatives and progressively assume increased responsibilities

Share knowledge with other team members and colleagues

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 • calibration and calibration standards <ul style="list-style-type: none"> ○ basic, secondary and working standards 	12

	<ul style="list-style-type: none"> • 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 ○ Electrical safety ○ Oil and gas industries <p>Identify electrical hazards and apply safe work practices</p> <p>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- 	
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	<p style="text-align: center;">Hazardous location</p> <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 <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 	140

	<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) <p>Introduction to pressure measurement</p> <ul style="list-style-type: none"> ● Types of pressure <ul style="list-style-type: none"> ○ 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 <ul style="list-style-type: none"> ○ Pneumatic 	
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	<ul style="list-style-type: none"> ○ Electronic <ul style="list-style-type: none"> ▪ Analog ▪ Digital ○ Pressure Transmitters ● Installation of pressure measuring devices <ul style="list-style-type: none"> ○ 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 <ul style="list-style-type: none"> ○ Device Operation ○ Primary Calibration Standards ○ Differential Pressure Measurement ○ Pascal's Law ○ Absolute and Atmospheric Pressure ○ Relationship between Pressure and Column of Liquid ○ Hydrostatic Head Pressure ○ U-Tube and Well Manometers ○ Bourdon Pressure Gage <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 	
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- Maintain device
 - Manufacturers' recommended maintenance procedures

Introduction to temperature measurement

- Define Temperature, Heat and Energy
- Temperature scales
 - Fahrenheit
 - Celsius
 - Kelvin
 - Conversions between scales
- Temperature measuring devices, their operation and Transmitters
 - Thermometer
 - Thermocouple
 - Thermocouple tables
 - Resistance Temperature Detectors (RTD)
 - RTD tables
 - Thermistor
 - Liquid in Glass and Filled bulb systems
 - Pyrometer
 - Semi-conductor mechanical thermal system
 - Infrared radiation
 - Fibre Optic
 - Thermal Expansion Thermometers
 - Temperature Transmitters
- Temperature calibrating instruments
 - Thermometers
 - Multimeters
 - Millivolt source
 - Resistance source
 - Temperature baths
 - Dry block calibrators

	<ul style="list-style-type: none"> ○ 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) ○ 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 	
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- Documenting calibration

Introduction to level measurement

- Level measuring devices, their operation and Transmitters
 - Dip Stick Level Measurement
 - Basic Sight Glasses
 - Float and Cable Arrangements
 - Ultrasonic
 - Capacitance Probe
 - Rotating Paddle
 - Radar Level System
 - Laser Level System
 - Interface Measurement
 - Hydrostatic Pressure
 - Open Tank Level
 - Air Bubbler System
 - Level Transmitters
- Calibration instruments used on level measuring devices
 - Pressure calibrator
 - Laptop / software
 - Handheld programmer
- Install, calibrate and service level measuring devices
 - Manufacturers' specifications
 - Selection /Location of measuring device
 - Process application
 - Zero Suppression/Elevation
 - Process medium
 - Best practices
 - Device check / calibration
 - Interpretation of calibration results
 - Cause / effect of calibration error
 - Device adjustments
 - Repairing/replacing device components

- Verification of operation

- Documenting calibration

Introduction to density measurement

- Density measuring devices and their operation

- Applications and Selection

- Hydrometer

- Hydrostatic head

- Displacers

- Radiation Densitometers

- Oscillating Coriolis Densitometer

- Ultrasonic Sludge and Slurry Densitometers

- Gas Densitometers

- Effect of temperature on density

- Calibration instruments used on density measuring devices

- Pressure calibrator

- Laptop / software

- Handheld programmer

- Install, calibrate and service density measuring devices

- Manufacturers' specifications

- Selection /Location of measuring device

- Process application

- Process medium

- Best practices

- Verify operation

- Device check / calibration

- Interpretation of calibration results

- Cause / effect of calibration error

- Device adjustments

- Repair/replace device components

- Documenting calibration

Introduction to weight measurement

- Weight measuring devices and their operation
 - Load cells
 - Scales
 - Strain gauges
- Calibration instruments used on weight measuring devices
 - Test weights
 - Wheatstone bridge
 - Laptop / software
 - Handheld programmer (configurator)
- Install, calibrate and service weight measuring devices
 - Manufacturers' specifications
 - Selection /Location of measuring device
 - Process application
 - Best practices
 - Verify operation
 - Device check / calibration
 - Interpretation of calibration results
 - Cause / effect of calibration error
 - Device adjustments
 - Repair/replace device components
 - Documenting calibration

