# SYLLABUS OF SEMESTER SYSTEM

# FOR THE TRADE OF

# E L E C T R I C I A N

**UNDER**
**CRAFTSMEN TRAINING SCHEME (CTS)**
**(Two Years / Four Semesters)**

**Redesigned in**
**2014**

***By***
Government of India
Ministry of Labour and Employment (DGET)

## GENERAL INFORMATION

| | | |
|---|---|---|
| 1. | Name of the Trade | : ELECTRICIAN |
| 2. | N.C.O. Code No. | : 7137.10(851.10), 7241.20(851.30) |
| 3. | Duration of Craftsmen Training | : 2 Years (4 Semesters having duration of six months each) |
| 4. | Entry Qualification | : Passed 10th class examination under 10+2 System of education with Science and Mathematics or its equivalent. |
| 5. | Unit Strength (No. Of student) | : 16 |
| 6. | Space norms | : 98 Sq. metres. |
| 7. | Power norms | : 5.2 KW (for two units in one shift) |
| 8. | Instructors Qualification | : Degree in Electrical / Electrical and Electronics Engineering from recognized Engineering College/ university with one year experience in the relevant field<br>**OR**<br>Diploma in Electrical / Electrical and Electronics Engineering from recognized board of technical education with two years experience in the relevant field<br>**OR**<br>10th class examination and NTC/NAC in the Trade of "Electrician" With 3 years' post qualification experience in the relevant field. and one year Craftsman instructor training under CITS |

**LIST TRADE EXPERTS, CORE GROUP MEMBERS & MENTOR COUNCIL MEMBERS**

(S/Shri)

| | | |
|---|---|---|
| 1. | Dr. S.P. Gupta | Professor, IIT Roorkee, (CHAIRMAN) |
| 2. | R.N. Bandopadhyay | Director, CSTARI, Kolkatta |
| 3. | R. Senthil Kumar | Director, ATI, Chennai |
| 4. | A VenkateshwaraRao | Joint Director, ATI, Chennai |
| 5. | P. Saibaba | Joint Director, ATI, Chennai |
| 6. | K.L. Kuli | Joint Director, CSTARI, Kolkatta |
| 7. | K. Srininvasa Rao | Joint Director, CSTARI, Kolkatta |
| 8. | M. Thamizharasan | Joint Director, CSTARI, Kolkatta |
| 9. | S. Mathivanan | Dy Director, ATI, Chennai, (TEAM LEADER) |
| 10. | Amrit Pal Singh | Dy. Director, DGET, New Delhi.(MENTOR) |
| 11. | B.N. Sridhar | Dy Director, FTI, Bangalore |
| 12. | Ketan Patel | Dy Director, RDAT, Mumbai |
| 13. | B. Ravi | Dy Director, CTI, Chennai |
| 14. | A.S. Parihar | Dy Director, RDAT, Kolkata |
| 15. | Nirmalya Nath | Asst Director, CSTARI, Kolkatta |
| 16. | Parveen Kumar | Asst Director, ATI-EPI, Hyderabad |
| 17. | C.C. Jose | Trg Officer, ATI, Chennai |
| 18. | L.M. Pharikal | Trg Officer, ATI, Kolkata |
| 19. | M. Asokan | Trg Officer, CTI, Chennai |
| 20. | Mohan Raj | Trg Officer, NIMI Chennai |
| 21. | U.K. Mishra | Trg Officer, ATI, Mumbai |
| 22. | C.M. Diggewadi | Trg Officer, RDAT, Mumbai |
| 23. | A. Chakraborthy | Trg Officer, CSTARI, Kolkatta |
| 24. | T.K. Ghosh | Trg Officer, CSTARI, Kolkatta |
| 25. | Prasad U.M. | Voc Instructor, MITI, Calicut |
| 26. | Gabriel Pradeep A.P. | JTO. Govt ITI, Hosur Road, Bangalore |
| 27. | Latha | JTO. Govt ITI, Hosur Road, Bangalore |
| 28. | D. Viswanathan | ATO. Govt ITI, North Chennai |
| 29. | B. Navaneedhan | ATO, ITI. North Chennai |
| 30. | R . Rajasekar | ATO, ITI, Ambattur, Chennai |
| 31. | K. Amaresan | ATO, Govt ITI, Guindy, Chennai |
| 32. | Dr.P. Mahanto | Professor, IIT, Guwahati |
| 33. | K.K. Seth | Ex. Director, BHEL, Noida |
| 34. | N. Chattopadhyay | Sr. DGM, BHEL, Kolkatta |
| 35. | Surendu Adhikari | OTIS Elevator Co. India Ltd, Kolkatta |
| 36. | K. Raju | Consultant- Energy Area, ASCI, Hyderabad |
| 37. | Ravi G Deshmukh | Certified Energy Auditor, PPS Energy solutions, Pune |
| 38. | R. Thiruppathi | JTS, IIT, Madras, Chennai |
| 39. | M.N. Krishnamurthy | Retd. Ex Engineer, TNEB, Chennai |
| 40. | S. Kirubanandam | Asst. Ex Engineer, TANTRANSCO, Chennai |
| 41. | R. Kasi, | Asst. Ex Engineer, TANTRANSCO, Chennai |
| 42. | L.R. Sundarajan | Jr. Works Manager, Heavy vehicles factory |
| 43. | B.S. Sudheendara | Consultant, VI micro systems pvt ltd, Chennai. |
| 44. | S. Ganesh | Manager, L&T , Chennai |
| 45. | G. Neethimani | Vice principal, Rane engine valves ltd, Chennai. |

**COURSE INFORMATION – Electrical Power Sector - (TRADE: ELECTRICIAN)**

## 1. INTRODUCTION:

- This course is meant for the candidate who aspires to become Technician in ELECTRICIAN.
- This course curriculum is revised and re-structured to make the First Semester Syllabus common for all the Trades under "POWER SECTOR"

