SYLLABUS OF SEMESTER SYSTEM
FOR THE TRADE OF

W I R E M A N

Under

Craftsmen Training Scheme (CTS)

(Two years/Four Semesters)

Redesigned in

2014

By

Government of India

Ministry of Labour & Employment (DGE&T)

GENERAL INFORMATION

- Name of the Trade: : WIREMAN
- N.C.O. Code : 7137.20
- Entry Qualification : 8^{th} pass
- Duration of Training : 2 Years (4 Semesters)
- Unit Size : 16
- Space Requirement : 88 Sq. metres (11 x 8 metres)
- Power Requirement : 5 KW
- Instructors Qualification : Degree in Electrical / Electrical and Electronics Engineering from recognized Engineering 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

  NTC/NAC in the Trade of Electrician/ Wireman with three years post qualification experience in the relevant field and one year Craftsman instructor training under CITS in 'Wireman'.

Job Description/Job Role : (Ref NCO 7137.20)

- Install different instruments for measurement of Voltage, Current, Power, Power factor, Energy, etc.
- Mark according to a given sketch, file a given job with an accuracy of ± 0.25 mm, drill and Tap a hole.
- Use simple carpenter's & sheet metal worker's hand tools.
- Use of Basic Computer operations.
- Carry out simple domestic wiring circuits and provide earthing.
- Install Fluorescent, Sodium Vapour Lamp, Neon Sign, Decorative Lights, CFL Lamps, LED Lamps etc.
- Carryout wiring for lighting and power as per I.E. rules and test in residential buildings and Workshops.
- Connect, run, test and rectify the faults of electrical Wiring Installations.
- Carryout commercial lighting for decoration etc.
- Test the wiring installation, locate fault and rectify them.
- Wire up commercial & industrial installations as per I.E. rules.
- Carryout UPS / INVERTER wiring.
- Carryout Video /audio cabling.
- Do computer / LAN cabling & networking.
- Troubleshooting and maintenance of commercial / industrial wiring.
- Plan & estimate for commercial / industrial installations.
- Test, connect and run D.C. machines and repair faults, in any wiring system.
- Wire up motors to the supply as per standards.
- Maintain and repair power and control wiring of motors & controls.
- Operate, maintain alternators and troubleshoot faults, rectify them.
- Operation and maintenance of AC/DC Motors.
- Operate and maintain 3 phase systems.
- Wire up power and control wiring of motors.
- Install and connect Transformers, parallel connection, carry out necessary maintenance,
- Charge, discharge & maintain battery.
- Synchronizing of Alternator output with EB Supply.
- Wiring the control Panel board with all indicating, controlling and protection devices.

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.	BN 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.	UK 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.	Dr.A.K. Ghoshal	Professor, IIT, Guwahati
27.	Dr.P. Mahanto	Professor, IIT, Guwahati
28.	K.K. Seth	Ex. Director, BHEL, Noida

29. N. Chattopadhyay	Sr. DGM, BHEL, Kolkatta
30. Surendu Adhikari	OTIS Elevator Co. India Ltd, Kolkatta
31. K. Raju	Consultant- Energy Area, ASCI, Hyderabad
32. Ravi G Deshmukh	Certified Energy Auditor, PPS Energy solutions, Pune
33. R. Thiruppathi,	JTS, IIT, Madras, Chennai
34. B. Navaneedhan,	ATO, ITI. North Chennai
35. R . Rajasekar,	ATO, ITI, Ambattur, Chennai
36. K. Amaresan,	ATO, Govt ITI, Guindy, Chennai
37. M. N. Krishnamurthy	Retd. Ex Engineer, TNEB, Chennai
38. S. Kirubanandam,	Asst. Ex Engineer, TANTRANSCO, Chennai
39. R. Kasi,	Asst. Ex Engineer, TANTRANSCO, Chennai
40. L.R. Sundarajan,	Jr. Works Manager, Heavy vehicles factory
41. B.S. Sudheendara	Consultant, VI micro systems pvt ltd, Chennai.
42. S. Ganesh	Manager, L&T , Chennai
43. G. Neethimani	Vice Principal, Rane engine valves ltd, Chennai.