Introduction to flow measurement (volumetric, mass flow)

- Flow measuring devices and their operation
 - Types of Flow
 - Reynolds Number
 - Types of flow meters
 - head type
 - variable area type
 - quantitative flow meters
 - mass flow meters
 - Differential Pressure Flowmeters
 - Concentric and Eccentric Orifices

	<ul style="list-style-type: none"> ▪ Flow Nozzle ▪ Venturi and Pitot Tubes ○ Target Flowmeter ○ Rotameter or Variable Area Meter ○ Magnetic, Vortex, Turbine, and Ultrasonic Flowmeters ○ Doppler Effect ○ Flow Tube Vibration and Twist ○ Coriolis ○ Thermal Mass Flowmeters ○ Positive Displacement Flowmeters <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 	
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	<ul style="list-style-type: none"> ○ Verify operation ○ Device check / calibration ○ 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> <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 , 	10

	<p>CO)</p> <ul style="list-style-type: none"> ○ 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 <ul style="list-style-type: none"> ○ Plastic ○ Stainless steel ○ Copper ○ Rubber ○ Process and pressure requirements ○ Sizes 	20

	<ul style="list-style-type: none"> ○ 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 <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 	
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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 <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 	60
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	<p>law</p> <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 ○ $\text{Watts} = E \times I$ ● Examine resistors, potentiometers and rheostats <ul style="list-style-type: none"> ○ Differences ○ Power ratings ○ 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 	
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	<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 ▪ 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 	
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	<p>Introduction to Power Electronics (Only Block diagrams)</p> <ul style="list-style-type: none"> • SMPS • Convertor • Inverter • UPS • DC and AC Drives 	
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 	50

	<ul style="list-style-type: none"> ▪ Bolts ▪ Springs ▪ Seats ▪ 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 ▪ O-rings 	
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	<ul style="list-style-type: none"> ▪ 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 ▪ Stems ▪ Packing <ul style="list-style-type: none"> • Types and applications of valve packing <ul style="list-style-type: none"> ○ Teflon 	
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	<ul style="list-style-type: none"> ○ Graphite ○ Rope ● 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 ○ 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 	
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	<ul style="list-style-type: none"> ▪ 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 ○ 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 	
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	<ul style="list-style-type: none"> ○ Configuring ○ Set stroke ○ Set pressures ○ Match to actuator ○ Auto tune ○ Calibrating ○ Connecting calibration instruments ○ Calibration parameters ○ Interpretation of calibration results ○ Cause/effect of calibration errors ○ Component maintenance 	
7.	<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>	28

- Smart Components
 - Typical smart DP Transmitter
 - Smart temperature transmitter
 - Benefits

Service supervisory control and data acquisition (SCADA) systems

- types of SCADA protocols and configurations
 - Applications
 - Online history
 - Remote equipment operation
 - Network layout
 - Protocols
 - Host
 - Field
 - Addressing methods
- types of SCADA equipment and servers for data acquisition and storage
 - Radio Telemetry Units (RTU)
 - Wireless Communications systems
 - Cellular
 - Satellite

communication systems

- types of signal transmission systems
 - Fibre optics
 - Armoured cable
 - Non armoured cable
 - Multimode / single mode transmission
 - Wired
 - Coax
 - UTP
 - Wireless
 - Satellite

	<ul style="list-style-type: none"> ○ 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 ○ Control Capabilities <ul style="list-style-type: none"> ▪ Discrete control ▪ Analog control ○ Compatibility with other process systems ○ Networks ○ Protocols 	80

