

SYLLABUS FOR THE TRADE
OF
ELECTRICIAN
(SEMESTER PATTERN)

UNDER
CRAFTSMEN TRAINING SCHEME (CTS)

Designed in – 2013

By
Government of India
Directorate General of Employment & Training
Ministry of Labour & Employment (DGET)
New Delhi

List of members attended the Trade Committee Meeting for revising the course curriculum and introduction of topics related to renewable energy in the trade of “**Electrician**” under Craftsmen Training Scheme (CTS) on 12th & 13th August 2010.

| Sl. No. | Name and Designation S/SHRI | Organization | Remarks |
|---------|---|--|-----------------|
| 1 | <i>S.D.Lahiri, Director</i> | <i>C.S.T.A.R.I, Kolkata</i> | <i>Chairman</i> |
| 2 | <i>S. Bhattacharya, Director</i> | <i>W.B.R.E.D.A, Kolkata</i> | <i>Member</i> |
| 3 | <i>Amarnath Sanyal, Addl, Director</i> | <i>I.EM, Kolkata</i> | <i>Member</i> |
| 4 | <i>R. Gangopadhyay, Lecturer</i> | <i>Kanchrapara Railway Workshop, Eastern-Railway</i> | <i>Member</i> |
| 5 | <i>R, N. Banerjee, Director</i> | <i>Sunshine Power Products, Kolkata</i> | <i>Member</i> |
| 6 | <i>P. K. Ghosh, Training Manager</i> | <i>G.R.S.E. Ltd, Kolkata</i> | <i>Member</i> |
| 7 | <i>S. K. Pal, Manager</i> | <i>M/s Mascot Integrated Industry, Kolkata</i> | <i>Member</i> |
| 8 | <i>Dr. Soumen Bose, Dy, Director</i> | <i>Directorate of Industrial Training, WB</i> | <i>Member</i> |
| 9 | <i>Dibyendu Paul, Lecturer</i> | <i>Sahaj Academy, Kolkata</i> | <i>Member</i> |
| 10 | <i>Dr. Tapas Kr Majumder, Manager</i> | <i>B S N L, Kolkata</i> | <i>Member</i> |
| 11 | <i>S.K.Bose, Manager</i> | <i>Trans Bio Energy Ltd, Kolkata</i> | <i>Member</i> |
| 12 | <i>Monisha Sarkar, Asstt Manager</i> | <i>Trans Bio Energy Ltd, Kolkata</i> | <i>Member</i> |
| 13 | <i>Dr.K. mukhopadhyya, Director</i> | <i>AGNI, Kolkata</i> | <i>Member</i> |
| 14 | <i>Anupam Bose, Manager</i> | <i>Geetanjali Solar, Kolkata</i> | <i>Member</i> |
| 15 | <i>A Majumder, DE</i> | <i>W.B.R.E.D.A, Kolkata</i> | <i>Member</i> |
| 16 | <i>Joy Chakraborty, DE</i> | <i>W.B.R.E.D.A, Kolkata</i> | <i>Member</i> |
| 17 | <i>Utpal Kr Roy, Supervisor</i> | <i>W.B.R.E.D.A, Kolkata</i> | <i>Member</i> |
| 18 | <i>A.Ghosh, Supervisor</i> | <i>W.B.R.E.D.A, Kolkata</i> | <i>Member</i> |
| 19 | <i>Moloy Kr Mondal, Supervisor</i> | <i>W.B.R.E.D.A, Kolkata</i> | <i>Member</i> |
| 20 | <i>Rudrendu Basu, Asstt. Director</i> | <i>W.B.R.E.D.A, Kolkata</i> | <i>Member</i> |
| 21 | <i>S.K.Biswas, Asstt Director</i> | <i>W.B.R.E.D.A, Kolkata</i> | <i>Member</i> |
| 22 | <i>D.K.Hazra, Spervisor</i> | <i>W.B.R.E.D.A, Kolkata</i> | <i>Member</i> |
| 23 | <i>A.Karmakar, Supervisor</i> | <i>W.B.R.E.D.A, Kolkata</i> | <i>Member</i> |
| 24 | <i>Gautam Banerjee, Manager</i> | <i>ESAB India Ltd, Kolkata</i> | <i>Member</i> |
| 25 | <i>M.K.Saha, Trg Superintendent</i> | <i>G.R.S.E. Ltd. Kolkata</i> | <i>Member</i> |
| 26 | <i>P.Majumder, Chief Consultant</i> | <i>Park Chember Housing Development, Kolkata</i> | <i>Member</i> |
| 27 | <i>Rabin Debnath, Asstt. Director</i> | <i>Directorate of Industrial Training, WB</i> | <i>Member</i> |
| 28 | <i>Sib Chandra Pal, Instructor</i> | <i>Govt, ITI, Howrah Homes, WB</i> | <i>Member</i> |
| 29 | <i>Pradipta Kishore Swain, Trg-Officer</i> | <i>Govt, ITI, Howrah Homes, WB</i> | <i>Member</i> |
| 30 | <i>Anil Kumar, Joint Director of Trg</i> | <i>C.S.T.A.R.I, Kolkata</i> | <i>Member</i> |
| 31 | <i>L. K. Mukherjee, Dy.Director of Trg</i> | <i>C.S.T.A.R.I, Kolkata</i> | <i>Member</i> |
| 32 | <i>A. Nandi, Dy.Director of Trg</i> | <i>C.S.T.A.R.I, Kolkata</i> | <i>Member</i> |
| 33 | <i>P.K.Dutta, Asstt. Director of Trg</i> | <i>C.S.T.A.R.I, Kolkata</i> | <i>Member</i> |
| 34 | <i>N.Nath, Asstt. Director of Trg</i> | <i>C.S.T.A.R.I, Kolkata</i> | <i>Member</i> |
| 35 | <i>S. B. Sarder, Asstt. Director of Trg</i> | <i>C.S.T.A.R.I, Kolkata</i> | <i>Member</i> |
| 36 | <i>R. N. Manna, Trg. Officer</i> | <i>C.S.T.A.R.I, Kolkata</i> | <i>Member</i> |
| 37 | <i>L. M. Pharikhal, Trg-Officer</i> | <i>ATI, Kolkata</i> | <i>Member</i> |

List of members attended the Workshop to finalize the syllabi of existing CTS into Semester Pattern held from 6th to 10th May'2013 at CSTARI, Kolkata.