Syllabus for the Trade of "*Wireman*"

Duration : Six Months

First Semester

Semester Code: WM: SEM I

Week No.	Trade Practical	Trade Theory
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 Practice on use of fire extinguishers.	**Occupational Safety and Health** Basic safety introduction, Personal protection. Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution and personal safety message. Use of Fire extinguishers. Visit and observation of sections. 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. Use, care and maintenance of various hand tools.	Identification of Trade-Hand tools-Specifications
3	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 and effects of electric current Explanation, Definition and properties of conductors, insulators and semi-conductors

	Demonstration and Practice on bare conductors joints-- such as Britannia, straight, Tee, Western union Joints	Wires/cable & its specification. Types of wire joint & use.
4	Practice on soldering- Measurement of Resistance. Determination of specific Resistance.	Solders, flux and soldering technique. Types & properties of resistors Specific Resistance.
5 - 6	Verification of Ohm's Law, Verification of Kirchhoff's Laws. Verification of series and parallel circuits. Verification of open circuit and closed circuit network. Measuring unknown resistance using different methods- a) Using Wheatstone Bridge b) By voltage drop method. Experiment to demonstrate the variation of resistance of a metal with the change in temperature.	**Ohm's Law -** Simple electrical circuits and problems. **Resistors -**Law of Resistance. Series and parallel circuits. **Kirchhoff's** Laws and applications. Wheatstone bridge principle and its applications. Effect of variation of temperature on resistance. Different methods of measuring the values of resistance.
7	Demonstration and identification of types of cables. Demonstration and practice on using standard wire gauge & micrometre. Practice on crimping thimbles, Lugs.	Introduction of National Electrical Code Voltage grading of different types of Insulators, Temp. Rise permissible. Types of wires and cables standard wire gauge. Specification of wires and Cables-insulation and voltage grades -Low , medium and high voltage Precautions in using various types of cables / Ferrules
8-10	Grouping of Dry cells for a specified voltage and current. Practice on Battery Charging, Preparation of battery charging, Testing of cells, Installation of batteries, Charging of batteries by different methods.	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.

	Charging of a Lead acid cell, filling of electrolytes- Testing of charging .checking of discharged and fully charged battery. Care and maintenance of Batteries	Cells - Primary & Secondary 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. Application of battery/cell in Inverter, Battery Charger, UPS, etc. Lead Acid cell, general defects and remedies. Nickel Alkali Cell-description charging. Power and capacity of cells. Efficiency of cells. Rechargeable dry cell, description advantages and disadvantages. Care and maintenance of cells Grouping of cells of specified voltage and current, Sealed Maintenance free Batteries, Solar battery.
11-12	ALLIED TRADES: Use of chisels and hacksaw on flats, sheet metal filing practice, filing true to line. Sawing and planning practice. Practice in using firmer chisel and preparing simple half lap joint.	Introduction of fitting trade. Safety precautions to be observed. Description of files, hammers, chisels hacksaw frames & blades, punch, etc- 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.
13	Drilling practice in hand drilling and power drilling machines. Grinding practice 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. Use of thread gauge.

14	Practice in using snips, marking and cutting of straight and 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.	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. Types of different soldering irons and their proper uses. Use of different bench tools used by sheet metal worker.
15	Identification and use of wiring accessories Practice on installation and overhauling common electrical accessories. Fixing of switches, holder plugs etc. in wooden/PVC/ Metallic boards.	Common Electrical wiring Accessories, their specifications in line with NEC - Explanation of switches, lamp holders, plugs and sockets. Developments of domestic circuits, Alarm & switches. Use & specification of Fire alarm, MCB, ELCB, MCCB.
16-17	Trace the magnetic field. Prepare Electromagnet. Use of magnetic compass. Assembly / winding of a simple electro magnet Identification of different types of Capacitors. 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, methods of magnetising magnetic materials. Para and Diamagnetism and Ferro magnetic materials. Principle of electro-magnetism, Maxwell's corkscrew rule, Fleming's left and right hand rules, Magnetic field of current carrying conductors, loop and solenoid. MMF, Flux density, reluctance. B.H. curve, Hysteresis, Eddy current. Principle of electro-magnetic Induction, Faraday's Law, Lenz's Law. Electrostatics: Capacitor- Different types, functions and uses.

18-19	Determine the characteristics of R, XL and XC in A.C. Circuits both in series and parallel. Experiment on poly phase circuits. Current, voltage, power and power factor measurement in single & poly- phase circuits. Measurement of energy in single and poly-phase circuits. Use of phase sequence meter.	**Alternating Current -**Comparison and Advantages D.C and A.C. Related terms frequency Instantaneous value, R.M.S. value Average value, Peak factor, form factor. Generation of sine wave, phase and phase difference. Inductive and Capacitive reactance Impedance (Z), power factor ; Active and Reactive power, Simple problems on RLC A.C. circuits, Single phase and three-phase system etc. Problems on A.C. circuits. Power consumption in series and parallel, P.F. etc. Concept three-phase Star and Delta connection. Line and phase voltage & current and power in a 3 phase circuits with balanced and unbalanced load.
20	**Practice on Earthing** - different methods of ear thing. Measurement of Earth resistance by earth tester. Connection & Testing of Earth Leakage by ELCB.	**Earthing** - Principle of different methods of ear thing. i.e. Pipe, Plate, etc Importance of Earthing. Improving of earth resistance Earth Leakage circuit breaker (ELCB). 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. **Diodes**-symbol - Tests - Construct & Test Half wave rectifier circuit Full wave rectifier circuit Bridge rectifier circuit	**Basic electronics**- Semiconductor energy level, atomic structure 'P' type and 'N' type. Type of materials –P-N-junction. Classification of Diodes – Reverse and Forward Bias, Heat sink. Specification of Diode Explanation and importance of D.C. rectifier circuit. Half wave, Full wave and Bridge circuit. Filter circuits-passive filter.
22 - 23	Industrial visit / project work	
24 - 25	NCVT EXAMINATION	
26	Semester Gap	