- PLC languages and symbols
 - Structured Text
 - Instruction list
 - Ladder Logic
 - Function block
 - Sequential function chart
- PLC components
 - CPU
 - Memory organization
 - Input interface
 - Output interface
 - Power supply
 - Programming/Monitoring interface
 - Data Table
 - User Program

fundamental theories of process operation and equipment

- Common industrial processes
 - Continuous Process
 - Batch process

Introduction to control theory

- Basic control theory
 - Set point / process variable / manipulated variable
 - Relation of output to input
 - Steady state value and dynamic component
 - Control loop gains / loop stability
- Control modes
 - On / Off control
 - Differential Gap
 - Proportional only
 - Integral only
 - Proportional plus Integral
 - PID -Proportional, Integral, Derivative

	<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 ○ 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 	
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	<ul style="list-style-type: none"> ○ 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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1.4 Industrial Electronics

S. No.	Course ID	Name of the Course	Level
1	L3 IE1 LU	Repair & Maintenance of Power Supply, Inverters & UPS	L3

National Institute of Electronics and Information Technology

ESDM Courses

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

Course ID: L3 IE1 LU **Course Name:** 1.4.1 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
- PK9. Introduction to Inverter, Block diagram of Inverter
- PK10. UPS, Working principle, specifications, explanation with the help of block diagram
- PK11. Find the total Load and Select suitable Inverter/UPS
- PK12. Range of tools and testing equipment available and their functionality
- PK13. Construction of Battery, Case Cover plates, Separator, Cells, Electrolyte, etc Factor affecting charging, Cause of battery failure, diagnosis and testing, visual inspection, Heavy load test
- PK14. Standard fault-finding (troubleshooting) techniques
- PK15. Component testing methods
- PK16. Troubleshooting through circuit diagram
- PK17. 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
- PS2. etc.
- PS3. Understand use of Electronics Component such as Diodes, Transistors, ICs etc.
Use of Test and Measurement Equipment
- PS4. **Soldering skills**
- PS5. Understand Soldering Requirements
- PS6. Operation of Equipment required for Soldering
Use of Desoldering Pump
- PS7. **Stabilizer and CVT Repairing Skill**
- PS8. Working principle, types of stabilizer
- PS9. Transformer employed in stabilizer, multiwinding/multitaped transformer
- PS10. Understanding General Circuit diagram of CVT, Working principle of CVT
- PS11. Finding fault in Stabilizer and CVT
Replace faulty components in Stabilizer and CVT
- PS12. **Inverter and UPS Repairing Skill**
- PS13. Working principle of Inverter and UPS
- PS14. Working Principle of Rectifier
Finding fault in Inverter and UPS
Replace faulty components in Inverter and UPS
- PS15. **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
Utilize appropriate tools to rectify faults

Core Skill:

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

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

Detailed Syllabus of Course

Sl. No.	Modules	Min: No. of Hours
		Theory/ Practical
1.	Introduction to Electricity Electric Charge, Voltage, Electric Current Ohm's Law, Electric Potential, Cell Serial and Parallel Circuit, their effect on Voltage and Current Transformer, Use and Operation	5 / 5
2.	Electronic and Electrical components Active and Passive Components Resistors, Capacitors and Inductors, their identification, types and application Semiconducting Devices: Diodes, its type, characteristics and applications	15 / 15