| Sl. No. | Name & Designation | Organisation | Remarks |
|----------------|---|--|----------------|
| 1. | R.N. Bandyopadhyaya, Director | CSTARI, Kolkata-91 | Chairman |
| 2. | K. L. Kuli, Joint Director of Training | CSTARI, Kolkata-91 | Member |
| 3. | K. Srinivasa Rao, Joint Director of Training | CSTARI, Kolkata-91 | Member |
| 4. | L.K. Mukherjee, Deputy Director of Training | CSTARI, Kolkata-91 | Member |
| 5. | Ashoke Rarhi, Deputy Director of Training | ATI-EPI, Dehradun | Member |
| 6. | N. Nath, Assistant Director of Training | CSTARI, Kolkata-91 | Member |
| 7. | S. Srinivasu, Assistant Director of Training | ATI-EPI, Hyderabad-13 | Member |
| 8. | Sharanappa, Assistant Director of Training | ATI-EPI, Hyderabad-13 | Member |
| 9. | Ramakrishne Gowda, Assistant Director of Training | FTI, Bangalore | Member |
| 10. | Goutam Das Modak, Assistant Director of Trg./Principal | RVTI, Kolkata-91 | Member |
| 11. | Venketesh. Ch. , Principal | Govt. ITI, Dollygunj, Andaman & Nicobar Island | Member |
| 12. | A.K. Ghate, Training Officer | ATI, Mumbai | Member |
| 13. | V.B. Zumbre, Training Officer | ATI, Mumbai | Member |
| 14. | P.M. Radhakrishna pillai, Training Officer | CTI, Chennai-32 | Member |
| 15. | A.Jayaraman, Training officer | CTI Chennai-32, | Member |
| 16. | S. Bandyopadhyay, Training Officer | ATI, Kanpur | Member |
| 17. | Suriya Kumari .K , Training Officer | RVTI, Kolkata-91 | Member |
| 18. | R.K. Bhattacharyya, Training Officer | RVTI, Trivandrum | Member |
| 19. | Vijay Kumar, Training Officer | ATI, Ludhiana | Member |
| 20. | Anil Kumar, Training Officer | ATI, Ludhiana | Member |
| 21. | Sunil M.K. Training Officer | ATI, Kolkata | Member |
| 22. | Devender, Training Officer | ATI, Kolkata | Member |
| 23. | R. N. Manna, Training Officer | CSTARI, Kolkata-91 | Member |
| 24. | Mrs. S. Das, Training Officer | CSTARI, Kolkata-91 | Member |
| 25. | Jyoti Balwani, Training Officer | RVTI, Kolkata-91 | Member |
| 26. | Pragna H. Ravat, Training Officer | RVTI, Kolkata-91 | Member |
| 27. | Sarbojit Neogi, Vocational Instructor | RVTI, Kolkata-91 | Member |
| 28. | Nilotpall Saha, Vocational Instructor | I.T.I., Berhampore, Murshidabad, (W.B.) | Member |
| 29. | Vijay Kumar, Data Entry Operator | RVTI, Kolkata-91 | Member |

GENERAL INFORMATION

1. Name of the Trade : ELECTRICIAN
2. N.C.O. Code No. :
3. Duration of Craftsmen Training : 2 Years (4 Semesters having duration of six months each)
4. Power norms : 5.2 KW (for two units in one shift)
5. . Space norms : 98 Sq. metres.
6. Entry Qualification : Pass in 10th Class examination
7. Unit size (No. Of student) : 16
8. Instructors Qualification : Degree in Electrical / Electrical & Electronics Engineering
from recognized engg. college/university with one year experience in
the relevant field OR
Diploma in Electrical / Electrical & Electronics Engineering
from recognized board of technical education with two years experience
in the relevant field

OR

10th class examination and NTC/NAC in the Trade of “Electrician”
With 3 years’ post qualification experience in the relevant field.
9. Desirable qualification : Preference will be given to a candidate with CIC (Craft Instructor
Certificate).

NOTE: At least one Instructor must have Degree/ Diploma in the relevant Trade.

Syllabus for the Trade of “Electrician”
Duration : Six Month

First Semester

Semester Code: ELE: SEM I

| Week No. | Trade Practical | Trade Theory | Engineering Drawing | Vocational Science & Calculation |
|----------|---|---|--|--|
| 1 | 2 | 3 | 4 | 5 |
| 1 | Implementation in the shop floor of the various safety measures. Visit to the different sections of the Institute Demonstration on elementary first aid. Artificial Respiration | Occupational Safety & Health Basic safety introduction, Personal protection:- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Use of Fire extinguishers. Visit & observation of sections. Various safety measures involved in the Industry. Elementary first Aid. Concept of Standard | Definition of Engineering Drawing. Uses of Engineering Drawing. Freehand sketching of straight lines, rectangles, squares circle, polygons etc. | Units – Definition, different types & system of units, F.P.S., C.G.S & S.I - conversion. |
| 2 | Demonstration of Trade hand tools. Identification of simple types- screws, nuts & bolts, chassis, clamps, rivets etc. Use, care & maintenance of various hand tools. | Identification of Trade-Hand tools- Specifications | Geometrical construction of Square, Rectangle, Triangle, Circle, Ellipse, Polygons, etc. | Applied workshop problems involving addition, subtraction, multiplication and division. Different types of materials used in industry, their uses & properties. |
| 3 - 4 | Practice in using cutting pliers, screw drivers etc. skinning the cables, and joint practice on single strand. | Fundamental of electricity. Electron theory- free electron, Fundamental terms, definitions, units & effects of electric current | Do | Applied workshop problems involving common fractions. Application of fraction to shop problems. Properties and uses of copper, |

| | | | | |
|---|---|---|--|--|
| | Demonstration & Practice on bare conductors joints--such as Britannia, straight , Tee, Western union. Joints | | | zinc, lead, tin, aluminium, brass, bronze, solder, bearing metals, timber and rubber. |
| 5 | Practice in soldering-Measurement of Resistant and Measurement of specific Resistant. Application of Wheatstone bridge in measurement of Resistance | Solders, flux and soldering technique. Resistors types of resistors & properties of resistors. | Lettering practice | Different types of Insulators used in Electrical industry Mass and Weight – Difference between mass and weight. Specific Gravity & Density – Related problems. Archimedes principle. Relation between Sp. Gravity and density. |
| 6 | Demonstration and identification of types of cables. Demonstration & practice on using standard wire gauge. Practice on crimping thimbles, Lugs. Examination and checking of cables and conductors and verification of materials according to the span. | Introduction of National Electrical Code 2011 Explanation, Definition and properties of conductors, insulators and semi-conductors. Voltage grading of different types of Insulators, Temp. Rise permissible Types of wires & cables standard wire gauge Specification of wires & Cables-insulation & voltage grades -Low , medium & high voltage Precautions in using various types of cables / Ferrules | Different types of line. Drawing of different types of line. | Rounding of decimal values use of approximation. Speed, Velocity, Acceleration, Retardation, Equations of motions – related simple problems Properties & uses of cast iron, wrought iron, plain carbon steel, etc. |
| 7 | Verification of Ohm’s Law, Verification of Kirchoff’s Laws. Verification of laws of series and parallel circuits. | Ohm’s Law - Simple electrical circuits and problems. Resistors - Law of Resistance. Series and parallel circuits. | 1st angle projection, 3 rd angle projection. Orthographic views, Isometric views. | Reduction of common fractions to decimal and vice-versa - related shop problems. Momentum of a moving body. Force, Its units in SI & FPS |

| | | | | |
|----|---|--|---|--|
| | <p>Verification of open circuit and closed circuit network.</p> <p>Measuring unknown resistance using Wheatstone bridge</p> | <p>Kirchoff's Laws and applications. Wheatstone bridge principle and its applications .</p> | | Systems |
| 8. | <p>Practice on installation and overhauling common electrical accessories.</p> <p>Fixing of switches, holder plugs etc. in T.W. boards.</p> <p>-Identification and use of wiring accessories concept of switching.</p> | <p>Common Electrical Accessories, their specifications in line with NEC 2011-Explanation of switches lamp holders, plugs and sockets. Developments of domestic circuits, Alarm & switches, with individual switches, Two way switch .Security surveillance, Fire alarm, MCB, ELCB, MCCB.</p> | Drawing of plan, elevation & side views from isometric views. | <p>L.C.M., H.C.F.</p> <p>Square roots & Cube roots</p> <p>Newton's Laws of motion and related problems.</p> |
| 9 | <p>Assembly of a Dry cell-Electrodes-Electrolytes.</p> <p>Grouping of Dry cells for a specified voltage and current, Ni cadmium & Lithium cell. Practice on Battery Charging, Preparation of battery charging, Testing of cells, Installation of batteries, Charging of batteries by different methods.</p> <p>Practice on Electroplating and anodising, Cathodic protection.</p> | <p>Chemical effect of electric current-Principle of electrolysis. Faraday's Law of electrolysis. Basic principles of Electroplating and Electro chemical equivalents. Explanation of Anodes and cathodes. Lead acid cell-description, methods of charging-Precautions to be taken & testing equipment, Ni-cadmium & Lithium cell, Cathodic protection. Electroplating, Anodising. Different types of lead acid cells.</p> | Do | <p>Factorisation, Simple algebraic problems</p> <p>Laws of parallelogram of forces.</p> |
| 10 | Routine care & maintenance of Batteries | <p>Rechargeable dry cell, description advantages and disadvantages. Care and maintenance of cells Grouping of cells of specified voltage & current, Sealed Maintenance free Batteries,</p> | Dimensioning practice on orthographic views | <p>Ratio & proportion, related shop problems.</p> <p>Friction, Laws of friction, coefficient of friction, angle of</p> |