SEMESTER-II

Week No.	Trade Practical	Trade Theory
1 - 2	**ELECTRICAL MEASURING INSTRUMENTS-** Measurement of voltage, current & resistance in different circuits. Direct & indirect measurement of electrical power & energy. Calibration of energy meters. Measurement of current and voltage using CT & PT, Measurement of 3 Phase energy using CT & PT. Phase sequence meter, measure current and voltage using Tong tester. Power measurement by Two & Three watt meter method Insulation resistance test by Megger. Measurement of earth resistance by earth tester. Calibration of indicating type analogue instruments: voltmeter, ammeter, and wattmeter. Measurement of soil conductivity. Introduction of Digital meters.	Type of measuring instruments – MC & MI, Construction & working principles of Ammeter, Voltmeter, Ohm-meter ,Wattmeter, Energy meter, P.F. meter, frequency meter, multi meter, clamp meter, Megger & earth tester. Introduction of Digital meters. CT & PT. Tong tester / Clip on Meter.
3 - 4	**DOMESTIC WIRING - METHODS, INSTALLATION & TESTING-** Demonstration & Practice on connecting common electrical accessories in circuits and testing them in series board. Demonstration on Testing & replacement of different types of fuses. Identification of different wiring materials and their specifications. Removing of insulation from assorted wires and cables. Demonstration and practice crimping thimbles/lugs of various sizes. Jointing practice with single and multi-stranded conductors of different wires and cables.	Introduction and explanation of electrical wiring systems, cleat wiring, casing & Capping, CTS, Conduit and concealed etc., I. E. Rules. Related to wiring, National Building codes for house wiring, specification and types, rating & material.
5	Layout on wiring boards. Practice in P.V.C. insulated cable wiring on wood buttons with distribution board and number of points.	Branching of circuits with respect to loads such as lighting and power. CTS/PVC Conduit-surface and concealed/metal conduit/PVC casing and capping. IE rules regarding clip distance. Fixing of screws, cable bending etc

6	Practice of wiring: A) One lamp controlled by one SP switch, (B) Two lamps controlled by two independent switches, (C) One lamp controlled by two 2way switches (Staircase wiring), (D)One lamp controlled by intermediate switch from three different locations, (E)Hospital wiring, (F)Tunnel/Godown wiring, (G)Hostel wiring, (H)Bell Buzzer Indicator wiring (I)Domestic wiring practice	Description of different electrical fittings and accessories such as lamp holders, switches, plugs brackets, ceiling rose, cut out etc. IS 732-1963.Wiring materials used for P.V.C. cables I.E. rules, Indian standards regarding the above wiring such as-clip distance fixing of screws, cable bending etc.
7	Demonstration and practice of using Rowel tools, Demonstration and practice of casing and capping wiring. Testing of wiring installation by using Megger.	Description of Rowel tools and Rowel plugs, their sizes, plugging, compound, plugs- wall jumper and their sizes and uses. Introduction to estimation procedure, P.V.C. casing and capping materials, sizes and grades etc.
8	Demonstration and practice in cutting and threading conduit pipes. Cold and hot bending of pipes. Fitting of conduit accessories.	Conduit pipe wiring materials and accessories, types and sizes of conduit.
9	Preparation of conduit threads using different fittings and use of running threads wiring in conduit, using metal clad 3 pin plug, Earthing the conduit using earth clips and earth wire.	Layout of Light points, fan points etc. Layout of heating leads etc.- their controls, main switches, distribution boards as per I.E. rules. I. E. Rules for earthing conduits using earth clips and earth wire as per IS 732-1963.
10	**ILLUMINATION:-** Installation of - Neon Sign tube, Mercury vapour (H.P. & L.P.), Sodium vapour, Halogen Lamps, single tube, double tube, Metal halide lamps. Emergency light. Practice on decoration lighting . Practice on using LUX Meter. Installation and testing of CFL Lamps and LED Lamps	Introduction of Illumination- Terms & definitions, laws of illumination, illumination factors, intensity of light –importance of light, colour available. Construction, working & applications of – Incandescent lamp, Fluorescent tube, CFL, Neon sign, Halogen, Mercury vapour and types, sodium vapour etc. Decoration lighting, Drum Switches etc.
11-13	**INDUSTRIAL WIRING-** Tests on insulating materials. Measurement of insulation resistance, of commercial and industrial installation Additional practice in conduit wiring. Industrial	Connections of different types of motors used in industry, their normal methods of wiring, Control , starting and protection devices-their connections, layouts and earthing Code practice for earthing of Industrial Wiring.

