

MAHARASHTRA STATE BOARD OF VOCATIONAL EDUCATION EXAMINATION, MUMBAI - 51

| 1 | Name of Course | Certificate Course In Maintenance of Power Supply, Inverter & UPS (301110) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------------------|--|--|-------|----------|------------|------------|--|--------------------------|------------|-----------------|-------|-------|------------|------------|--------|----------|--|------|-------|-----|----|---------|----------|--|------|----------|-----|----|---|----------|--|------|-------|-----|----|---|----------|--|------|-------|-----|----|--|--|-------|--|--|-----|-----|
| 2 | Max. Nos. of Student | 25 Students | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Duration | 6 Month | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Type | Part Time | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | Nos. Of Days / Week | 6 Days | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | Nos Of Hours /Days | 4 Hrs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | Space Required | Theory Class Room – 200 sqft Workshop – 200 sqft | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | Entry Qualification | S.S.C. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | Objective Of Syllabus/ introduction | 1) Knowledge of soldering techniques, use of tools in assembly. 2) Knowledge of electronic competent used in Power supply, Inverter & UPS 3) Ability to read schematic layouts wrings diagrams. 4) Awareness of Safety precautions. 5) Maintenance of Power supply, Inverter & UPS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | Employment Opportunity | The trainee will either to be able to take up jobs with agencies which maintain and repair such equipments or with working experience will be in a position to start his own independent Business. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | Teacher’s Qualification | Diploma in Electronics & Telecommunication Engineering. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | Training System | <table><tr><th colspan="7">Training System Per Week</th></tr><tr><td colspan="2">Theory</td><td colspan="2">Practical</td><td colspan="3">Total</td></tr><tr><td colspan="2">6 Hours</td><td colspan="2">18 Hours</td><td colspan="3">24 Hours</td></tr></table> | | | | | | Training System Per Week | | | | | | | Theory | | Practical | | Total | | | 6 Hours | | 18 Hours | | 24 Hours | | | | | | | | | | | | | | | | | | | | | | | |
| Training System Per Week | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Theory | | Practical | | Total | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 Hours | | 18 Hours | | 24 Hours | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | Exam. System | <table><tr><th>Sr. No.</th><th>Paper Code</th><th>Name of Subject</th><th>TH/PR</th><th>Hours</th><th>Max. Marks</th><th>Min. Marks</th></tr><tr><td>1</td><td>30111011</td><td>Basic Electronics & Assembly Technique</td><td>TH-1</td><td>3 hrs</td><td>100</td><td>35</td></tr><tr><td>2</td><td>30111012</td><td>Repair & maintenance of Power supply, Inverter & UPS</td><td>TH-2</td><td>3 hrs</td><td>100</td><td>35</td></tr><tr><td>3</td><td>30111021</td><td>Basic Electronics & Assembly Technique</td><td>PR-1</td><td>3 hrs</td><td>100</td><td>50</td></tr><tr><td>4</td><td>30111022</td><td>Repair & maintenance of Power supply, Inverter & UPS</td><td>PR-2</td><td>3 hrs</td><td>100</td><td>50</td></tr><tr><td></td><td></td><td>Total</td><td></td><td></td><td>400</td><td>170</td></tr></table> | | | | | | Sr. No. | Paper Code | Name of Subject | TH/PR | Hours | Max. Marks | Min. Marks | 1 | 30111011 | Basic Electronics & Assembly Technique | TH-1 | 3 hrs | 100 | 35 | 2 | 30111012 | Repair & maintenance of Power supply, Inverter & UPS | TH-2 | 3 hrs | 100 | 35 | 3 | 30111021 | Basic Electronics & Assembly Technique | PR-1 | 3 hrs | 100 | 50 | 4 | 30111022 | Repair & maintenance of Power supply, Inverter & UPS | PR-2 | 3 hrs | 100 | 50 | | | Total | | | 400 | 170 |
| Sr. No. | Paper Code | Name of Subject | TH/PR | Hours | Max. Marks | Min. Marks | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 30111011 | Basic Electronics & Assembly Technique | TH-1 | 3 hrs | 100 | 35 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 30111012 | Repair & maintenance of Power supply, Inverter & UPS | TH-2 | 3 hrs | 100 | 35 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 30111021 | Basic Electronics & Assembly Technique | PR-1 | 3 hrs | 100 | 50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 30111022 | Repair & maintenance of Power supply, Inverter & UPS | PR-2 | 3 hrs | 100 | 50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Total | | | 400 | 170 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