	<p>Transistors, Integrated Circuits</p> <p>Study of a transistor, use of a transistor as an amplifier and as a switch.</p> <p>Analog ICs, 555 timer, IC741, characteristics of 741</p> <p>Digital ICs, ICs for logic gates, Truth table verification of logic gates</p> <p>Connectors</p> <p>Fuse, types, Use of Fuses and its rating</p> <p>Relays and Switches</p> <p>Panel Components</p> <p>Digital electronics – gates and its application, multiplexers, de-multiplexers, counter</p>	
3.	<p>Soldering/ de- soldering techniques</p> <p>Soldering Iron, Soldering wire, Soldering Flux, Soldering method,</p> <p>Zero defect soldering</p> <p>Desoldering pump, Temperature controlled soldering station,</p> <p>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</p> <p>Tweezers, Different Types of Tweezers, Nose Pliers, Wire Cutter</p> <p>Hot air gun</p> <p>Liquid solder pest, Magnifying Lamp and Measuring Tools</p> <p>Brush, CRO, Nipper</p> <p>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</p> <p>Autocut and automatic stabilizer, Servo Stabilizer, Study of Control Circuit of Stabilizer</p> <p>Transformer employed in stabilizer, multiwinding/multitaped transformer</p> <p>Introduction to Constant Voltage transformer, General Circuit</p> <p>diagram of CVT, Working principle of CVT</p> <p>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> <p>Rectifier, its type and working principle, PIV of Diode, Filter</p>	20 / 30

	<p>employed in rectifier Battery charger circuit, working of Inverter Oscillator, type of Oscillator, Square wave Generator PWM, DC to AC Converter/Inverter, Designing an investor, Circuit using PWM UPS, Working principle, specifications, explanation with the help of block diagram UPS Installation Find the total Load and Select suitable Inverter/UPS</p>	
7.	<p>Battery Battery types, Primary Cell, Secondary Cell, Wet- charged, Dry-charged, Low maintenance Construction of Battery, Case Cover plates, Separator, Cells, Electrolyte, etc Lead Acid battery, Electrochemical reaction, N1-CD battery, Capacity rating, CCA, RC, AH & Power(watt) Factor affecting charging, Cause of battery failure, diagnosis and testing, visual inspection, Heavy load test</p>	10 / 20
8.	<p>Troubleshooting techniques Basic troubleshooting method, Getting into troubleshooting, selected instruments for troubleshooting Component testing methods, Testing of components in circuits , Logical steps of fault finding, Troubleshooting through circuit diagram Removal and Replacement of faulty component</p>	40 / 60
9.	<p>Safety and Security Procedures Reporting incidents, system failures, power failures etc., protection equipment First aid requirement in case of electrical shocks and other injuries</p>	5 / 5
10.	<p>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</p>	15 / 15

Customer Communication, Convey proposed solution to the customer, responding queries 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 nos. each	20
2.	Capacitor of different types	20 nos. each
3.	Transistors – BC 546, BC 547, SL 100, 2N3055 nos. each	10
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

1.5 Medical Electronics

S. No.	Course ID	Name of the Course	Level
1	L3 ME2 SJ	Repair & Maintenance of Dental Equipment	L3
2	L3 ME3 SJ	Repair & Maintenance of ECG & ICCU Equipment	L3
3	L3 ME4 SJ	Repair & Maintenance of Imaging Equipment	L3
4	L5 ME1 SJ	Post-Diploma in Repair & Maintenance of Hospital Equipment	L5

National Institute of Electronics and Information Technology

ESDM Courses

Level Code: L-3 **Vertical Name:** Medical Electronics

Course ID: L3 ME2 SJ **Course Name:** 1.5.1 Repair & Maintenance of Dental 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 Dental Equipment

Duration of the Course (in hours) 350 Hours

Minimum Eligibility Criteria and pre-requisites, if any Candidate should be 10th Pass and not less than 16 years of age

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:

National Institute of Electronics and Information Technology

ESDM Courses

Level Code: L-3 **Vertical Name:** Medical Electronics

Course ID: L3 ME3 SJ **Course Name:** 1.5.2 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 Candidate should be 10th Pass and not less than 16 years of age

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:

National Institute of Electronics and Information Technology

ESDM Courses

Level Code:

L-3

Vertical Name:

Medical Electronics

Course ID:

L3 ME4 SJ

Course Name:

1.5.3 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

Candidate should be 10th Pass and not less than 16 years of age

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:

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Text Books:

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Reference Books:

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National Institute of Electronics and Information Technology

ESDM Courses

Level Code: L-5 **Vertical Name:** Medical Electronics

Course ID: L5 ME1 SJ **Course Name:** 1.5.4 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 Candidate should be Diploma Holder or BSc. Graduate and not less than 21 years of age