	power wiring involving single phase & 3phase motors with switches & starters.	Wiring methods & types in workshop & factories.
14	**COMMERCIAL WIRING-** Inverter wiring./ Control panel wiring / multi-storeyed building wiring. Introduction to LAN wiring.	Wiring in commercial building- their special precautions as per I.E. rules. Introduction to LAN wiring.
15-16	Installation of 1 ph. and 3 ph. on line / off line UPS wiring. Testing of Industrial wiring and UPS wiring installation.	Power drives - Introduction, types, advantages & disadvantages. UPS- Introduction, types, Load calculation, Backup time calculation.
17	Straight and cross crimping of RJ-45 cable. crimping of co-axial cable, proper installation of co-axial cable from dish antenna to Television set.	Computer networking - Identification of network hardware / component. CAT-6 cable, RJ-45. DTH- Introduction of direct to home system, Music channel wiring/interconnecting couplers.
18	**Industrial wiring installations** for mixed load, both light and power. Layout of L.V. AC/DC machines and their panels. Wiring of Low power A.C./ D.C. machines in metal conduit system as per I.E. Rules. Testing of wiring installation	General idea of fixing meter boards & taking service connection. Sealing of I.C. cut out & meters as per I.E. Rules, General Electric Appliances using heating effect – their capacities, voltage ranges, Calculation of current
19	Wiring of different circuit using Single core cable use for 2 ways, intermediate master switches etc. Testing of wiring installation.	Explanation of inter connection wiring circuits in the main building and auxiliary blocks, meter boards and its locations. Study of layout symbols in the preparation of layout diagrams

20-21	**COMPUTER AWARNESS:** Identification of Computer Parts, Switching ON/OFF of PC, Safety Precautions. Identifying and using Windows, like folders, files, Editing and saving. Windows Explorer, Notepad, Paint and calculator. **OFFICE PACKAGE& INTERNET:** Using /Practicing WORD, EXCEL, POWER POINT for communication. Documentation. Internet Practicing – Browsing/ Creating Email, Downloading.	Block diagram of computer, main parts inside the system unit, ports & connectors, of PC parts & peripherals associated with PC like-keyboard, Mouse, Printers, Scanners, Camera, Modem, External Storage Devices & UPS. Features of Operating System like M.S. Windows, Components of Windows- Calculator, Notepad, Paint, Windows Explorer. INTERNET : Websites, Browsing, Downloading Creating and Using E-mail ID's Using it for Communications.
22 - 23	Industrial visit / project work	
24 - 25	NCVT EXAMINATION	
26	Semester Gap	

SEMESTER-III

Week No.	Trade Practical	Trade Theory
1	Identify the terminals of LED, Diode , transistor, Zener diode, UJT, SCR , regulator ICs and test it.	LED , Diode, types of transistor, UJT, SCR, regulator ICs and Zener diode uses and its application
2	Construct and test variable DC power supply and trouble shoot the defects in a simple power supply.	IC - voltage regulator pin configurations and applications.
3-4	Construction & testing of various electrical circuits with different accessories. Connection of Calling Bell, Buzzer, Electric Iron, Heater, Light & Fan etc. Practice in soldering and brazing by following Indian Electricity rules.	Common Electrical Accessories, their specifications-Explanation of switches, lamp holders, plugs and sockets etc. Development of domestic circuits using switches, fuse, MCB, sockets, lamp, fan, calling bell/buzzer, Two way switch, I.C.T.P, I.C.D.P, MCCB, ELCB, RCCB etc. Importance of Neutral, effect of opening of neutral wire **Soldering**- Solders, flux and soldering techniques. Types of soldering irons-their proper use.
5	**D.C. GENERATORS,** Identification of the parts of D.C. Generators. Testing and measuring the field and Armature resistances. Dismantle the D.C. Generator and Reassemble and test for its working.	Introduction to D.C Generators and working principle, parts of D.C. Generator. Classification of Generators- Self excited and separately excited- their application in practical field.
6-7	Identification of different parts of generators testing fields & Apparatus. Insulation resistance measurements. Building up of voltage and loading generators. Servicing of generators including replacing of carbon brushes.	Types and characteristics of D.C. Generators – Series, Shunt and compound, their applications. Explanation of Armature reaction, interlopes, commutation and EMF equation of DC generators. Parallel operation of Generators
8	**MOTORS & STARTER:** Practice in connecting generators- Generators- Testing of D.C. Machines by Megger. General maintenance of D.C. machines.	**I**ntroduction to D.C. Motor-Working principle, types of motors Explanation of terms used Torque, speed, Back E.M.F. etc. Characteristics, Speed control of DC motors
9-10	Testing of D.C. Motors - connect run and change direction of rotation. Study of DC starters- 2 point 3	Necessity of starter- Types of starters, 2 point 3 point and 4 point starters, Protective devices used. Methods