| | | | | |
|-------|---|---|---|--|
| | | Solar battery. | | friction, simple problems related to friction. |
| 11 | Charging of a Lead acid cell, filling of electrolytes-Testing of charging checking of discharged and fully charged battery | Inverter, Battery Charger, UPS-Principle of working. Lead Acid cell, general defects & remedies. Nickel Alkali Cell-description charging. Power & capacity of cells. Efficiency of cells. | Conventional symbols of Electrical installation as per BIS code & IEEE, IES norms Drawings of the typical diagram of plug and socket outlets. Graphical symbols used in electric technology, circuits. Elements. | Average and related shop problems. Work, Power & Energy – Their units and related problems. |
| 12-13 | Introduction of fitting trade. Safety precautions to be observed Description of files, hammers, chisels hacksaw frames & blades-their specification & grades. Care & maintenance of steel rule try square and files. Marking tools description & use. Description of carpenter's common hand tools such as saws planes, chisels mallet claw hammer, marking, dividing & holding tools-their care and maintenance. | <u>ALLIED TRADES:</u> Marking use of chisels and hacksaw on flats, sheet metal filing practice, filing true to line. Sawing and planing practice. Practice in using firmer chisel and preparing simple half lap joint. | Drawing the typical diagram of D-type cartridge fuse, H.R.C. type fuse. Fuse curves Graphics as per relevant IS standard. Symbols indicating the method of operation of the instrument and accessories as per relevant IS: Standard Simple isometric drawings, isometric views of simple objects- cubes, rectangular blocks etc. | Factorisation of polynomials. (Simple problems). Rotational motion. Angular velocity and acceleration. Square roots & Cube roots by the method of factorisation. Centrifugal & Centripetal forces. Related problems. |
| 14 | Types of drills description & drilling machines, proper use, care and maintenance. Description of taps & dies, types in rivets & riveted joints. Use of thread gauge. | Drilling practice in hand drilling & power drilling machines. Grinding of drill bits. Practice in using taps & dies, threading hexagonal & square nuts etc. cutting external threads on stud and on pipes, riveting practice. | Free hand sketching of nuts & bolts with dimensions from samples. Free hand sketching of rivets and washers with dimensions from samples. | Standard algebraic formula and related problems. Moment of a force Couple and Torque. Related problems |
| 15 | Description of marking & | Practice in using snips, marking & cutting | Free hand sketching of keys | Percentage and related shop |

| | | | | |
|--|---|---|--|--|
| | <p>cutting tools such as snubs shears punches & other tools like hammers, mallets etc. used by sheet metal workers. Types of soldering irons-their proper uses. Use of different bench tools used by sheet metal worker. Soldering materials, fluxes and process.</p> | <p>of straight & curved pieces in sheet metals. Bending the edges of sheets metals. Riveting practice in sheet metal. Practice in making different joints in sheet metal in soldering the joints.</p> | <p>with dimensions from samples.</p> <p>Free hand sketching of screw threads with dimensions from samples.</p> | <p>problems</p> <p>Moment of Inertia, Radius of gyration.</p> <p>Mechanical properties of metals – tenacity, elasticity, malleability, brittleness, hardness, compressibility and ductility, etc</p> |
|--|---|---|--|--|

| | | | | |
|-------|---|--|--|---|
| 16-17 | <p>Demonstration on-CRO – The magnetic flux produced by Electromagnet, Demonstration on Tracing the B-H Curve & Hysteresis loop for a specimen using C.R.O and using samples of CRGO & Dynamo grade.</p> <p>Demonstration on effect of eddy current on different samples.</p> <p>Assembly / winding of a simple electro magnet</p> <p>Identification of different types of Capacitors. Charging & discharging of capacitor, Testing of Capacitors using DC voltage and lamp. Use of magnetic compass.</p> | <p>Magnetism - classification of magnets, methods of magnetising, magnetic materials. Properties, care & maintenance, methods of magnetising magnetic materials. Para & Diamagnetism and Ferro magnetic materials.</p> <p>Principle of electro-magnetism, Maxwell’s corkscrew rule, Fleming’s left & right hand rules, Magnetic field of current carrying conductors, loop & solenoid.</p> <p>MMF, Flux density, reluctance. B.H. curve, Hysteresis, Eddy current. Principle of electro-magnetic Induction, Faraday’s Law, Lenz’s Law.</p> <p>Electrostatics: Capacitor- Different types, functions & uses.</p> | <p>Drawing the typical symbols used in electrical circuits.</p> <p>Graphical symbols used in electro technology, kinds of distribution systems and methods of connections.</p> | <p>Solving of Quadratic equations.</p> <p>Simple problems on moment of Inertia.</p> |
|-------|---|--|--|---|

| | | | | |
|-------|--|--|------------|--|
| 18-19 | <p>Measurement of resistance by different methods-</p> | <p>Resistance- Different Types of resistors used in</p> | <p>Do.</p> | <p>Simple Problems on Profit & Loss.</p> |
|-------|--|--|------------|--|

| | | | | |
|-------|--|--|---|--|
| | <p>a) Using Wheatstone Bridge b) By voltage drop method. Experiment to demonstrate the variation of resistance of a metal with the change of temperature. -Measure of 'R' by drop method. -Series & shunt circuits-use of Multimeters</p> | <p>electrical circuits. Specification of resistance and tolerance. Effect of variation of temperature on resistance. Different methods of measuring the values of resistance,</p> | | <p>Levers – its different types and their advantages. Simple related problems.</p> |
| 20-21 | <p>Connection of Calling Bell, Buzzer, Alarms, Electric Iron, Heater, Light. Rewinding /assembly of different electrical appliances. Study, maintenance and repair of domestic equipments – Electric Kettle, Heater / Immersion Heater Hot Plate, Geyser, Washing machine Cooking range, Incubators, Furnaces, Pump set. Etc.</p> | <p>Working principles and circuits of common domestic equipments & appliances</p> | <p>Detailed diagram of calling bell electromagnet etc</p> | <p>Simple Problems on Profit & Loss. Mechanical advantage, Velocity ratio, Efficiency of different types of levers.</p> |