## 2. TERMINAL COMPETENCY:

**At the end of the course the trainee shall be able to**

- carryout Installation, maintenance & repair works of Electrical AC, DC, machinery, lighting circuits, domestic appliances and equipments used in domestic and industries
- read and interpret the blue print reading ( Electrical layout Drawing as per BIS specification & standards)
- carry out Domestic and Industrial wiring, Earthing System
- test electrical wiring installation , locate and rectify the faults by using megger and Earth tester
- Make and solder the wire joints, wires on PCB and do de-soldering technique
- Use of electrical instrument(analog/digital) like voltmeter, Ammeter, Wattmeter, Energy Meter, Wheatstone bridge, oscilloscope, Earth tester, Tong tester, etc to measure to different electrical quantities
- Armature winding, single & three phase motor winding and small transformer winding
- Operate, maintain and test the switch gears, circuit breakers, relays and transformer
- Identify and maintain the Power Generating stations (conventional and non-convential), Transmission and distribution system protecting devices.
- Construct & test semiconductor devices
- Practice on using fitting carpentry and sheet metal tools.
- Carried out break down, over hauling, routine & preventive maintenance of electrical machines and equipments

## 3. EMPLOYMENT OPPORTUNITIES

- All state Electricity Boards and departments
- Public sectors, MNC, Private and Govt. Industries
- License Certificate for self employment
- Wiring Contractors
- Huge job opportunities in power generation, transmission, distribution station.
- Huge abroad job opportunities

## 4. FURTHER LEARNING PATHWAYS

- Apprentice training in designated trade
- Craft Instructor certificate course
- License Certificate in all State Electricity Boards
- Diploma in Electrical Engineering

**Syll a bus f or the T ra de of " *Electr icial P ower sector* " *(TRADE: ELECTRICIAN)***

**Duration : Six Month**

**First Semester**

**Semester Code: EL: SEM I**

| Week No. | Trade Practical | Trade Theory |
|---|---|---|
| 1 | Implementation in the shop floor of the various safety measures.<br>Visit to the different sections of the Institute.<br>Demonstration on elementary first aid.<br>Artificial Respiration<br>Practice on use of fire extinguishers. | **Occupational Safety and Health**<br>Basic safety introduction,<br>Personal protection.<br>Basic injury prevention, Basic first aid,<br>Hazard identification and avoidance, safety signs for Danger, Warning, caution and personal safety message.<br>Use of Fire extinguishers.<br>Visit and observation of sections.<br>Various safety measures involved in the Industry. Elementary first Aid. Concept of Standard. |
| 2 | Demonstration of Trade hand tools. Identification of simple types- screws, nuts & bolts, chassis, clamps, rivets etc.<br>Use, care and maintenance of various hand tools. | Identification of Trade-Hand tools- Specifications , Uses and their care maintenance. |
| 3 | Practice in using cutting pliers, screw drivers, etc. skinning the cables and jointing practice on single strand and multi stranded conductor.<br>Demonstration and Practice on bare conductors joints-- such as Britannia, straight, T, Western union Joints | Fundamental of electricity. Electron theory- free electron, Fundamental terms, definitions, units and effects of electric current<br>Explanation, Definition and properties of - conductors, insulators and semi-conductors.<br>Wires/cable & its specification.<br>Types of wire joints & uses. |
| 4 | Practice on soldering & Brazing.<br>Measurement of Resistance.<br>Determination of specific Resistance. | Solders, flux and soldering technique. Brazing .<br>Types & properties of resistors<br>Specific Resistance. |

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| 5-6 | Verification of Ohm's Law, Verification of Kirchoff's Laws.<br>Verification of laws of series, parallel and combination circuits. | **Ohm's Law -**<br>Simple electrical circuits and problems.<br><br>**Resistors -**Laws of Resistance.<br>Series, parallel and combination circuits. |

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| | Verification of open circuit and closed circuit network.<br>Measuring unknown resistance using different methods-<br>a) Using Wheatstone Bridge<br>b) By voltage drop method.<br>Experiment to demonstrate the variation of resistance of a metal with the change in temperature. | **Kirchoff's** Laws and applications. Wheatstone bridge principle and its applications.<br>Effect of variation of temperature on resistance.<br>Different methods of measuring the values of resistance. |
| 7 | Demonstration and identification of types of cables.<br>Demonstration and practice on using standard wire gauge & micrometer.<br>Practice on crimping thimbles, Lugs. | Introduction of National Electrical Code<br>Voltage grading of different types of Insulators, Temp. Rise permissible.<br>Types of wires and cables standard wire gauge.<br>Specification of wires and Cables-insulation and voltage grades -Low , medium and high voltage<br>Precautions in using various types of cables / Ferrules |
| 8 | Identification and use of wiring accessories<br>Practice on installation and overhauling common electrical accessories.<br>Fixing of switches, holder plugs etc. in wooden/PVC/ Metallic boards. | Common Electrical wiring Accessories, their specifications in line with NEC -<br>Explanation of switches, lamp holders, plugs and sockets. Developments of domestic circuits, Alarm & switches,<br>Use & specification of Fire alarm, MCB, ELCB, MCCB. |
| 9 - 11 | Grouping of Dry cells for a specified voltage and current.<br>Practice on Battery Charging, Preparation of battery charging, Testing of cells, Installation of batteries, Charging of batteries by different methods.<br>Charging of a Lead acid cell, filling of electrolytes-Testing of charging .checking of discharged and fully charged battery.<br>Care and maintenance of Batteries | Chemical effect of electric current-<br>Principle of electrolysis.<br>Faraday's Law of electrolysis.<br>Basic principles of Electroplating and Electro chemical equivalents.<br>Explanation of Anodes and Cathodes.<br>Cells - Primary & Secondary<br>Lead acid cell-description, methods of charging-Precautions to be taken & testing equipment,<br>Ni-cadmium & Lithium cell, Cathodic protection.<br>Electroplating, Anodising.<br>Different types of lead acid cells.<br>Application of battery/cell in Inverter, Battery Charger, UPS, etc.<br>Lead Acid cell, general defects and remedies.<br>Nickel Alkali Cell-description charging.<br>Power and capacity of cells. Efficiency of cells.<br>Rechargeable dry cell, description advantages and disadvantages.<br>Care and maintenance of cells |