SYLLABUS

Theory - I

Basic Electronics & Assembly Technique

1. Introduction of training & institute, Familiarization with the institute, type of work & responsibility of trainees, syllabus, safety precautions, elementary first aid, and symbols related to the theory Hand-Tools & equipments identification, Introduction to Tools & Soldering Techniques, SMT Technology, uses and maintenance
2. Introduction to electricity, batteries, voltage, current, resistance & power ohm's law. Alternating current A. C. induced voltage, current. Direct current simple lead cell, lead acid accumulator, battery charger, Battery is an electric.
3. RESISTORS: - Construction of carbon resistor wire wound resistors, wire wound resistors potentiometer, thermostat, series & parallel connection of resistors colour code of resistors, unit for resistance.
4. Capacitors :- what is capacity & capacitance parallel & series connection of capacitor in electric circuit unit of capacitor different, types of capacitor variable & fixed value trimmers, mica ceramic, paper polyester electrolytic etc value of capacitor
5. Inductor & transformer-coil concept, mutual induction series & parallel connection of inductors Types of coils air core, Iron core, Powdered iron core etc. unit for inductance Transformers, turns ratio types of transformer, step-up & step down transformer, power transformer etc.
6. Simple Meters: - Moving coil meter voltmeter, ammeter, ohm meter, multimeter (Moving coil and digital).
7. Semiconductor: - difference between semiconductor & conductor, Germanium & Silicon. Type semiconductor 'P' type & 'N' type semiconductor, P.N. junction diode, junction diode types of diodes, Zener diode, LED etc.
8. Transistor: - PNP and NPN transistor pin configuration, CB, CE, CC connection function of transistor Heat sink, use of heat sink. P C B (printed circuit Board).
9. Rectifiers, filters, Regulated power supply with Zener diode, transistors and regulator IC's 741, 7806, 7906, 7812, 7912, etc.
10. Construction, working & testing of SCR, DIAC, TRIAC, UJT, Power MOSFET, IGBT.

Theory - II

Repair & Maintenance of Power Supply, Inverter & UPS

1. Review on Wires and Cables, their types, Voltage and current rating, selection of cables for various applications
2. Diode, Power diodes -capacitance of diode, low frequency and high frequency applications, Rectifiers, 3 phase rectifiers, Switching action, period and power rating of transistors, low frequency and high frequency transistors, Heat sinks - their types, ratings and their cooling systems, Review of Power supply, filter circuits, ripple factor, High current rectifier circuits, precaution and handling of rectifier circuits.
3. Various controlling and protective devices - Switches, main switches, Fuse, MCB, ELCB, relays and S S Relays etc,
4. Inverter - their principle & operation, power rating, change over period. Installation of Inverters, Protection circuits used in inverters- battery level, over load, over charging etc. Various faults and its rectification.
5. Review on Batteries - various types, their selection, grouping of cells and batteries, charging of batteries, Various Battery charging circuits used in Inverters and UPS , Maintenance of Batteries
6. Concept of UPS, OFF LINE and ONLINE. Difference between Inverters and UPS. Low power off line UPS circuits. Selection of UPS -calculation of load power, Line interactive UPS.
7. Block diagram of Power Supply, Inverter & UPS, and basic fault finding procedure.
8. Maintenance of Power Supply, Inverter & UPS.
9. Installation of Power Supply, Inverter & UPS.