| | | | | |
|-------|--|---|---|---|
| 22-23 | <p>Identification and study of the parts of a D.C. machine. Practicing dismantling and assembling in D.C. Machine.</p> | <p>D.C. Machines - General concept of Electrical Machines. Principle of D.C. generator. Use of Armature, Field Coil, Yoke, and Commutator, slip ring Brushes, Laminated core. Explanation of D.C. Generators-types – parts. E.M.F. equation-self excitation and separately excited Generators-Practical uses. Brief description of series, shunt and compound generators.</p> | <p>Sketching of brush and brush gear of D.C. machines. Lay out D.C. Panel board arrangement. Lettering-Numbers Alphabets. Sketching of D.C. 3-point face Plate starter top scale.</p> | <p>MENSURATION – Perimeter and Area of Square & Rectangle. Simple problems on straight and bell cranked levers.</p> |
| 24 | <p>Connection of shunts Generators, Measurement of voltages-Demonstration on field excitation. Connection of compound Generator-Voltage measurement-cumulative and differential – No Load & Load characteristics of Series, Shunt & Compound Generator. Controlling and protecting DC Generator.</p> | <p>Explanation. Of Armature reaction, interpoles and their uses, connection of interpoles, commutation. DC Motors - Terms used in D.C. motor-Torque, speed, Back-e.m.f. etc. their relations practical application. Related problems</p> | <p>Graphic symbols for Rotating m/cs and Transformers.</p> | <p>Perimeter and Area of Triangle. Simple machines - Determination of efficiency of simple m/cs. Like winch, pulley blocks, wheel and compound axle.</p> |
| 25 | <p>Project work Industrial visit (optional)</p> | | | |

26

Examination

Syllabus for the Trade of “Electrician”
Duration : Six Month

Second Semester

Semester Code: ELE: SEM II

| Week No. | Trade practical | Trade Theory | Engineering Drawing | Vocational Science & Calculation |
|----------|--|---|--|--|
| 1-2 | Demonstration and practice on identification of parts and terminals. Study of the characteristics of DC motors. | Types, characteristics and practical application of D.C. motors. Special precaution to be taken in DC Series motors. Starters used in D.C. motors | Reading of simple blue prints. | Circumference and area of Circle. Transmission of motion through Belt, Pulley, Gears, etc. and related problems. |
| 3-4 | practical application of D.C. motors. Special precaution to be taken in DC Series motors. Starters used in D.C. motors | Types of speed control of DC motors in industry. Control system. AC-DC, DC-DC control. Thyristor/electronic controls. | Free hand isometric sketching of simple objects with dimensions. Sketching of D.C. - 4-point starter to scale. | Calculation of Volume and weight of simple solid bodies- Cubes, Cuboids, solid and hollow cylinders and related shop problems. |
| 5 | Types of speed control of DC motors in industry Word-Leonard control, Thyristor/electronic controls | Insulating materials – properties common insulating materials, classifications | Do | Do |
| 6-7 | Electric wirings , importance, I.E.E. rules. Types of wirings both domestic & industrial - | Electric wirings , I.E. rules. Types of wirings both domestic & industrial - Specifications for wiring. – | Free hand sketching of simple objects. Layout arrangement of D.C. Generators & motors, control panel | Trigonometry functions & Ratios .Use of trigonometric |

| | | | | |
|-----|--|---|--|---|
| | <p>Specifications for wiring – Grading of cables and current ratings. Principle of laying out in domestic wiring-testing by meggar</p> <p>Wiring system - Using casing capping, P.V.C., concealed system.</p> <p>-Maintenance & Repairing data sheet preparation..</p> <p>Specifications, standards for conduits & accessories.</p> | <p>Grading of cables and current ratings. Principle of laying out in domestic wiring-testing by Meggar. Voltage drop concept.</p> <p>Wiring system - P.V.C., concealed system.</p> <p>-Maintenance & Repairing data sheet preparation..</p> <p>Specifications, standards for conduits & accessories</p> <p>- Power Wiring</p> <p>- Control Wiring</p> <p>- Information Communication Entertainment Wiring.</p> <p>Basic principle of energy audit.</p> | | <p>tables-Applied problems.</p> <p>Definition of Stress, Strain, Young’s modulus, Bulk modulus, Factor of safety – Their related problems.</p> <p>Effect of force on materials such as expanding, bending, twisting and shearing.</p> <p>Voltage drop calculation. Line regulation cable table reading.</p> |
| 8-9 | <p>Practice on Earthing - different methods of earthing. Importance of Earthing.</p> <p>-Earth Leakage Relay.</p> | <p>Earthing - Principle of different methods of earthing. Importance of Earthing</p> <p>-Earth Leakage Relay.</p> <p>In absence of latest revision in respective BIS provision for Earthing it is recommended to follow IEC 60364 guidelines.</p> | Free hand sketching of Staircase wiring. | <p>Simple problems on Heights & Distances using trigonometric ratios.</p> <p>Heat and temperature, Thermometric scales- centigrade, Fahrenheit & Kelvin scale and their conversion. Names and uses of temperature measuring instruments used in workshop,</p> |

| | | | | |
|---------|---|---|---|--|
| 10 - 11 | <p>Demonstration of sine wave, instantaneous values etc. Study of the behaviour of R, X_L & X_C in A.C. circuits both in series and in parallel. Experiment on poly phase circuits. Current, voltage & power measurement in poly-phase circuits.</p> <p>Measurement of energy in single & poly-phase circuits.</p> <ul style="list-style-type: none"> - Use of phase sequence meter. - Use of single phase - Demo of distorted wave - SMPS / Electronic device – Wave distortion - Power measurement <p>True R.M.S concept</p> | <p>Alternating Current -Comparison D.C& A.C. , Advantages of A.C. Alternating current & related terms frequency Instantaneous value, R.M.S. value Average value, Peak factor , form factor. Generation of sine wave, phase and phase difference. Inductive & Capacitive reactance X_L & X_c, Impedance (Z), power factor (p.f) ; Vector diagram. Active and Reactive power, Simple problems on A.C. circuits, single phase & three-phase system etc.</p> <p>Problems on A.C. circuits. Both series & parallel power consumption P.F. etc.</p> <p>Concept three-phase Star & Delta connection Line voltage & phase voltage, current & power in a 3 ph circuits, with balanced and unbalanced load.</p> <p>Harmonics: causes & effects</p> | <p>Free hand sketching of simple Geometrical shapes & hollow shapes. Drawing of simple electrical circuits. Using electrical symbols. View of simple solid & hollow bodies. Drawing of sine waves. Views of simple solid and hollow bodies'. Circuit. Diagram of battery charging circuits. With all details of panel board.</p> <p>Blue print reading.</p> | <p>Calculation of areas of triangles, etc. with the aid of trigonometry.</p> <p>Calorimetry, Latent Heat – Their related problems.</p> |
|---------|---|---|---|--|

| | | | | |
|--------|--|--|---|---|
| 12- 15 | <p>Identification of types of transformers. Connection of transformers efficiencies of transformers testing of transformer parallel operation of transformer. Use of C.T. & P.T. use of Instrument transformer.</p> <p>1. Conducting No-load and short circuit tests.</p> <p>Testing of single phase and Three Phase. Transformers - Cleaning and maintenance of Transformers, Changing of oil.</p> <p>Single to 3 phase and six phase connection.</p> | <p>Working principle of Transformer, classification C.T., P.T. Instrument and Auto Transformer/Variac Construction, Single phase and Poly phase.</p> <p>E.M.F. equation, parallel operation of transformer, their connections. Regulation and efficiency, Cooling of transformer, protective devices.</p> <p>Specifications, simple problems on e.m.f. Equation, turn ratio, regulations and efficiency. Special transformers.</p> <p>Transformer - construction cores winding shielding, auxiliary parts breather, conservator buckholtz relay, other protective devices cooling of transformer Transformer oil testing and Tap changing off load and on load. Dry transformer. Transformer bushings and termination. Transformer bushing and termination and specification.</p> | <p>Exercises on Blue print reading of connection to motors through Ammeter, voltmeter & K.W. meters.</p> <p>Exercises on Blue print reading, tracing the wiring diagram of an alternator & reproducing it in proper sequence with protective equipment sketching the synchroniser connections.</p> <p>Free hand sketching of simple objects related to the trades.</p> <p>Block diagram of single to three phase and six phase diagram.</p> | <p>Use of trigonometric formulae and applied problems. Expansion of Solid, Liquid and Gases – Their related problems.</p> |
|--------|--|--|---|---|