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| | | Grouping of cells of specified voltage and current, Sealed Maintenance free Batteries, Solar battery. |
| 12-13 | ALLIED TRADES:<br>Marking use of chisels and hacksaw on flats, sheet metal filing practice, filing true to line.<br>Sawing and planning practice. Practice in using firmer chisel and preparing simple half lap joint. | Introduction of fitting trade.<br>Safety precautions to be observed Description of files, hammers, chisels hacksaw frames and blades- their specification and grades. Care and maintenance of steel rule, try square and files. Marking tools description and use. Description of carpenter's common hand tools such as saws planes, chisels mallet claw hammer, marking, dividing and holding tools-their care and maintenance. |
| 14 | Drilling practice in hand drilling and power drilling machines.<br>Grinding practice<br>Practice in using taps and dies, threading hexagonal and square nuts etc. cutting external threads on stud and on pipes, riveting practice. | Types of drills description and drilling machines, proper use, care and maintenance. Description of taps and dies, types of rivets and riveted joints.<br>Use of thread gauge. |
| 15 | Practice in using snips, marking and cutting of straight and curved pieces in sheet metals.<br>Bending the edges of sheets metals. Riveting practice in sheet metal.<br>Practice in making different joints in sheet metal in soldering the joints. | Description of marking and cutting tools such as snubs shears punches and other tools like hammers, mallets, etc. used by sheet metal workers. Different types soldering materials, fluxes and process.<br>Types of different soldering irons and their proper uses.<br>Use of different bench tools used by sheet metal worker. |
| 16-17 | Trace the magnetic field.<br>Assembly / winding of a simple electro magnet.<br>Use of magnetic compass.<br>Identification of different types of Capacitors.<br>Charging and discharging of capacitor, Testing of Capacitors using DC voltage and lamp. | **Magnetism** - classification of magnets, methods of magnetising, magnetic materials. Properties, care and maintenance.<br>Para and Diamagnetism and Ferro magnetic materials.<br>Principle of electro-magnetism, Maxwell's corkscrew rule, Fleming's left and right hand rules, Magnetic field of current carrying conductors, loop and solenoid.<br>MMF, Flux density, reluctance. B.H. curve, Hysteresis, Eddy current. Principle of electro-magnetic Induction, Faraday's Law, Lenz's Law.<br>Electrostatics: Capacitor- Different types, functions and uses. |
| 18-19 | Determine the characteristics of RL,RC and | **Alternating Current -**Comparison and Advantages D.C and A.C. Related terms |

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| | RLC in A.C. Circuits both in series and parallel.<br>Experiment on poly phase circuits. Current, voltage, power and power facor measurement in single & poly- phase circuits.<br>Measurement of energy in single and poly-phase circuits.<br>- Use of phase sequence meter. | frequency<br>Instantaneous value, R.M.S. value Average value, Peak factor, form factor.<br>Generation of sine wave, phase and phase difference.<br>Inductive and Capacitive reactance Impedance (Z), power factor (p.f).<br>Active and Reactive power, Simple problems on A.C. circuits, single<br>phase and three-phase system etc.<br>Problems on A.C. circuits.<br>Power consumption in series and parallel, P.F. etc. Concept three-phase Star and Delta connection.<br>Line and phase voltage, current and power in a 3 phase circuits with balanced and unbalanced load. |
| 20 | **Practice on Earthing** - different methods of earthing.<br>Measurement of Earth resistance by earth tester.<br>Testing of Earth Leakage by ELCB and relay. | **Earthing** - Principle of different methods of earthing. i.e. Pipe, Plate, etc<br>Importance of Earthing.<br>Improving of earth resistance<br>Earth Leakage circuit breaker (ELCB).<br>In absence of latest revision in respective BIS provision for Earthing it is recommended to follow IEC guidelines. |
| 21 | Determine the resistance by Colour coding Identification of active/passive components.<br><br>**Diodes**-symbol - Tests -<br><br>Construct & Test Half wave rectifier ckt.<br>Full wave rectifier ckt.<br>Bridge rectifier ckt. | **Basic electronics**- Semiconductor energy level, atomic structure 'P' type and 'N' type.<br>Type of materials –P-N-junction. Classification of Diodes – Reverse and Forward Bias,<br>Heat sink.<br>Specification of Diode<br>PIV rating.<br>Explanation and importance of D.C. rectifier circuit. Half wave, Full wave and Bridge circuit.<br>Filter circuits-passive filter. |
| 22-23 | Industrial visit / project work | |
| 24-25 | NCVT EXAMINATION | |
| 26 | Semester Gap | |

**CTS First Semester: (Electrician, Wireman, Electroplater, Lift & Escalator Mech.)**

## LIST OF TOOLS and EQUIPMENT

### A. TRAINEES TOOL KIT FOR 16 TRAINEES +1 INSTRUCTOR

| TOOL KIT | | | |
|---|---|---|---|
| ***Sl. No.*** | ***Name of the items*** | ***Quantity*** | ***Remarks*** |
| 1 | Steel Tape, 15 m length | 17 Nos. | **Sr. No. 1 to 18 tool kits to be Common for 1 to 4 semesters.** |
| 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. | |
| ***NOTE:*** *For 2nd Unit of the Trade, only Trainees Tool Kit (from Sl No- 1 to 18) is required additionally.* | | | |

### B. SHOP TOOLS, INSTRUMENTS and MACHINERY

| | | | |
|---|---|---|---|
| 1 | C- Clamp 200 mm, 150 mm and 100 mm | 2 Nos each | **Common for 1 to 4 semesters.** |
| 2 | Spanner Adjustable 150 mm,300mm | 2 Nos each | |
| 3 | Blow lamp 0.5 ltr | 1 | |
| 4 | Melting Pot | 1 | |
| 5 | Ladel | 1No | |
| 6 | Chisel Cold firmer 25 mm X 200 mm | 2 | **Common for 1 to 4 semesters.** |
| 7 | Chisel 25 mm and 6 mm | 2 Nos each | |
| 8 | Hand Drill Machine | 1 | |
| 9 | Portable Electric Drill Machine 6 mm capacity | 1 | |
| 10 | Pillar Electric Drill Machine 12 mm capacity | 1 | |
| 11 | Allen Key | 1 set | |
| 12 | Oil Can 0.12 ltr | 1 | |
| 13 | Grease Gun | 1 No | |
| 14 | Out Side Micrometer | 2 | **Common** |