	point and 4 point speed control of D.C. Motors and speed measurement. Use Revolution counter. Trouble shooting and fault rectification. Identify and test different types of D.C motors.	of speed control, advantages, disadvantages & Industrial applications. Trouble shooting and fault rectification.
11 -12	Tests on 3 phase circuit. – Current and voltage measurement in star and delta connections. Measurement A.C. 3 ph. power. Determine the V and I relation in Star/Delta connections in a 3-Ph motor.	Introduction to A.C. Poly phase systems-advantages, 3 phase star delta. Terms used in 3Ø systems, connection and their relations w.r.t. current and voltage. Principle of measurement of A.C. 3 ph. Power. Simple calculation of A.C. 3 phase circuit parameter - I, V, Z & P.F. etc.
13-14	**A.C. GENERATORS, MOTORS & STARTERS** Identification of Alternator of parts. Running of Alternator by prime mover and loading it to find out regulation at different loads. Testing of alternators (IR tests). Connect and test Parallel operation of alternators.	Parts and construction of Alternators, principle of working, types of Alternators, EMF equation. Various applications and power rating of alternators. General idea of loading and regulation of Alternator. Parallel operation of Alternators, synchronising methods.
15	Demonstration and practice on A.C single phase motors starting and running for specific requirements.	Introduction to A.C single phase motors and types. Capacitors start/run- start and run. FHP motors and their uses. Various application of A.C single phase motors.
16-18	Constructional details of three phase squirrel cage induction motor and slip ring induction motor. Determination of slip and efficiency. Familiarisation of DOL starter, Star- delta starter, Autotransformer starter and slip ring IM starter. Phase sequence test on three phase IM motors, Single phasing preventer. Identification of A.C and D.C motors (identify motors from the stock/scrap). Construction of simple control circuits using push button and contactors.	**Three phase Induction motor: -** Construction, Principle of operation of Three phase induction motor. Squirrel cage induction motor and slip ring induction motor. Rotor slip, rotor frequency and rotor torque. factors affecting torque. Effect of variation in applied voltage. Starting methods. Speed control methods. Importance of phase sequence in three phase induction motor. Single phasing preventer.
19	Connect and run the A.C single phase and 3-Ph motors by using starters.	Starters - DOL starter, Star – delta starter and Auto transformer starter.

20-21	A.C. motor panel wiring (slip ring Induction type) **POWER WIRING FOR DC & AC MOTORS** Practice power and control circuits on boards. Assembly & testing of the frame for a panel – suitable for motor generator set. I.S. 3072 Part-II of 1961. Erection of panel board, fixing of controlling and starting equipment, necessary meters.	Description of starter delta starter (manual, semi and Auto). Internal arrangement of a motor resistance starter for slip ring induction motor. Motor control circuit and starting devices. Power and control wiring circuits of AC motors.
22-23	Industrial visit / project work	
24-25	NCVT EXAMINATION	
26	Semester Gap	

SEMESTER-IV

Week No.	Trade Practical	Trade Theory
1-4	Identification of types of transformers. To test / check the polarity of single phase transformer. Insulation Testing of single phase and Three Phase. Conducting No-load/O.C. & short circuit tests. Connection of transformers, efficiencies of transformers, parallel operation of transformer. Ratio test and voltage regulation.	**TRANSFORMERS –** Power Transformer – Its construction, working, performance, parallel operation of transformer, their connections. Cooling of transformer, S.C. & O.C. tests. Regulation and efficiency, Specifications, problems on e.m.f. Equation, transformation ratio. Characteristics of ideal transformer. Construction of core, winding shielding, auxiliary parts breather, conservator. Buchholz's relay, other protective devices. Transformer oil testing and Tap changing off load and on load. Transformer bushings and termination. Auto transformer- Its construction, working, performance & uses.
5-7	Familiarize and practice operation of OH line components. Visit to generating station (Thermal/ Hydro/Nuclear) Visit to a sub-station to familiarize OH line components. Prepare a line diagram of the institute/ ITI supply system.	**GENERATION, TRANSMISSION AND DISTRIBUTION OF ELECTRICAL POWER** Generation of Electricity and their types. General idea about overhead transmission, distribution (LV,MV& HV) and their types of accessories used. General arrangement and maintenance of outdoor type of substation. Explanation of overhead bus bar, side by bar. Bus trunking and rising mains. I.E. rules regarding panel erection, bus bar, spacing bus bar chamber, danger boards. Connection of high voltage metering equipment