| | | | | |
|---------|---|--|---|---|
| 16 - 18 | Demonstration on alternators, voltage Building, load characters & regulation. Practice on installation, running and maintenance of Alternators. | Explanation of alternator, prime mover, types, regulations, phase sequence, specification of alternators and brushless alternator. Induction generator. Automatic Voltage Regulator. | Diagram of connection to a squirrel cage induction motor. Sketching the connection diagram of controlling & protective devices for Induction motors. Development of winding diagram for an electrical machine. Preparation of working drawing from sketches. | Drawing & reading of simple graphs. Transmission of heat - Conduction, Convection and Radiation. |
| 19-21 | Study of - M.C.P.M. meter Multi-meter Wattmeter P F meter Energy meter Frequency meter THD meter Thermograph Calibration of - Multi-meter C.R.O. Maximum Demand meter Phase sequence indicator Digital Instruments. | Electrical Measuring Instruments - -types, indicating types. Deflecting torque, Controlling torque & Damping torque , -Moving coil permanent magnet -Moving iron -Range extension -Multimeter -Wattmeter - P.F. meter -Intergrading type, Digital Energy meter – megger. -Energy meter -Frequency meter - Tri vector meter -Max Demand meter -Phase Sequence indicator -Multimeter –Analog and Digital - C.R.O, Solar insulation meter. | Sketching of simple objects related to trades. Sketching of different shapes of coil. Further practice in Blue print reading. Drawing development diagram for single-phase A.C. motors. | Different forms of energy, Thermal, mechanical and electrical, conversion from one to another. |
| 22-24 | Installation of - Neon Sign Mercury vapour (H.P. & L.P.) | Explanation of light White light-illumination factors, intensity of light –importance of light, human eye factor units. | Drawing the development diagram for D.C. Simplex Lap & Wave winding | Applied workshop problems. |

| | | | | |
|----|---|---|--|--|
| | Sodium vapour Halogen Lamps single tube & double tube Practice on decoration lighting Principle of layout of lighting installation. | Types illumination & lamps -Neon sign Halogen, Mercury vapour, sodium vapour, Fluorescent tube CFL, Solar lamp applications, Concept of Energy -Characters watt ages, fixing places. Types of lighting. Decoration lighting Drum Switches, Direct & indirect lighting-efficiency in lumens per watt, colour available. Thumb rule calculations of lumens. Estimating placement of lights and fans and ratings. | | |
| 25 | | Project Work Industrial visit (optional) | | |
| 26 | | Examination | | |

Syllabus for the Trade of “Electrician”
Duration : Six Month

Third Semester

Semester Code: ELE: SEM III

| Week no. | Trade practical | Trade Theory | Engg. Drawing | Vocational Science & Calculation |
|----------|---|--|---|--|
| 1-2 | Practice on winding of Transformers of different types and ratings. | <u>TRANSFORMER</u> – winding , Principle of different winding techniques | Practice in reading panel diagram. Practice in reading circuits Containing Resistance, inductances Practice in reading typical example of circuits containing R,X & C. | Practice in the use of Logarithmic tables for multiplication, division square root, cube root. Insulating material including transformer oil. |

| | | | | |
|-----|--|---|--|---|
| 3-4 | Practice on different types of winding ,Growler testing , Baking , Impregnation and Varnishing .Testing for faults | D.C. m/c Winding-- pole pitch, coil pitch, back pitch, front pitch , Lap & Wave winding , Progressive and retrogressive winding. | Further practice in Blue Print reading, drawing the development diagram for simple lap and wave winding. | Calculation of Volume, weight of simple solid bodies by using Logarithm. Further problems on mensuration. Insulating materials synthetic. Brief description and properties of electrical materials such as silicon, Nichrome, silver etc. |
| 5 | Practice on starting ,running, connection to bus bar, Study on effect of changing the field excitation and Power factor correction of Industrial load. | SYNCHRONOUS MOTOR - Working principle, effect of change of excitation and load. Application in industry in power factor improvement. | Tracing of wiring diagram of an alternator and reproducing it. | Properties of triangles and circles, tangent, etc. Insulating materials synthetic. Brief description and properties of electrical materials such as silicon, Nichrome, silver etc. |

| | | | | |
|-------|---|---|---|---|
| 6 - 9 | <p>Induction Motors - Study of Squirrel cage and Slip ring Induction motor , Measurement of slip, P.F. at various loads. Practice on connection of D.O.L Starter, Star /Delta starter, Autotransformer starter, And starting, running & speed control.</p> <p>Connection of single phase motor, identification, testing, running, and reversing.</p> <p>Identification, connection, testing, running and reversing of universal motor.</p> | <p>Induction motor – Working principle, Squirrel Cage Induction motor , Slip-ring induction motor- Construction and characteristics, starting and speed control.</p> <p>D.O.L Starter, Star /Delta starter, Autotransformer starter.</p> <p>Single phase induction motor- Working principle, different method of starting and running (capacitor start/capacitor run, shaded pole technique). FHP motors.</p> <p>Universal motor-advantages Principle, characteristics, applications in domestic appliances and industry, Fault Location and Rectification. Braking system of motor.</p> | <p>Drawing the schematic diagram of automatic voltage regulators of A.C. generators. Drawing the schematic diagram of A.C. 3-ph reversing magnetic starter. Sketching a breather. Free hand sketching of transformer and auxiliary parts and sectional views.</p> <p>Drawing the schematic diagram of plow and pipe earthing I.S.3043. Wiring diagram of the connection of arrangement and push button control of two speed AC motor. IS : 3914 – 1967.</p> | <p>Problems on mensuration related to solid bodies of Prism, Pyramid, Sphere, etc.</p> <p>Forms and properties of matter. The molecule and atoms.</p> <p>Trigonometric function Use of trigonometric tables-applied problems- Calculation of areas of triangles and polygons. Problems on Mensuration.</p> |
| 10-11 | <p>Making forma, coil insulation, Slot insulation, Insertion of coils in slots, coil connection, Practice on single layer concentric Winding, Baking, impregnating and varnishing.</p> | <p>A.C. m/c Winding-- Armature winding terms, coil side, end coil and grouping of coils. Connection to adjacent poles, connected armature winding, alternate pole connection, armature winding.</p> | <p>Drawing the schematic diagram of the starting and controlling gears of slip ring and Sq. cage Ind. Motor. IS. 3914 – 1967</p> <p>Drawing the schematic diagram of Autotransformer starter, Push button starter and Star Delta Starter.</p> | <p>Simple problems involving Trigonometric function. Atmospheric pressure, pressure gauge and absolute pressure.</p> |
| 12-13 | <p>Starting, running and building up voltage and loading of M-G set.</p> | <p>Converter-inverter, M.G. Set-description-Characteristics, specifications-running and</p> | <p>Drawing the schematic diagram of 4 typical D.C. speed regulators for shunt and compound motors. -do- Magnetic controller with dynamic breaking.</p> | <p>Laws of Indices and related problems</p> |