Practical –I

Basic Electronics & Assembly Technique

1. Introduction to work- shop & equipments care. Introduction to electricity supply system. Uses of Tools, measuring instruments soldering & disordering.
2. Identification of conductors, insulator voltage, current power. Test measure of A. C. Voltage current. Test of measure of D. C. Voltage and current.
3. To study differ. Types of resistors. Colour code reading value of resistors calculation of series & parallel resistance testing of resistance by multimeter.
4. Checking of capacitor, testing by multimeter. Function and uses of capacitor.
5. Checking of coil by multimeter. Checking of differ. Type of transformer hot checking & cold checking To study their uses.
6. Operation, Rules and use of multimeter, voltmeter, ammeter.
7. Testing of P N junction diode by multimeter Identify their poles (A & K.)
8. Assembled various rectifier circuits with R.C. & L. C. filter CKT. Voltage doublers circuit.
9. Build Zener diode regulator circuit, Build transistor regulator circuits, Build a regulator circuit, and Build a regulator IC power supply
10. SCR, DIAC, TRIAC, UJT, Power MOSFET, IGBT. testing by multimeter Identification of lead.

Practical –II

Repair & Maintenance of Power Supply, Inverter & UPS

1. Familiarize with various types of wires and cables, Exercises on High Wattage resistors, Capacitors, various types of Inductors. Identify the terminals and rating of various types of switches and protective devices.
2. Understand the wiring circuits and protective devices used in domestic and industrial wiring
3. Testing of Power Diodes and Power transistors. Familiarize with various packages of diodes and Transistors. Identification and selection of Heat sinks for various applications. Assemble and test the high current rectifier circuits, measure various parameters, find out the simulated fault and rectify
4. Assemble and test the various battery charging circuit.
5. Testing methods used for MOSFET, IGBT. Familiarize with various packs of MOSFET and IGBT.
6. Construct and test Inverters of various power ratings Installation of inverters, Test the various protection circuits used in Inverters, fault finding in inverters.
7. Assemble and test low power Off-line UPS circuits. Selection of UPS.
8. Familiarize with the various types of ON-LINE UPS and their circuits. Fault finding in UPS.
9. 3 phase UPS Circuits, Installation of single phase & 3 phase UPS.

List of Tools Equipment :

| | Description of Items | Qty. |
|----|---|--------|
| 1 | Crimping tool set | 4 |
| 2 | Spanner set DE, Ring | 2 |
| 3 | Screw drivers assorted size | 2 each |
| 4 | Soldering Iron 65w | 2 |
| 5 | Neon Testers, 500V | 2 |
| 6 | Combination Plier | 4 |
| 7 | Loose Nose plier | 4 |
| 8 | Diagonal cutter | 4 |
| 9 | Neon Tester | 10 |
| 10 | Screw driver set | 10 |
| 11 | Electrician Knife | 10 |
| 12 | Allen key set | 4 |
| 13 | Electric drilling machine portable 10mm | 4 |
| 14 | Bench vice 200mm | 6 |

Equipment List

| Sr. No. | Description of Item | Qty. |
|---------|---|--------|
| 1 | Inverters 500VA with suitable batteries | 4 |
| 2 | Inverter 1KVA, with suitable batteries | 1 each |
| 3 | OFF - LINE UPS 500VA, 1KVA, | 1 each |
| 4 | ON-LINE UPS 2 KVA | 1 each |
| 5 | Inverter 3 phase 3 KVA | 1 |
| 6 | ON-LINE UPS, 3 phase, 3 KVA | 1 |
| 7 | Clip on Meter - digital | 2 |
| 8 | Power supplies 0-30V, 5A | 2 |
| 9 | Multimeter 20Meg, 20 Amps AC/DC | 4 |
| 10 | Watt meter 10A | 1 |
| 11 | Earth Megger | 2 |
| 12 | Digital Multimeter | |
| 13 | Dual power supply 0-30V, 2A | 1 |
| 14 | CRO, 50 MHz, Dual Trace | 2 |
| 15 | Function Generator | 2 |
| 16 | Battery charger | 2 |
| 17 | Line Interactive UPS | 1 |
| 18 | Discharge Tester | 2 |
| 19 | Power Electronics Trainer | 1 each |

Reference Book

1. Principles of Electronics By V. K. Mehta.
2. Power Electronics By S K Sohni
3. Thyresteries power systems by Sungandhi
4. Rectifiers, Cycloconverters, and AC Controllers By Barton, Thomas H
5. Switch mode power supply handbook, By Billings, Keith H.