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| | | | **for 1 to 3 semesters.** |
| 15 | Motorised Bench Grinder | 1 | **Common for 1 to 4 semesters.** |
| 16 | Rawl plug tool and bit | 2 set | |
| 17 | Pully Puller | 2 | |
| 18 | Bearing Puller | 2 | |
| 19 | Pipe vice | 4 | |
| 20 | Thermometer 0 to 100 deg Centigrade | 1 No. | |
| 21 | Scissors blade 150 mm | 4 Nos. | Common for 1 & 3 semesters |
| 22 | Crimping Tool | 2 sets | **Common for 1 to 4 semesters.** |
| 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 Extractor 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. | **Common for 1 to 3 semesters.** |
| 29 | Outside and Inside Divider Calliper | 2 Nos. each | |
| 30 | Pliers flat nose 150 mm | 4 Nos. | **Common for 1 to 4 semesters.** |
| 31 | Pliers round nose 100 mm | 4 Nos. | |
| 32 | Tweezers 100 mm | 4 Nos. | |
| 33 | Snip Straight and Bent 150 mm | 2 Nos. each | **Common for 1, & 3 semesters.** |
| 34 | D.E. metric Spanner | 2 Nos. | **Common for 1 to 4 semesters.** |
| 35 | Drill hand brace | 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 | 2 Nos. each | |
| 38 | Gauge, wire imperial | 2 Nos. | |
| 39 | File flat 200 mm 2nd cut | 8 Nos. | |
| 40 | File half round 200 mm 2nd cut | 4 Nos. | |
| 41 | File round 200 mm 2nd 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 | 2 Nos. each | |
| 47 | Copper bit soldering iron 0.25 kg. | 2 Nos. | |
| 48 | Desoldering Gun | 4 Nos. | **Common for 1 to 4 semesters.** |
| 49 | Hand Vice 50 mm jaw | 4 Nos. | |
| 50 | Table Vice 100 mm jaw | 8 Nos. | |

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| 51 | Pipe Cutter to cut pipes upto 5 cm. dia | 4 Nos. | **Common for 1, to 3 semesters.** |
| 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 | Stock and Dies conduit | 1 No. | |
| 55 | Ohm Meter; Series Type & Shunt Type | 2 Nos. each | **Common for 1 to 4 semesters.** |
| 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. Milli ammeter 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 | 1 No. each | |
| 65 | Power Factor Meter | 1 No. | |
| 66 | Frequency Meter | 1 No. | |
| 67 | Flux meter | 1 No. | |
| 68 | Wheat Stone Bridge with galvanometer and battery | 1 No. | |
| 69 | Laboratory Type Induction Coil | 1 No. | |
| 70 | DC Power Supply 0-30V, 2 amp | 1 No. | **Common for 1, to 3 semesters.** |
| 71 | Rheostat<br>0 -1 Ohm, 5 Amp<br>0 -10 Ohm, 5 Amp<br>0- 25 Ohm, 1 Amp<br>0- 300 Ohm, 1 Amp | 1 No. each | |
| 72 | 1 Phase Variable Auto Transformer | 1 No. | **Common for 1 to 4 semesters.** |
| 73 | Battery Charger | 1 No. | |
| 74 | Hydrometer | 1 No. | |
| 75 | Miniature Breaker 16 amp ( Raw Material) | 1 No. | **Common for 1 to 4 semesters.** |
| 76 | Working Bench 2.5 m x 1.20 m x 0.75 m | 4 Nos. | |
| 77 | Fire Extinguisher $CO_2$, 2 KG | 2 Nos. | |
| 78 | Fire Buckets | 2 Nos. | |
| **Note: The items which are available in the market nearest of the specification as mentioned above may be procured.** | | | |

**FURNITURE :**

| *Sl. No.* | *Name of the items* | *Quantity* | *Remarks* |
|---|---|---|---|
| 1 | Instructor's table | 1 No. | **Common for 1 to 4 semesters** |
| 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. | |

**Syll a bus f or the T ra de of " *Electr ician* "**

**Second Semester** **Duration : Six Month**

**Semester Code: ELE: SEM II**

| Week No. | Trade practical | Trade Theory |
|---|---|---|
| 1-2 | Different wave shapes of rectifiers and their values using C.R.O.<br>Identification of terminals, construction & Testing of transistor.<br>Assembly and testing of a single stage Amplifier and checking using an oscilloscope. | Working principle and uses of an oscilloscope.<br>Explanation of principle of working of a transistor & configuration.<br>Types of transistors & its application.<br>Specification and rating of transistors.<br>Explanation of transistor Amplifiers, Amplifiers. – class A,B and C<br>Power amplifier |
| 3-4 | Measure Voltage, current & wave shape of oscillator using CRO.<br>Simple circuits containing U.J.T. for triggering, FET as an amplifier and Power control circuits by S.C.R. and Diac, triac, I.G.B.T.<br>Logic gates and circuits. | Explanation of oscillator-working principle<br>Explanation of stages and types.<br>Multivibrator – applications.<br>Introduction of basic concept of ICs, U.J.T., F.E.T.<br>Basic concept of power electronics devices e.g. S.C.R., Diac, Triac, power MOSFET, G.T.O and I.G.B.T.<br>**Digital Electronics** -Binary numbers, logic gates and combinational circuits, |
| 5-6 | Practice in casing, Capping.<br>Conduit wiring with minimum to more number of points.<br>Use of two way switches.<br>Testing of wiring installation by meggar.<br>-Fixing of calling bells/buzzers.<br>-Making of test boards & extension boards<br>Identification & demonstration on conduits and accessories & their uses, cutting , threading & laying<br>Installation, Testing, Maintenance and Repairing of wiring. | **Electric wirings**, I.E. rules.<br>Types of wirings both domestic and industrial.<br>Specifications for wiring.<br>Grading of cables and current ratings.<br>Principle of laying out in domestic wiring.<br>Voltage drop concept.<br>**Wiring system -** P.V.C., concealed system.<br>Maintenance and Repairing data sheet preparation. Specifications, standards for conduits and accessories<br>- Power Wiring<br>- Control Wiring<br>- Information Communication<br>- Entertainment Wiring.<br>Testing of wiring installation by meggar. |
| 7 | Application of fuses, relay, MCB, ELCB. | Study of Fuses, Relays, Miniature circuit breakers (MCB), ELCB, etc. |