| | | | | |
|-------|--|---|---|--|
| | Maintenance of M-G Sets. Solid state controller and invertors. Operation and use. VSD O&M | maintenance. Solid state controller and invertors. V.S Drive, Theory and application | Block diagram of solid state systems. | Inclined plane, Parallelogram laws of Forces – their related problems. |
| 14-15 | Practice on Installation of conduit pipe wiring for lighting and power circuits for both 230V & 400V | Techniques, procedures of Layout of conduit wiring as per I.S-732-1963. Use of flame proof and explosion proof, Installation of P.V.C. conduct switches. | Schematic diagram of magnetically rated. D.C. motors with three-push bottom control station, Lumina sent Lamps. | Further problems on mensuration. Heat treatment processes. |
| 16-17 | Study of fuses. Study of contactors, MCB. Study of relays of different types. | Fuse / cut out / kit Kat – function, characteristics, and materials. H.R.C Fuses – application. Contactors – Miniature circuit breakers. Relays – Thermal, Electromagnetic, solid state relays, Control Relays and Protective Relays. Different types of contractor and limit switches. | Sketching indicating instruments. Drawing the diagram of typical marking plate of a distribution transformer. Typical wiring diagram for drum and controller operation of A.C. wound rotor motor. | Resolution and composition of forces. Representation of force by vectors, simple problems on lifting tackles like jib wall, crane-Solution of problems with the aid of vectors. |
| 18-22 | Practice on wiring of electric motor, control panel, etc. Study of different circuit Breakers. Laying and installation of overhead and underground cables. Protective and control relays, contactors, circuit breaker, etc. Operation and use of XLPE cables. | Industrial wiring. Code of practice & relevant span. Wiring of electric motors, control panel, etc. Types, specifications, advantages of different types of circuit brackets construction and maintenance. I.E. rules for overhead service lines, study of U.G. Cables and laying techniques. XLPE cable. Working principle and construction of domestic and agricultural appliances-their maintenance. | Layout diagram of a substation. Sketching different shapes of coils, Sketches indicating possible faults in stator winding. Drawing the development diagram for dupler lap and Wave winding with brush position. | Examples of simply supported Load. General condition of equilibriums for series of forces on a body. |

| | | | | |
|-------|--|--|---|---|
| 23-24 | <p>Practice of fixing lightning arrestors and lightning conductors, Horn gap.</p> <p>Identification of semiconductors. Diodes-symbol - Tests on Diodes. Studying the Characteristics of Diodes using multi-meter. I.S. 2032 of VIII 1965.</p> <p>Identification of semiconductors. Diodes-symbol - Tests on Diodes. Studying the Characteristics of Diodes using multimeter. I.S. 2032 of VIII 1965.</p> | <p>Lightning arrestor/lighting conductor, Horn gap. Concept of overhead line, HV transmission, surge voltage. Introduction to Basic electronics- Semiconductor energy level atomic structure. 'P' & 'N' type of materials –P-N-junction. Diode-classification of Diodes – Reversed Bias and Forward Bias, Heat sink. Specification of Diode – PIV rating.</p> | <p>Single line diagram of substation feeders. Connection diagram of typical overload current relays.</p> <p>Introduction to Basic electronics- Semiconductor energy level atomic structure. 'P' & 'N' type of materials –P-N-junction. Diode-classification of Diodes – Reversed Bias and Forward Bias, Heat sink.</p> <p>Specification of Diode – PIV rating. Key diagram of a power station.</p> <p>Central controlling panel.</p> <p>Drawing D.I.S. symbols for electronic components.</p> <p>DIODE, TRANSISTOR Zener diode, S.C.R. I.C. etc.</p> | <p>Centre of gravity simple experiments, stable, unstable and neutral equilibrium.</p> <p>Mechanical advantages velocity ratio, ratio, efficiency of simple pulley wheel screw jack and winch.</p> <p>Simple harmonic motion – motion of a pendulum, spring, vibrating body .</p> |
| 25 | <p>Project Work Industrial Visit(optional)</p> | | | |
| 26 | <p>Examination</p> | | | |

Syllabus for the Trade of “Electrician”
Duration : Six Month

Fourth Semester

Semester Code: ELE: SEM IV

| Week No. | Trade Practical | Trade Theory | Engineering Drawing | Vocational Science & Calculation |
|----------|--|--|--|--|
| 1-3 | Study of – Half wave rectifier ckt. Full wave rectifier ckt. Bridge rectifier ckt. Filter ckt Oscilloscope Different wave shapes and their values using C.R.O. | Explanation and importance of D.C. Rectifier ckt. Half wave, Full wave and Bridge ckt. L.E.D. and Solar cells. Filter circuits-passive filter. Working principle and uses of an oscilloscope. | Filling of m/cs history card and maintenance cards and inventory control cards. | Simple estimation of the requirement of materials etc. as applicable to the trade. Problems on estimation and costing. |
| 4-5 | Study of a transistors- Identification of construction and terminals. Testing of Transistors Study of the characters of transistors. | Explanation of principle of working of a transistor- Types of transistors Characters of a transistors Biasing of transistors. Mode of use of transistor. Specification and rating of transistors | Drawing of B.I.S/I.S.I. symbols for Electronic devices Drawing of half wave, Full wave and Bridge circuits. | -do- |
| 6-7 | Assembly and testing of a single stage Amplifier and checking in an oscilloscope. Study of types of wave shapes & Cascade Amplifier. Study of power amplifier. Uses of standard I.C Amplifier 810 | Explanation of transistor Amplifiers, Amplifiers. – class A,B & C Power amplifier. | Drawing circuits for a single stage Amplifiers and Multi stage Amplifies and types of signals. | Magnetism , Magnetic material, magnetic field, flux density, magnetic moment, permeability, Susceptibility, electro magnet (solenoid) – practical applications. |
| 8 | Study of oscillator Voltage measurement current And study wave shapes in scope. | Explanation of oscillator-working principle Explanation of stages and types. Multivibrator – applications. | -do- | -do- |

| | | | | |
|-------|---|---|---|---|
| 9 | Study of various Op. Amp. Application and Timers. | OP-AMP – Working principles and applications. Timer I.C.555 | - do - | Electricity, Effects of electric current. |
| 10-12 | Studies of simple circuits containing U.J.T. for triggering. -do- FET as an amplifier. -do- Power control circuits by S.C.R. & Diac, triac, I.G.B.T. | Introduction of basic concept of ICs, U.J.T., F.E.T., basic concept of power electronics devices e.g. S.C.R. Diac, Triac, power MOSFET, G.T.O & I.G.B.T. | Drawing of circuits containing U.J.T. F.E.T. & Simple power control circuits. | -do- |
| 13-15 | Demonstration on DC/AC power control using transistor/thyristor. Study of voltage stabilizer, UPS. Study of DC/AC motor drives, speed control etc. Uses of SCR and other modern semiconductor devices in controlling speed of motors and in changing the direction of rotation of motors. | D.C/A.C Power control using power transistor, thyristor. Voltage stabilizer, U.P.S. DC/AC motor drives using transistor/thyristor. Voltage regulator . | Block diagram of Voltage regulator . | Meaning of Horse Power & Brake horsepower. Simple problems on work, power & energy. |
| 16-17 | Demonstration on power supply stabilizer. Study Op DC. /AC. Motor Drives. | Power Supply Stabilizer, Ferro resistant . DC/AC motor drives using Thyristor/Transistor control. | -do- | Rectifier, Maximum, Average, R.M.S. current in rectifiers, form factor, ripple factor. |
| 18-19 | Study of Logic gates and circuits. Flip Flops, Counter, Register & Timer. Using digital I.C. chips | Digital Electronics -Binary numbers, logic gates and combinational circuits, Flip Flops, Counter, Register & Timer. | Free hand drawing of Logic gates and s. | Number system decimal and binary, Hexa decimal. BCD code, conversation from decimal to binary and vice-versa. |
| 20-22 | Practice in wiring and in maintenance of institute and hostel, hotel, residential building. Layout and repairing of workshop electrical installation. Practice on Auto wiring. | Complete House-wiring layout. splitting load wire in accordance with NEC . I.E.E. Rules. Multistoried system. Fault finding and trouble shooting of domestic electrical appliances. | Schematic drawing of house wiring. | |
| 23-24 | Installation Fault finding practice | Decorative lighting - Fault finding techniques in Decoration lighting. | -do- | -do- |