		used with bus bar.
8	Demonstration, testing and use of line protecting devices as per I.E. Rules. Visit to Distribution - station.	Types of Distribution, Explanation of line protecting devices and their general principle. Brief description of connection of places of use.
9-10	Familiarization and operation of various CBs ACB, VCB, SF6, OCB etc. visit to sub-station. Demonstration and Tests on Multi range switches, Rotary switches. Cooker control Panel, Power circuit switches Thermostats. Mercury switches, visit/in plant training in a industry.	**SUBSTATION EQUIPMENTS** Switchgear-CBs – ACB,VCB, SF6, OCB etc. protection schemes, CT/PT-Protective relays, lightning arrestors, Explanation of different types of switches and switches gears multi Range switches, rotary switches, cooker control panels, power circuit switches, thermostat, mercury switches etc.
11	Familiarize the parts of substations low and high voltages	**TYPES OF SUBSTATIONS - INDOOR, OUTDOOR & POLE MOUNTING** Substation construction: i. Outdoor and Indoor substation. ii. E.H.T. substation iii. H.T. substation iv. Medium & low voltage substation (Pole mounting type)
12-13	Demonstration and practice in terminating an U.G. cable to a bus bar chamber. Crimping lugs to the conductors of U.G. cable and connection to bus bar Loop connection for other circuit.	**U.G. CABLE** Construction of cable, Types , Application & methods of jointing UG cable & testing General idea of laying method and jointing precautions to be observed and different accessories used for medium voltage termination.
14	**Synchronizing** Building up the alternator output voltage, Synchronizing of bus bar voltage with generated voltage	Need of Synchronizing, various methods, precautions to be observed while Synchronizing.
15-16	**Control panel wiring** Preparation of control panel board and its layout Fixing of indicating meters /Instruments, Control devices, Protection devices. Fixing of cable entry	Control Panel elements, types and specifications. Layout and installation of panel board , Panel board wiring methods, colour coding of cables for its easy identification. Grouping and numbering of cables by

	and exit points	using ferrules.
17	Preventive maintenance and routine tests. Fault location and remedy practice both in domestic and industrial wirings. Practice in fixing conduit along with the girder, steel structures station etc.	Importance and advantages of maintenance. Points to be observed to maintain the installation, preventive maintenance and routine tests. Common faults, causes and remedies in domestic and industrial wiring installation, Methods of Locating faults.
18-20	**Planning , Estimation and Costing of Wiring-** Planning and Preparation of layout for domestic, commercial, Multi storied building wiring and workshop electrical wiring. Estimation and costing of Labour, materials and accessories as per layout.	Concept and Principle of plan, estimation and cost. Preparation of complete house wiring layout, industrial wiring, commercial wiring for office Lodge, Hospital, Bank, Hotels etc. I.E. rules for Multi-storied buildings.
21-22	**Project Work** 1. Over hauling and Testing of 3 phase Induction motor 2. Over hauling and testing of Ceiling / Table Fan. 3. Preparation of series test board with indicating digital metres. 4. Construction and test regulated power supply of 6-12 Volt DC. 5. Construct and Test Decorative running LED lamp assembly. 6. Installation of Pumpset.	
23	Industrial visit	
24-25	NCVT EXAMINATION	
26	Semester Gap	

TRADE: WIREMAN

LIST OF TOOLS AND EQUIPMENTS

TRAINEES TOOL KIT FOR 16 TRAINEES + 1 INSTRUCTOR

(COMMON FOR ALL SEMSTERS)

Sl. No	Description	Broad Specification	Qty	Expected life	Approx. cost in Rs/one Unit
1	Steel rule	300mm	17 Nos	5 years	78.00
2	Screw Driver	200mm	17 Nos	5 years	36.00
3	Screw Driver	100mm	17 Nos	5 years	30.00
4	Terminal screw Driver	75 mm (Connector)	17 Nos	5 years	20.00
5	Knife Electrician	D.B.	17 Nos	5 years	15.00
6	Hammer Ball peen.	0.25 Kg	17 Nos	5 years	115.00
7	Plumb bob	115grams	17 Nos	5 years	110.00
8	Combination pliers insulated	200 mm	17Nos	5 years	150.00
9	Neon tester pencil bit type	500 volt	17 Nos	2 years	120.00
10	Try square	200 mm	17 Nos	5 years	60.00
11	Small crimping tools (assorted)	10 – 100 mm (5nos)	17 Sets	5 years	250.00
12	Spanner set DE	Set of 6 from 6x7 to 16x7	17 Sets	5 years	500.00
13	Screw driver set (set of 5)	100-300 mm	17 Sets	5 years	250.00
14	File half round 2nd cut	250 mm	17 Nos	5 years	200.00
15	File round 2nd cut	150 mm	17 Nos	5 years	200.00
16	Soldering iron	60 w/230 v	17 Nos	2 years	300.00
17	Neon tester	230 v	17 Nos	1 year	50.00

Tools common for all semesters and
EQUIPMENT & MACHINERY IS COMMON FOR SEMESTER I