Professional Knowledge:

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

Professional Skill:

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

Core Skill:

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

Detailed Syllabus of Course

Module. No	Modules	Minimum No. of Hours
1.	Basic Block of Biomedical Equipment	30
2.	ECG Machine and analytical	30
3.	Diagnostic Equipment	30
4.	Biomedical instrumentation	30
5.	Hands on Experience	200
6	Soft Skills	30
Total Hours:		350

**Recommended
Hardware:**

**Recommended
Software:**

Text Books:

Reference Books:

1.6 Office Automation, IT & Networking

S. No.	Course ID	Name of the Course	Level
1	L1 OA1 LU	Installation & Maintenance of Photocopiers and Printers	L1

National Institute of Electronics and Information Technology

ESDM Courses

Level Code: L1 **Vertical Name:** Office Automation, IT & Networking (IT)

Course ID: L1 OA1 LU **Course Name:** 1.6.1 Installation & Maintenance of Photocopiers and Printers

Objective of the Course:

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

Learning Outcomes:

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

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

Expected Job Roles:

Photocopier and Printer Repair Technician

Duration of the Course (in hours) 200

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

Professional Knowledge:

The individual on the job needs to know and understand:

- PK1. Knowledge of Electronic and Electrical Components
- PK2. Resistors, Capacitors and Inductors, their identification, types and application
- PK3. Protection equipment (anti-static wrist bands, shoes, dress, packaging, and other
- PK4. appropriate insulations) 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
- PK8. and Toner Unit.
- PK9. Identify the various sensors used in the copier and their fixtures.
- PK10. Paper trays, Paper feed mechanism and the sensors used for paper movement
- PK11. Periodic cleaning and servicing of copier machines
- PK12. Printers and their types
- PK13. Thermal Printers and Inkjet Printer, their Working Principle
- PK14. Laser Printers and its operation
- PK15. Different Parts of Printer
- PK16. Cartridges, toner, drum, their use and its replacement
- PK17. Overall fault finding and repair of Printer
- PK18. Standard fault-finding (troubleshooting) techniques
- PK19. Component testing methods
- PK20. Troubleshooting through circuit diagram
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
- PS2. etc.
- PS3. Understand use of Electronics Component such as Diodes, Transistors, ICs etc.
Use of Test and Measurement Equipment
- PS4. **Soldering skills**
- PS5. Understand Soldering Requirements
- PS6. Operation of Equipment required for Soldering
Use of Desoldering Pump
- PS7. **Photocopier Repairing Skill**
- PS8. Understand Operation of Photocopier
- PS9. Dismantling and assembling of paper feed mechanism, paper tray, Thermal unit
- PS10. and Toner Unit.
- PS11. Identify the various sensors used in the copier and their fixtures.
- PS12. Fault finding and repairing in electrostatic high voltage unit.
- PS13. Dismantling and fitting of drum unit- cleaning of drum unit
- PS14. Dismantling and refitting of Carriage unit , mirror unit and light unit
Periodic cleaning and servicing of copier machines
- PS15. Overall fault finding and repair a photo copier machine.
- PS16. **Printer Repairing Skill**
- PS17. Understand Working Principle of Thermal Printers and Inkjet Printer
- PS18. Understand Operation of Laser Printers
- PS19. Different Parts of Printer and their use
Cartridges, toner, drum, their use and its replacement
- PS20. Overall fault finding and repair of Printers
- PS21. **Troubleshooting Skills**
- PS22. How to approach a defect
- PS23. Make use of standard OEM specified troubleshooting steps
Interpret intermediate results and progress fault rectification accordingly
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 Semiconducting Devices: Diodes, its type, characteristics and applications Transistors, Integrated Circuits	10/ 10

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

6.	Printers Printers and their types. 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	25 / 25
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 nos. each	20
2.	Capacitor of different types	20 nos. each
3.	Transistors – BC 546, BC 547, SL 100, 2N3055 nos. each	10
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