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| 8-9 | Identification of the parts of a D.C. machine.<br>Connection of shunt Generators<br>Voltages build up in DC Shunt Generator (OCC)<br>Measurement of voltages, Demonstration on field excitation. | **D.C. Machines -** General concept of Electrical Machines.<br><br>**Principle of D.C. generator.** Use of Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, slip ring Brushes, Laminated core.<br><br>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. |
| 10-11 | Connection of compound Generator, Voltage measurement, cumulative and differential –No Load and Load characteristics of Series, Shunt and Compound Generator.<br>Controlling and protecting DC Generator.<br><br>Practicing dismantling and assembling in D.C. Machine. | Explanation of Armature reaction, inter poles and their uses, connection of inter poles, Commutation. Losses & Efficiency of D.C.Generator, Parallel Operation of D.C.Generator.<br>Application of D.C. generators.<br>Care, Routine & preventive maintenance. |
| 12-13 | Identification of parts and terminals of DC motors.<br>Connection, starting, running of DC motors using Starters.<br>Characteristics curve of DC motors.<br>Practical application of D.C. motors. | **DC Motors -** Terms used in D.C. motor-Torque, Brake Torque, speed, Back-e.m.f. etc. and their relations, Types of D.C.Motor.<br>Starters used in D.C. motors<br>Related problems<br>Characteristics of D.C.Motor, Losses & Efficiency, Application of D.C. motors.<br>Care, Routine & preventive maintenance. |
| 14 | Speed control of DC motors by voltage , field, armature & Word-Leonard system. | Types of speed control of DC motors in industry.<br>Control system. AC-DC, DC-DC control. |
| 15-18 | Identification of types of transformers. Connection of transformers, Transformation ratio, OC (No-load) and SC (short circuit) tests,efficiencies of transformers, testing of transformer, parallel operation of transformer.<br>Use of Current Transformer (C.T.) and Potential | Working principle of **Transformer**.<br>classification C.T., P.T. Instrument and Auto Transformer(Variac), Construction, Single phase and Poly phase.<br>E.M.F. equation, parallel operation of transformer, their connections.<br>Regulation and efficiency.<br>Type of Cooling for transformer.<br>Protective devices.<br>Specifications, simple problems on e.m.f. Equation, turn ratio, regulations and |

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| | (Voltage) transformer (P.T.)<br>Testing of single phase and Three Phase Transformers - Cleaning, maintenance, testing and changing of oil.<br>Single and three phase connection. | efficiency. Special transformers.<br>Transformer – Classification of transformer. Components, Auxiliary parts i.e. breather, Conservator, buchholze relay, other protective devices. Transformer oil testing and Tap changer (off load and on load). Dry type transformer.<br>Bushings and termination. |
| 19-21 | Identify the type of Instruments.<br>Use of **-P**MMC , MI meter, Multi-meter(Digital/Analog) , Wattmeter, P F meter, Energy meter, Frequency meter,<br>Calibration of **-** Multi-meter Phase sequence meter, Digital Instruments, etc<br>Calibration of Energy meter. | **Electrical Measuring Instruments -**<br>-types, indicating types. Deflecting torque, Controlling torque and<br>Damping torque ,<br>PMMC & MI meter (Ammeter, Voltmeter)<br>-Range extension<br>-Multimeter(Digital/Analog)<br>-Wattmeter<br>- P.F. meter<br>- Energy meter (Digital/analog)<br>–Insulation Tester (Megger), Earth tester.<br>-Frequency meter<br>-Phase Sequence meter<br>-Multimeter –Analog and Digital<br>-Tong tester<br>-Techometer. |
| 22-23 | Industrial visit / project work | |
| 24-25 | NCVT EXAMINATION | |
| 26 | Semester Gap | |

# CTS Second Semester: Electrician

## SHOP TOOLS, INSTRUMENTS and MACHINERY

| *Sl. No.* | *Name of the items* | *Quantity* | *Remarks* |
|---|---|---|---|
| 1 | Tachometer | 1 No. | **Common for 2 to 4 semesters** |
| 2 | Current Transformer<br>415 Volt,50 Hz, CT Ratio 150 / 5 Amp, 5VA | 1 No. | |
| 3 | Potential Transformer<br>415 Volt,50Hz, PT Ratio 11KV/ 110V, 10VA | 1 No. | |
| 4 | Growler | 1 No. | **Common for 2 to 4 semesters** |
| 5 | Tong Tester / Clamp Meter 0 – 100 amp. AC | 1 No. | |
| 6 | Megger 500 volts | 1 No. | |
| 7 | Contactor & auxiliary contacts 3 phase, 440volt, 16amp (Raw Material) | 1 No. each | |
| 8 | Contactor & auxiliary contacts 3 phase, 440 volt, 32 amp. (Raw Material) | 1 No. each | |
| 9 | Limit Switch (Raw Material) | 1 No. | |
| 10 | Rotary Switch 16 A (Raw Material) | 1 No. | |
| 11 | Load Bank 5 KW( Lamp / heater Type) | 1 No. | |
| 12 | Brake Test arrangement with two spring balance 0 to 25 kg rating | 1 No. | **Common for 2 & 3 semesters** |
| 13 | Knife Switch DPDT fitted with fuse terminals 16 amp (Raw Material) | 4 Nos. | **Common for 2 to 4 semesters** |
| 14 | Knife Switch TPDT fitted with fuse terminals 16 amp (Raw Material) | 4 Nos. | |
| 15 | Voltage Stabiliser<br>Input: 150 – 230 volt AC<br>Output: 220 volt AC | 1 No. | |
| 16 | 3- point D.C. Starter | 1 No. | |
| 17 | 4- point D.C. Starter | 1 No. | |
| 18 | Electrical Machine Trainer –<br>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 unit | 1 for 8 (4+4) Units | **Common for 2 to 4 semesters** |
| 19 | Motor-Generator (AC to DC) consisting of :<br>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.<br>Induction Motor rating: 7 HP, 400V, 50 cycles, 3 phase<br>DC Shunt Generator rating: 5 KW, 440V | 1 No. | |
| 20 | Used DC Generators-series, shunt and compound type | 1 No. each | |