| | |
|----|-------------|
| 25 | Revision |
| 26 | Examination |

TRADE: ELECTRICIAN
LIST OF TOOLS & EQUIPMENT
A. TRAINEES TOOL KIT FOR 16 TRAINEES +1 INSTRUCTOR

| TOOL KIT | | |
|-----------------|--|-----------------|
| Sl. No. | Name of the items | Quantity |
| 1 | Steel Tape, 10 m length | 17 Nos. |
| 2 | Plier Insulated, 150 mm | 17 Nos. |
| 3 | Plier Side Cutting, 150 mm | 17 Nos. |
| 4 | Screw Driver, 100 mm | 17 Nos. |
| 5 | Screw Driver, 150 mm | 17 Nos. |
| 6 | Electrician Connector, screw driver insulated handle thin stem, 100 mm | 17 Nos. |
| 7 | Heavy Duty Screw Driver , 200 mm | 17 Nos. |
| 8 | Electrician Screw Driver thin stem insulated handle, 250 mm | 17 Nos. |
| 9 | Punch Centre , 150 mm X 9 mm | 17 Nos. |
| 10 | Knife Double Bladed Electrician | 17 Nos. |
| 11 | Neon Tester | 17 Nos. |
| 12 | Steel Rule 300 mm | 17 Nos. |
| 13 | Hammer, cross peen with handle | 17 Nos. |
| 14 | Hammer, ball peen With handle | 17 Nos. |
| 15 | Gimlet 6 mm. | 17 Nos. |
| 16 | Bradawl | 17 Nos. |
| 17 | Scriber (Knurled centre position) | 17 Nos. |
| 18 | Pincer 150 mm | 17 Nos. |

B. SHOP TOOLS, INSTRUMENTS & MACHINERY

| | | |
|----|---|------------|
| 1 | C- Clamp 200 mm, 150 mm and 100 mm | 2 Nos each |
| 2 | Spanner Adjustable 150 mm, 15 degree | 2 Nos each |
| 3 | Blow lamp 0.5 ltr | 1 No |
| 4 | Melting Pot | 1 No |
| 5 | Ladel | 1No |
| 6 | Chisel Cold firmer 25 mm X 200 mm | 2 Nos |
| 7 | Chisel 25 mm & 6 mm | 2 Nos each |
| 8 | Hand Drill Machine 0 to 6 mm capacity | 1 No |
| 9 | Portable Electric Drill Machine 6 mm capacity | 1 No |
| 10 | Pillar Electric Drill Machine 12 mm capacity | 1 No |
| 11 | Allen Key | 1 set |
| 12 | Oil Can 0.12 ltr | 1 No |
| 13 | Grease Gun | 1 No |
| 14 | Out Side Micrometer 0 to 25 mm | 2 Nos |
| 15 | Motorised Bench Grinder | 1 No |
| 16 | Rawl plug tool & bit | 2 set |
| 17 | Pully Puller | 2 Nos |
| 18 | Bearing Puller | 2 Nos |

| | | |
|----|---|---------------|
| 19 | Hygrometer | 1 set |
| 20 | Thermometer 0 to 100 deg Centigrade | 1 No |
| 21 | Scissors blade 150 mm | 4 Nos |
| 22 | Crimping Tool | 2 sets |
| 23 | Wire stripper 20 cm | 2 Nos |
| 24 | Chisel Cold flat 12 mm | 2 Nos |
| 25 | Mallet hard wood 0.50 kg | 4 Nos |
| 26 | Hammer Exeter type 0.40 kg | 4 nos |
| 27 | Hacksaw frame 200 mm 300 mm adjustable | 2 Nos each |
| 28 | Try Square 150 mm blade | 4 nos |
| 29 | Outside & Inside Divider Calliper | 2 Nos each |
| 30 | Pliers flat nose 150 mm | 4 Nos |
| 31 | Pliers round nose 100 mm | 4 Nos each |
| 32 | Tweezers 100 mm | 4Nos |
| 33 | Snip Straight & Bent 150 mm | 2 Nos each |
| 34 | D.E. metric Spanner | 2 Nos |
| 35 | Drill hand brace 0 to 100 mm | 4 Nos |
| 36 | Drill S.S. Twist block 2 mm, 5 mm 6 mm set of 3 | 4 set |
| 37 | Plane, smoothing cutters 50 mm | 4 Nos. |
| 38 | Gauge, wire imperial | 2 Nos |
| 39 | File flat 200 mm 2 nd cut | 8 Nos. |
| 40 | File half round 200 mm 2 nd cut | 4 Nos |
| 41 | File round 200 mm 2 nd cut | 4 Nos. |
| 42 | File flat 150 mm rough | 4 Nos. |
| 43 | File flat 250 mm bastard | 4 Nos. |
| 44 | File flat 250 mm smooth | 4 Nos. |
| 45 | File Rasp, half round 200 mm bastard | 4 Nos |
| 46 | Soldering Iron 25 watt, 65 watt, 125 watt | 4 Nos each |
| 47 | Copper bit soldering iron 0.25 kg. | 4 Nos. |
| 48 | Desoldering Gun | 4 Nos |
| 49 | Hand Vice 50 mm jaw | 4 Nos |
| 50 | Table Vice 100 mm jaw | 8 Nos |
| 51 | Pipe Cutter to cut pipes upto 5 cm. dia | 4 Nos |
| 52 | Pipe Cutter to cut pipes above 5 cm dia | 2 Nos |
| 53 | Stock and Die set for 20 mm to 50 mm G.I. pipe | 1 set |
| 54 | Ohm Meter; Series Type & Shunt Type | 2 Nos each |
| 55 | Stock and Dies conduit | 1 No |
| 56 | Multi Meter (analog) 0 to 1000 M Ohms, 2.5 to 500 V | 2 Nos |
| 57 | Digital Multi Meter | 6 Nos |
| 58 | A.C. Voltmeter M.I. 0-500V A.C | 1 No |
| 59 | Milli Voltmeter centre zero 100-0-100 m volt | 1 No |
| 60 | D.C. Milliammeter 0-500m A | 1 No |
| 61 | Ammeter MC 0-5 A, 0-25 A | 1 No each |
| 62 | A.C. Ammeter M.I. 0-5A, 0-25 A | 1 No each |
| 63 | Kilo Wattmeter 0-1-3 kw | 1 No |
| 64 | A.C. Energy Meter, Single phase 5 amp. Three Phase 15 amp | 1No each |
| 65 | Power Factor Meter | 1 No |