Sl. No	Description	Broad Specification	Qty	Expected life	Approx. cost in Rs/one Unit
1.	Forge with hand blower		1	5 years	200
2.	Conduit pipe cutting and threading machines adjustable	for 15mm to 30mm.	1	5 years	3500
3.	Conduit pipe bending machine, suitable	for 15mm,18mm, 25mm and 30mm pipe	1	5 years	2000
4.	Bar magnet		1	5 years	25
5.	Drill bit	6mm, 8mm & 10 mm	1 each	2 years	50
6.	Horse shoe magnet		1	5 years	25
7.	Crimping tool	25mm	1no	5 years	175
8.	Crimping tool for telephone/LAN cable		1no	5 years	100
9.	Rubber matting	2 meter x 1 meter x 9mm	2 nos.	5 years	180
10.	Wiring board on stand	3 meter x1 meter with 0.5 meter projection on the top	16	5 years	675
11.	Fire extinguishers	Dry chemical 5 Kg	2	5 years	2600
12.	Set of Rowel punch	8,10mm	16	1year	100.00
13.	Rawal tool holder & Bit	No.8, 10, 14, & 16	2 set	2 years	175.00
14.	Set of Wall jumper octagonal	37mm X 450mm and 37 X 600mm	4 sets	2 years	250.00
15.	Center punch	100mm	2	2 years	35.00
16.	Combination pliers insulated	200 mm insulated	16	5 years	175.00

17.	Rule four fold wood	600 mm	16	5 years	35.00
18.	Spanner set DE 6X7,8X9,10X11,12X13,14X15,16X17	Set of 6	16	5 years	180.00
19.	Bradawl	150 mm X 6mm square pointed	16	5 years	200.00
20.	Set of Rowel punch	8,10mm	16	1year	100.00
21.	wooden mallet	1kg.(75mm x15mm)	16	1 year	45.00
22.	Pliers side cutting insulated	200mm	5	5 years	150.00
23.	Pliers flat nose insulated	150mm	5	5 years	85.00
24.	Pliers round nose insulated	200mm	5	5 years	135.00
25.	Pliers long nose insulated	200mm	5	5 years	135.00
26.	Screw driver heavy duty	200mm	2	5 years	125.00
27.	Screw driver heavy duty	300 mm	5	5 years	65.00
28.	Firmer chisel	1”	10	2 years	100.00
29.	Firmer chisel	½ ”	10	2 years	75.00
30.	Hammer Ball Peen	0.50 kg.	5	2 years	85.00
31.	Wire stripper	150mm	5	2 years	85.00
32.	Hammer Ball Peen	1.00 kg	5	2 years	135.00
33.	Hammer cross Peen	0.50 kg.	5	2 years	135.00
34.	Rawal tool holder & Bit	No.8, 10, 14, & 16	2 set	2 years	175.00
35.	Set of Wall jumper octagonal	37mm X 450mm and 37 X 600mm	4 sets	2 years	250.00
36.	Scriber	150mm	2	2 years	35.00
37.	File flat	300mm rough	5	2 years	225.00
38.	File flat round	150mm smooth	5	2 years	85.00
39.	File round	300mm 2nd cut	5	2 years	165.00
40.	File triangular	150mm 2nd cut	5	2 years	95.00
41.	Spanner set of 6	Double ended	2 sets	5 years	300.00

	18X19,20X22,21X23,24X27,25X27 ,30X32,				
42.	Adjustable spanner	300mm	1	5 years	180
43.	Foot print Grip	250mm	2	5 years	65
44.	Allen keys	Set 5 to 11	1 set	5 years	225
45.	Spirit level	300mm	1	2 years	240
46.	Electric soldering iron	125 watts 230-250 V	2	2 years	125
47.	Blow lamp	1 liter capacity	2	5 years	275
48.	Forge with hand blower		1	5 years	200
49.	Bench vice	150mm	5	5 years	1300.00
50.	Hand vice	50mm jaw	5	5 years	225.00
51.	Rubber gloves	5000volts	2 pairs	1 year	225.00
52.	Safety belt with provision for keeping tools		10	2 years	350.00
53.	Tower ladder on type wheels	Min 10ft-Max 30ft	2	10 years	3500.00
54.	Portable extension ladder	Aluminum 6 to 9 meters	1	10 years	5500.00
55.	Trowel	150mm	2		45.00
56.	All types C.F.L. lamp sets	5watt,15watt,25watt	3each	5 years	150 each