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| | for overhauling practice | | |
| 21 | D.C. Shunt Generator with control panel,2.5 KW, 220V | 1 No. | |
| 22 | D.C. Compound Generator with control panel including fitted rheostat, voltmeter, ammeter and breaker, 2.5 KW, 220 V | 1 No. | |
| 23 | Diesel Generator Set with change over switch, over current breaker and water-cooled with armature, star-delta connections AC 3 phase, 5 KVA, 240 volt | 1 No. | **Common for 2 to 4 semesters** |
| 24 | DC Series Motor coupled with mechanical load 0.5 to 2 KW, 220 Volts | 1 No. | **Common for 2 & 4 semesters** |
| 25 | DC Shunt Motor 2 to 2.5 KW, 220 volts | 1 No. | |
| 26 | DC compound Motor with starter and switch 2 to 2.5 KW ,220 volts | 1 No. | |
| 27 | Single phase Transformer, core type, air cooled 1 KVA , 240/415 V, 50 Hz | 1 No. | |
| 28 | Three phase transformer, shell type oil cooled with all mounting 3 KVA , 415/240 V, 50 Hz , (Delta/Star) | 1 No. | |
| 29 | Oscilloscope Dual Trace, 30 MHZ | 1 No. | |
| 30 | Function Generator | 1 No. | |
| 31 | Discrete Component Trainer | 1 No. | |
| 32 | Linear I.C. Trainer | 1 No. | |
| 33 | Digital I.C. Trainer | 1 No. | |
| 34 | Oil Testing Kit | 1 No. | **Common for 2 & 4 semesters** |
| **Note: The items which are available in the market nearest of the specification as mentioned above may be procured.**<br>**Sl no. 18 , Electrical Machine trainer up to 8 (4+4) units- one no.**<br>**Sl no. 19 to 34 for 4(2+2) units no additional items are required.** | | | |

**Syll a bus f or the T ra de of " *Electr ician* "**

**Third Semester** **Duration : Six Month**

**Semester Code: ELE: SEM III**

| Week no. | Trade practical | Trade Theory |
|---|---|---|
| **1-3** | Identification of parts and terminals of AC motors.<br>Connection, starting, running of AC motors using Starters.<br>Measurement of slip, P.F. at various loads.<br>Practice on connection of D.O.L Starter, Star /Delta starter, Autotransformer starter, Rotor resistance starter, etc<br>Speed control of Induction motors by various methods.<br>Practical application of A.C. motors. | **Three phase Induction motor** –<br>Working principle –Production of rotating magnetic field, Squirrel Cage Induction motor, Slip-ring induction motor.<br>Construction , characteristics and Speed control, Slip & Torque .<br>Control & Power circuit of starters<br>D.O.L Starter, Star /Delta starter, Autotransformer starter, Rotor resistance starter, etc<br>Single phasing preventer.<br>Losses & efficiency.<br>Application of Induction Motor<br>Care, Routine & preventive maintenance. |
| **4-5** | Connection of single phase motor, identification, testing, running and reversing.<br><br>Identification, connection, testing, running and reversing of universal motor. Repulsion motor, stepper motor. | **Single phase induction motor-**<br>Working principle, different method of starting and running (capacitor start, permanent capacitor, capacitor start & run, shaded pole technique).<br>FHP motors, Repulsion motor, stepper motor, Hysteresis motor, Reluctance motor.<br>Application of Single phase induction motor<br>**Universal motor**-advantages, Principle, characteristics, applications in domestic and industrial appliances,<br>Fault Location and Rectification.<br>Braking system of motor.<br>Application of Universal motor. |
| **6-7** | Identification of parts and terminals of Alternator.<br>Connection, starting, running of Alternator.<br>Practical application of Alternator.<br>Practice on alternators, voltage Building, load characteristic, voltage regulation, Parallel operation.<br>Practice on installation, running and maintenance of Alternators. | **Alternator**<br>Explanation of alternator, types of prime mover, efficiency, regulations, phase sequence, Parallel operation.<br>Specification of alternators and Brushless alternator.<br>Verify the effect of changing the field excitation and Power factor correction of Industrial load. |

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| **8** | Identification of parts and terminals of Synchronous motor.<br>Connection, starting, running of Synchronous motor.<br>Plot V curve.<br>Practical application of Synchronous motor. | **SYNCHRONOUS MOTOR -**<br>Working principle, effect of change of excitation and load.<br>V and anti V curve.<br><br>Cause of low power factor.<br>Method of power factor improvement. |
| **9** | Starting, running, building up voltage and loading of Motor Generator (MG) set.<br>Maintenance of MG Sets.<br>Solid state controller and Invertors- Operation and Use | Rotary Converter- Inverter, M.G. Set description, Characteristics, specifications-running and Maintenance.<br>Solid state controller and Invertors. |
| 10 | Practice on winding of small Transformers. | **TRANSFORMER Winding** , Small Transformer winding techniques |
| 11-12 | Testing of burnt DC machine for rewinding – collection of data – developed diagram and connection – winding procedure<br>Making frame(forma), coil insulation, Slot insulation, Insertion of coils in slots, coil connection,<br>Practice on armature winding, Growler testing, Baking, Impregnation and Varnishing & assembling. | **DC machine Winding--** Armature winding terms, pole pitch, coil pitch, back pitch, front pitch , Lap and Wave winding , Progressive and retrogressive Winding, developed diagram.<br>Growler construction, working & application. |
| 13-15 | Testing of burnt motor for rewinding – collection of data – developed diagram and connection – winding procedure<br>Making frame(forma), coil insulation, Slot insulation, Insertion of coils in slots, coil connection, Practice on single & double layer, concentric Winding,<br>Winding of table & ceiling fans, single phase and three phase motors – testing of wound motor<br>Baking, impregnating and varnishing & assembling. | **AC machine Winding—** Motor winding terminology – classification of conducting and insulating materials used in winding – Types and methods of winding in single and three phase motors.<br><br>Stator winding terms, coil side, end coil and grouping of coils. Connection to adjacent poles, connected stator winding, alternate pole connection, developed diagram. |