| | | |
|----|--|--|
| 66 | Frequency Meter | 1 No |
| 67 | Tachometer with watch | 1 No |
| 68 | Current Transformer | 1 No |
| 69 | Potential Transformer | 1 No |
| 70 | Growler | 1 No |
| 71 | Tong Tester / Clamp Meter 0 – 100 amp. AC | 1 No |
| 72 | Megger 500 volts | 1 No |
| 73 | Wheat Stone Bridge with galvanometer & battery | 1 No |
| 74 | Contactors & auxiliary contacts 3phase, 440volt, 16amp | 1 No each |
| 75 | Contactors & auxiliary contacts 3 phase, 440 volt, 32 amp. | 1 No each |
| 76 | Limit Switch | 1 No |
| 78 | Rotary Switch 16 A | 1 No |
| 79 | Load Bank 5 KW (Lamp / heater Type) | 1 No |
| 80 | Brake Test arrangement with two spring balance 0 to 25 kg rating | 1 No |
| 81 | Knife Switch DPDT fitted with fuse terminals 16 amp | 4 Nos |
| 82 | Knife Switch TPDT fitted with fuse terminals 16 amp | 4 Nos |
| 83 | DC Power Supply | 1 No |
| 84 | Inverter- 1 KVA with 12 V Battery Input- 12 volt DC, Output- 220 volt AC | 1 No |
| 85 | Voltage Stabiliser Input: 150 – 230 volt AC Output: 220 volt AC | 1 No |
| 86 | Rheostat 0 -1 Ohm, 5 Amp 0 -10 Ohm, 5 Amp 0- 25 Ohm, 1 Amp 0- 300 Ohm, 1 Amp | 1 Nos. Each |
| 87 | <u>Domestic Appliances</u> – a. Electric Hot Plate 1500 watt b. Electric Kettle, 100 watts c. Electric Iron 1200 watts d. Immersion Heater 500/100/2000 watt e. A.C. Fan f. Geyser (Storage type) 15 ltr minimum g. Mixture & Grinder | 1 No 1 No 1 No 1 No 1 No 1 No 1 No |
| 88 | Flux meter | 1 No |
| 89 | Laboratory Type Induction Coil | 1 no |
| 90 | 3- point D.C. Starter | 1 no |
| 91 | 4- point D.C. Starter | 1 no |
| 92 | <u>Relays</u> - a. Cut out b. Reverse current c. Over current d. Over load e. Under voltage | 1 No each |
| 93 | <u>Starters for 2 to 5 H.P. A.C Motors</u> - a. Resistance type starter b. Direct on line Starter c. Star Delta Starter- manual, semi-automatic and automatic d. Auto Transformer type | 1 No each |

| | | |
|-----|--|---------------------------|
| 94 | <u>Electrical Machine Trainer</u> – Suitable for demonstrating the construction and functioning of different types of DC machines and AC machines (single phase and three phase). Should be fitted with friction brake arrangement, dynamo meter, instrument panel and power supply units | 1 for 8 (4+4) Units |
| 95 | <u>Motor-Generator (AC to DC) consisting of :</u> Squirrel Cage Induction Motor with star delta starter and directly coupled to DC shunt generator and switch board mounted with regulator, air breaker, ammeter, voltmeter, knife blade switches and fuses, set complete with case iron and plate, fixing bolts, foundation bolts and flexible coupling. <u>Induction Motor rating:</u> 7 HP, 400V, 50 cycles, 3 phase <u>DC Shunt Generator rating:</u> 5 KW, 440V | 1 No |
| 96 | <u>Motor Generator(DC to AC) set consisting of -</u> Shunt Motor with starting compensator and switch directly coupled to AC generator with exciter and switch board mounted with regulator, breaker, ammeter, voltmeter frequency meter, knife blade switch and fuses etc. Set complete with cast iron bed plate, fixing bolts, foundation bolts and flexible coupling <u>Shunt Motor rating :</u> 5 HP, 440V <u>AC Generator rating :</u> 3-Phase, 4 wire, 3.5 KVA, 400/230 Volts, 0.8 pf, 50cycles | 1 No |
| 97 | Used DC Generators-series, shunt and compound type for overhauling practice | 1No each |
| 98 | D.C. Shunt Generator with control panel, 2.5 KW, 230 V | 1 No |
| 99 | D.C. Compound Generator with control panel including fitted rheostat, voltmeter, ammeter and breaker, 2.5 KW, 230 V | 1 No |
| 100 | Diesel Generator Set with change over switch, over current breaker and water-cooled with armature, star-delta connections AC 3 phase, 5 KVA, 230 volt | 1 No |
| 101 | DC Series Motor coupled with mechanical load 0.5 to 2 HP, 220 Volts | 1 No |
| 102 | DC Shunt Motor 2 to 3 HP, 220 volts | 1 No |
| 103 | DC compound Motor with starter and switch 2 to 3 HP, 220 volts | 1 No |
| 104 | AC Squirrel Cage Motor with star delta starter and triple pole iron clad switch fuse. 2 to 3 HP, 3-phase ,400 volts, 50 cycles | 1 No |
| 105 | AC phase-wound slip ring Motor with starter and switch 5 HP, 400 volts, 3-phase, 50 cycles | 1 No |
| 106 | A.C. Series type Motor with mechanical load ¼ HP, 230V, 50 cycles | 1 No |
| 107 | Single Phase Capacitor Motor with starter switch 1 HP 230 volt 50 cycles | 1 No |

| | | |
|-----|---|-------|
| 108 | Universal Motor with starter/switch 230 volt, 50 cycles ¼ HP | 1 No |
| 109 | Stepper Motor with Digital Controller | 1 No |
| 110 | Shaded Pole Motor | 1 No |
| 111 | Single phase Transformer, core type, air cooled | 1 No |
| 112 | Three phase transformer, shell type oil cooled | 1 No |
| 113 | Variable Auto Transformer | 1 No |
| 114 | Oscilloscope Dual Trace,30 MHZ | 1 No |
| 115 | Function Generator | 1 No |
| 116 | Discrete Component Trainer | 1 No |
| 117 | Linear I.C.Trainer | 1 No |
| 118 | Digital I.C.Trainer | 1 No |
| 119 | Bath Impregnating | 1 No |
| 120 | Oven Stove | 1 No |
| 121 | Oil Testing Kit | 1 No |
| 122 | Battery Charger | 1 No |
| 123 | Hydrometer | 1 No |
| 124 | Air Breaker 5 KVA | 1 No |
| 125 | Miniature Breaker 16 amp | 1 No |
| 126 | Thyristor/IGBT controlled D.C. motor drive with tacho-generator feedback arrangement. 1 HP | 1 No |
| 127 | Thyristor/IGBT controlled A.C. motor drive with VVVF control 3 Phase, 2 HP | 1 No |
| 128 | Working Bench 2.5 m x 1.20 m x 0.75 m | 4 Nos |
| 129 | Fire Extinguisher | 2 Nos |
| 130 | Fire Buckets | 2 Nos |

C.WORKSHOP FURNITURE:

| Sl. No. | Name of the items | Quantity |
|---------|--|----------|
| 1 | Instructor's table | 1 No |
| 2 | Instructor's chair | 2 Nos |
| 3 | Metal Rack 100cm x 150cm x 45cm | 4 Nos |
| 4 | Lockers with 16 drawers standard size | 2 Nos |
| 5 | Almirah 2.5 m x 1.20 m x 0.5 m | 1 No |
| 6 | Black board/white board | 1 No |

NOTE :

1. For 2nd Unit of the Trade, only Trainees Tool Kit (from Sl No- 1 to 18) is required additionally.
2. Sl no- 94, Electrical Machine Trainer up to 8 (4+4) units- ONE no.
3. Sl no- 95 to 130, for 4 (2+2) units no additional items are required

