SYLLABUS

Repair & Maintenance of Power Supply, Inverter & UPS

Level Code: L3
Course ID: NL/S/L3/C003 EL/S/L3/C022 TL/S/L3.C033

Vertical Name: Industrial Electronics
Course Name: 2.6.2 Repair & Maintenance of Power Supply, Inverter & UPS (NIELIT/ESSCI/TSSC)**Objective of the Course:**
This course has been designed to provide knowledge of repair and maintenance of Power Supply, Inverter and UPS.
The participant will be able to troubleshoot problems of CVT, Inverter and UPS

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

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

Expected Job Roles:
Inverter Repair Technician, UPS Repair Technician, Power Supplies Repair Technician
Duration of the Course (in hours)
350
Minimum Eligibility Criteria and pre-requisites, if any
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

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

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

Stabilizer and CVT Repairing Skill
PS7. Working principle, types of stabilizer
PS8. Transformer employed in stabilizer, multiwinding/multitaped transformer
PS9. Understanding General Circuit diagram of CVT, Working principle of CVT
PS10. Finding fault in Stabilizer and CVT
PS11. Replace faulty components in Stabilizer and CVT
Inverter and UPS Repairing Skill
PS12. Working principle of Inverter and UPS
PS13. Working Principle of Rectifier
PS14. Finding fault in Inverter and UPS
Replace faulty components in Inverter and UPS
Troubleshooting Skills
PS15. How to approach a defect
PS16. Make use of standard OEM specified troubleshooting steps
PS17. Interpret intermediate results and progress fault rectification accordingly
PS18. Utilize appropriate tools to rectify faults

Core Skill:
The individual on the job needs to know and understand how to:
Reading skills
CS1. Read and understand technical manuals, work orders and reports
CS2. Read and understand organizational health and safety instructions
Writing Skills
CS3. Fill up record sheets clearly, concisely and accurately as per company procedures
Communication Skills
CS4. Clearly communicate relevant information to supervisors
CS5. Respond appropriately to queries

CS6. Communicate with customer/customer facing teams to understand handset performance issues
CS7. Communicate in the local language
CS8. Convey proposed solution to the customers

Time Management Skills

CS9. Prioritize and execute tasks in a high-pressure environment
CS10. Use and maintain resources efficiently and effectively

Analytical Skills

CS11. Analyse (and understand) customer complaints
CS12. Interpret reports, readings and numerical data
CS13. Keep up to date with new technology and performance issues

Other Skills

CS14. Create and maintain effective working relationships and team environment through collaboration
CS15. Take initiatives and progressively assume increased responsibilities
CS16. Share knowledge with other team members and colleagues

Detailed Syllabus of Course

Sl. No.	Modules	Min: No. of Hours	Theory/ Practical
1.	**Introduction to Electricity**	Electric Charge, Voltage, Electric Current Ohm's Law, Electric Potential, Cell Serial and Parallel Circuit, their effect on Voltage and Current Transformer, Use and Operation	5 / 5
2.	**Electronic and Electrical components**	Active and Passive Components 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 gate Connectors Fuse, types, Use of Fuses and its rating Relays and Switches	15 / 15

		Panel Components Digital electronics – gates and its pplication, multiplexers, de-multiplexers, counter Resistors, Capacitors and Inductors, their identification, types and application	
3.	**Soldering/ de-soldering techniques**	Soldering Iron, Soldering wire, Soldering Flux, Soldering method, Zero defect soldering Desoldering pump, Temperature controlled soldering station, Hands-on-practices of Soldering)	10 / 10
4.	**Tools and equipment use for Repairing and maintenance of Electrical Equipment**	Screw Driver Set Tweezers, Different Types of Tweezers, Nose Pliers, Wire Cutter Hot air gun Liquid solder pest, Magnifying Lamp and Measuring Tools Brush, CRO, Nipper Test and Measurement Equipment, Multimeter Operation etc.	10 / 10
5.	**Stabilizer and CVT**	Need of stabilizer, working principle, types of stabilizer Autocut and automatic stabilizer, Servo Stabilizer, Study of Control Circuit of Stabilizer Transformer employed in stabilizer, multiwinding/multitaped transformer Introduction to Constant Voltage transformer, General Circuit	20 / 30

		diagram of CVT, Working principle of CVT EMI/RFI filter, Surge Suppressor, Repairing of CVT	
6.	**Inverter and UPS**	Introduction to Inverter, Block diagram of Inverter Rectifier, its type and working principle, PIV of Diode, Filter employed in rectifier 20 / 30 107 Battery charger circuit, working of Inverter Oscillator, type of Oscillator, Square wave Generator PWM, DC to AC Convertor/Invertor, Designing an investor, Circuit using PWM UPS, Working principle, specifications, explanation with the help of block diagram UPS Installation Find the total Load and Select suitable Inverter/UPS	
7.	**Battery**	Battery types, Primary Cell, Secondary Cell, Wet- charged, Dry-charged, Low maintenance Construction of Battery, Case Cover plates, Separator, Cells, Electrolyte, etc Lead Acid battery, Electrochemical reaction, N1-CD battery, Capacity rating, CCA, RC, AH & Power(watt)	10 / 20

		Factor affecting charging, Cause of battery failure, diagnosis and testing, visual inspection, Heavy load test	
8.	**Troubleshooting techniques**	Basic troubleshooting method, Getting into troubleshooting, selected instruments for troubleshooting Component testing methods, Testing of components in circuits , Logical steps of fault finding, Troubleshooting through circuit diagram Removal and Replacement of faulty component	40 / 60
9.	**Safety and Security Procedures**	Reporting incidents, system failures, power failures etc., protection equipment First aid requirement in case of electrical shocks and other injuries	5 / 5
10.	**Reading, Writing and Communication Skills**	Understanding Technical Manuals, Reports, Work orders etc. Understanding Organizational health and safety instructions Types of documentation in organization, their importance, Company guidelines and norms, activities after maintenance process Spare management, Service Level Agreements (SLAs) Fill-up forms, record sheets, log book etc. as per company procedures Customer Communication, Convey proposed solution to the customer,	15 /15

		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	: 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:

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