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| 16-17 | Installation of -<br>Mercury & Sodium vapours (H.P. & L.P.)<br>Halogen Lamps<br>Single FL tube and twin FL tube.<br>Practice on decoration lighting<br>Principle of layout of lighting installation.<br>Practice on photo cells. | **Illumination**, Laws of Illuminations, terminology used , Illumination factors, intensity of light –importance of light, human eye factor, , units.<br>Types of illumination<br>Type of lamps<br>-Neon sign Halogen, Mercury vapour, sodium vapour, Fluorescent tube, CFL, LED, Solar lamp & photo cell applications, Decoration lighting, Drum Switches, efficiency in lumens per watt, Calculations of lumens.<br>Estimating placement of lights, fans and ratings. |
| 18-19 | Practice on wiring of electric motor, control panel, etc.<br>Trace/Test of different circuit Breakers.<br>Protective and control relays, contactors, etc.<br>Operation and use of XLPE cables. | **Industrial wiring**. Code of practice and relevant span. Wiring of electric motors, control panel, etc.<br>Types, specifications, advantages of different types of circuit brackets construction and maintenance.<br>Working principle and construction of domestic and agricultural appliances-their maintenance. |
| 20-21 | Practice of wiring Maintenance of institute, hostel, hotel, residential building.<br>Layout and repairing of workshop electrical installation.<br>Fault finding practice | Complete House-wiring layout.<br>Splitting load wire in accordance with NEC I.E.E. Rules.<br>Multi-storeyed system.<br>Fault finding and trouble shooting. |
| 22-23 | Industrial visit / project work | |
| 24-25 | NCVT EXAMINATION | |
| 26 | Semester Gap | |

# CTS Third Semester: Electrician

## SHOP TOOLS, INSTRUMENTS and MACHINERY

| *Sl. No.* | *Name of the items* | *Quantity* | *Remarks* |
|---|---|---|---|
| 1 | Hygrometer | 1 set | |
| 2 | a. Cut out Relays<br>b. Reverse current<br>c. Over current<br>d. Under voltage | 1 No. each | **Common for 3 & 4 semesters** |
| 3 | Starters for 2 to 5 H.P. A.C Motors<br>a. Resistance type starter<br>b. Direct on line Starter<br>c. Star Delta Starter- manual, semi-automatic and automatic<br>d. Auto Transformer type | 1 No. each | |
| 4 | Motor Generator(DC to AC) set consisting of - 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.<br>Shunt Motor rating : 5 HP, 440V<br>AC Generator rating : 3-Phase, 4 wire, 3.5 KVA, 400/230 Volts, 0.8 pf, 50cycles | 1 No. | |
| 5 | 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. | |
| 6 | AC phase-wound slip ring Motor with starter and switch 5 HP, 400 volts, 3-phase, 50 cycles | 1 No. | |
| 7 | A.C. Series type Motor with mechanical load ¼ HP, 230V, 50 Hz | 1 No. | |
| 8 | Single Phase Capacitor Motor with starter switch 1 HP 230 volt 50 cycles | 1 No. | |
| 9 | Universal Motor with starter/switch 230 volt, 50 cycles ¼ HP | 1 No. | |
| 10 | Stepper Motor with Digital Controller | 1 No. | |
| 11 | Shaded Pole Motor | 1 No. | |
| 12 | Bath Impregnating | 1 No. | |
| 13 | Oven Stove | 1 No. | |

**Note: The items which are available in the market nearest of the specification as mentioned above may be procured.**
**Sl no. 3 to 13 for 4(2+2) units no additional items are required.**

**TOOLS AND EQUIPMENT NEEDED ADDDITIONAL TO EXISTING TOOLS LIST**

| ***Sl. No.*** | ***Name of the items*** | ***Quantity*** | ***Remarks*** |
|---|---|---|---|
| 1 | Synchronous motor 3 Phase, 3 HP, 415V, 50Hz, 4 Pole, with accessories. | 1 no. | |
| 2 | Lux meter | 1 no. | |

**Syll a bus f or the T ra de of " *Electr ician* "**

**Fourth Semester** **Duration : Six Months**

**Semester Code: ELE: SEM IV**

| Week No. | Trade Practical | Trade Theory |
|---|---|---|
| 1-3 | **Machine control cabinet /Control Panel Layout, Assembly & Wiring**:<br><br>Practice Layout drawing of control cabinet , panel, power & control circuits<br><br>Preparing control cabinet / panel wiring for<br><br>1. Local & Remote control of Induction motor<br>2. Forward & Reverse operation of Induction motor<br>3. Automatic Star Delta Starter<br>4. Automatic star delta starter with change of direction of rotation<br>5. Sequential control of three motors.<br><br>**Preparation of Control cabinet & panel**: Necessary marking, cutting, filing, drilling, tapping etc.<br><br>**Mounting of control elements & wiring Accessories**: Isolator, pushbutton switches, Indicating lamps, meters, MCB, Fuse, Contactor, Relays, Overload Relay, Timers, Rectifier, Limit switches, control transformers, Raceways/cable channel, Terminal connectors etc.<br><br>**Wiring of control cabinet/panel:** As per wiring diagram.<br><br>Bunching of wires & cables, channelling, tying etc.<br><br>Checking / buzzing the wiring.<br><br>Power connections & motor connection & testing. | **Machine control cabinet /Control Panel Layout, Assembly & Wiring**:<br><br>Layout of Control cabinet & control panel<br><br>Study & Understand Layout drawing of control cabinet , panel, power & control circuits.<br><br>**Control Elements:** Isolator, pushbutton switches, Indicating lamps, MCB, Fuse, Contactor, Relays, Overload Relay, Timers, Rectifier, Limit switches, control transformers.<br><br>Wiring Accessories: Race ways/ cable channel, DIN Rail, Terminal Connectors, Thimbles, Lugs, Ferrules, cable binding strap & buttons, nylon cable ties, sleeves, Gromats & clips |

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| 4-6 | Repair & Test of Calling Bell, Buzzer, Alarms, Electric Iron, Heater, Light. Maintenance and repair of domestic equipments – Electric Kettle, Heater / Immersion Heater, Hot Plate, Oven, Geyser, Cooking range, Mixer, Washing machine, , Motor Pump set, etc. | **Domestic Appliances:** Working principles and circuits of common domestic equipment and appliances. – Calling Bell, Buzzer, Alarms, Electric Iron, Heater, Light Electric Kettle, Heater / Immersion Heater, Hot Plate, Oven, Geyser, Cooking range, Mixer, Washing machine, , Motor Pump set, etc.<br>Concept of Neutral and Earth. |
| 7 | Practice on Thermal power plant simulator (free version) or Plant visit.<br><br>To prepare layout plan, single line diagram of the Thermal power system of generation. | **POWER GENERATION :**<br>Generation sources of energy, Comparison of energy resources. Types of fuels. Advantages of liquid fuel & solid fuel.<br>Various ways of electrical power generation. • Thermal • Hydro electric • Nuclear • Non-Conventional<br>Thermal<br>Coal based, diesel based & Gas based Turbine. Constituents in steam power station. |
| 8 | Practice on Hydro power plant simulator (free version) or Plant visit.<br><br>To prepare layout plan, single line diagram of the Hydro electric power system of generation. | **Hydro Electric:**<br>Schematic arrangement of Hydro-Electric Power Station. Constituents of Hydro Electric Plant. Types of Hydro Electric Power station. Advantages & disadvantages. |
| 9 | Practice on Nuclear power plant simulator (free version) or Plant visit.<br><br>To prepare layout plan, single line diagram of the Nuclear power system of generation. | **Nuclear:**<br>Schematic arrangement of Nuclear Power Station. Composition of an atomic Nucleus. Advantages & disadvantages. Comparison of above Power Plant. |

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| 10-11 | Practice on Non-conventional power plant simulator (free version) or Plant visit.<br>To prepare layout plan, single line diagram of the non-conventional power system of generation. | **Non-Conventional**<br>An introduction to Power generation through non-conventional power generation such as Solar, Bio-Gas, Wind energy and Micro-hydel, Tidal waves, etc. Basic principal, Advantages & disadvantages of each. |
| 12 | Identification and specification of different type of insulator used in HT line.<br><br>Binding of Pin type insulator, shackle type and suspension type insulators.<br><br>Fixing of jumper by crimping tool. | **TRANSMISSION OF ELECTRICAL POWER**<br><br>Electrical Supply System :<br><br>Comparison of AC and DC transmission. Advantages of High transmission voltage.<br><br>Introduction to Single phase , three phase-3 wire system in transmission lines<br><br>Overhead Lines:<br><br>Main components of overhead lines-Types of power line Low voltage line medium Voltage line & high voltage line Voltage standard Conductor materials, line supports, Insulators, types of Insulators |
| 13 | Skinning and dressing of cables.<br><br>Straight joint of different types of underground cables.<br><br>Test /check the insulation resistance of cables by using megger.<br><br>Locating the faults (open circuit, short circuit & leakage) in cables. | **Under Ground Cable :**<br><br>Construction of cables. Material for cables, its insulation. Classification of cables, cables for 3-phase service, Laying of underground cable. Types of cable faults and their location. |

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| 14 | To visit & prepare layout plan, single line diagram of Transmission /distribution Substation.<br><br>Installation of bus bar and bus coupler on LT line.<br><br>Replacement and testing of transformer oil. | **DISTRIBUTION OF POWER**<br><br>Function and equipment used in substation.<br><br>Classification of distribution system-AC distribution, Overhead v/s underground distribution system.<br><br>Essential features of switchgears. Isolator, Switch gear equipments, bus-bar arrangement, Short circuit, faults in power system.<br><br>**Circuit breakers** – Introduction & Classification of circuit breakers<br><br>lightening arrestors used in HT lines. |
| 15-16 | Speed control of DC motor :<br>Connection, parameterization and speed control by Thyristor/ DC Drive. | Introduction, Construction & Working of power transistor, thyristor.<br>Introduction, Construction, Working, Parameters & application of DC drive. |
| 17-18 | Speed control of AC motor :<br>-Uses of SCR and other modern semiconductor devices in controlling speed of motors and in changing the direction of rotation of motors.<br>Connection, parameterization and speed control by AC Drive. | Speed control of 3 phase induction motor by using VVVF/AC Drive.<br>Introduction, Construction, Working, Parameters & application of AC drive |
| 19-21 | Break down, Routine & Preventive maintenance of DC/AC machines, Voltage stabilizer, Inverter, U.P.S. & Equipments. | Schedule of electrical preventive maintenance.<br>Break down, Routine & Preventive maintenance of DC/AC machines, Voltage stabilizer, U.P.S. & Equipments. |
| 22-23 | Industrial visit / project work | |
| 24-25 | NCVT EXAMINATION | |
| 26 | Semester Gap | |

# CTS Fourth Semester: Electrician

## SHOP TOOLS, INSTRUMENTS and MACHINERY

| *Sl. No.* | *Name of the items* | *Quantity* | *Remarks* |
|---|---|---|---|
| 1 | Inverter- 1 KVA with 12 V Battery<br>Input- 12 volt DC,<br>Output- 220 volt AC | 1 No. | |
| 2 | Domestic Appliances –<br>a. Electric Hot Plate 1500 watt<br>b. Electric Kettle, 1500 watts<br>c. Electric Iron 1500 watts<br>d. Immersion Heater 1500 watt<br>e. A.C. Fan<br>f. Geyser (Storage type) 15 ltr minimum<br>g. Mixture & Grinder | <br>1 No.<br>1 No.<br>1 No.<br>1 No.<br>1 No.<br>1 No.<br>1 No. | |
| 3 | Thyristor /IGBT controlled D.C. motor drive with tacho-generator feedback arrangement 1 HP | 1 No. | |
| 4 | Thyristor/IGBT controlled A.C. motor drive with VVVF control 3 Phase, 2 HP | 1 No. | |
| **Note: The items which are available in the market nearest of the specification as mentioned above may be procured.**<br>**Sl no. 1 to 4 for 4(2+2) units no additional items are required.** | | | |

## TOOLS AND EQUIPMENT NEEDED ADDDITIONAL TO EXISTING TOOLS LIST

| *Sl. No.* | *Name of the items* | *Quantity* |
|---|---|---|
| 1 | Pentium IV Computer or latest (Server- Linux), 2.8 GHz & above, 1 GB RAM, 80 GB HDD, DVD Combo Drive, 15/17" Monitor, optical scroll mouse, multimedia key board, 32 bit LAN card with UPP port, necessary Drivers, etc. | 2 Nos. |
| 2 | Ink jet/ laser printer | 1 No. |
| 3 | Washing Machine | 1 No. |
| 4 | Motor Pump set 1 HP, 1 Phase, 240 V | 1 No. |
| 5 | Pin Type, shackle type & suspension type insulators (Raw Material) | 2 Nos. each |