EQUIPMENT & MACHINERY

LIST OF METERS & EQUIPMENT FOR SEMESTER - II

Sl. No	Description	Broad Specification	Qty	Expected life	Approx. cost in Rs/one Unit
1.	Multi meter	0-5, 100, 200, 500 milli amperes 0-100-1000, 10000 ohms. 0-150, 300, 600 V AC/DC	4	5 years	1650
2.	Hot wire Ammeter	0-15 Amps.	1	5 years	375
3.	Wheatstone Bridge		1	5 years	3500
4.	Electrical power drilling machine	12mm, capacity 250 volts universal type	1	5 years	3500
5.	Megger (Insulation tester)	500 volts	2	5 years	750
6.	Voltmeter M.C.	O.-300 volts	1	5 years	75
7.	Voltmeter M.C/ Multi range	0.70, 150,300 & 600 V	1	5 years	1050
8.	Voltmeter M.C. Multi range	0-15,30,50 & 75 V	1	5 years	1050
9.	Voltmeter centre zero	15-0-15 volts	1	5 years	130
10.	Voltmeter M.I. multi-range	0-150, 300, 600 V	2	5 years	750
11.	Voltmeter M.I. multi-range	0-50, 75, 150 V	1	5 years	750
12.	Ammeter M.I.	0-30 Amp, panel board type	2	5 years	75
13.	Ammeter M.I.	0-5Amp. Panel board type	2	5 years	75
14.	Ammeter M.I	0 - 10 Amp. panel board mounting type	1	5 years	75
15.	Ammeter M.C. Centre zero	5-0-5Amp	1	5 years	75
16.	Ammeter MC	0 – 1 Amp	1	5 years	75
17.	Field regulator	0 – 1000 ohmic, 2 Amps	1	5 years	100
18.	Single phase K.W.H meter digital	5A, 250 V A. C	4	5 years	450
19.	Single phase K.W.H meter analog	5A, 250 V A. C	4	5 years	450
20.	3 Phase KW meter	15A 440 v	1	5 years	750

21.	Watt meter Dynamo meter type	5 Amps. and 250 v, 1.25 kw	1	5 years	750
22.	Personal computer system with printer		1	4 years	35000
23.	LCD projector		1	4 years	80000
24.	Clamp on ammeter	0-25A,0-200A	2	5 years	800
25.	Three phase K.W.H meter analog	25A,415 V A. C	4	5 years	700
26.	Three phase K.W.H meter digital	25A,415 V A. C	4	5 years	750
27.	UPS 500VA with battery	230V	1	5 years	10000
EQUIPMENT FOR SEMESTER III					
Sl. No. 1-17 of Semester – II to be utilized					
28.	D.C. compound motor	3 H.P 250 V with 4 point starter and field regulator (Laboratory type)	1	10 years	45000
29.	D.C. shunt motor	3 H.P 250 v with 3 point starter and speed regulator (Laboratory type	1	10 years	40000
30.	D. C. series motor with 2 point starter	3 H.P 250 v with 3 point starter and speed regulator (Laboratory type	1	10 years	30000
31.	DC Power supply	250v DC , 25 Amp	1	5 years	5000
32.	Capacitor motor	1/2 H.P. single phase 250 V	1	10 years	3500
33.	Split phase motor	1/2 H.P. single phase 250 V	1	10 years	3000
34.	Universal motor	1/2 H.P.AC/DC 250 V	1	10 years	4500
35.	M.G. Set consisting of squirrel cage induction motor 5 H.P. 400 V cycle with directly coupled compound generator 3K.W. 250 V with built in panel board consisting of :				60000
		1. 3 phase air circuit breakers	1set		
		2. Star Delta starter (contact type 8 point) & Automatic type	1 no		
		3. D.C circuit breaker	1		
		4. Suitable voltmeter on A.C. & D.C. side	1		
		5. Sunk field regulators	1		
		6. Suitable line ammeters on A.C. and D.C. side	1		
		7. Field circuit ammeter	1		

		8. Indicating lamps on both the sides (AC &DC)	1		
36.	Squirrel cage induction motor 3 H.P. 400 V with D.O.L. starter		1	10 years	12000
37.	Squirrel cage induction motor 5 H.P. 400 V with star delta starter		1	10 years	12000
38.	Manual star Delta starter		1	5 years	2500
39.	Semi-automatic star Delta starter		1	5 years	3000
40.	Automatic star Delta starter		1	5 years	3500
41.	Automatic Reverse Forward starter		1	5 years	3500
42.	Single phasing preventer	415V	3	5 years	1500
43.	D.O.L starter		1	5 years	2500
44.	Two point starter for DC series motor		1	5 years	3000
45.	Soft starter 1ph		1	5 years	1600
46.	Tachometer digital type	Non contact type 0-6000 RPM	1 no	5 years	3000
47.	Flux meter		1no	5 years	3000
48.	2KVA Alternator with 3 ph induction motor		1 no	10 years	30,000
49.	5 HP Slip ring induction motor with rotor resistance starter		1 no	10 years	30,000
50.	Lux meter		1 no	5 years	2500
51.	Lead Acid battery 75Ah	12V	1No	4 years	2500
52.	Battery Charger	15V,Current controlled	1No	4 years	3500
53.	Solar street light lamp set	12v , 18 / 24 watts	4 no	5 years	12000
54.	Hydraulic crimping tool for UG	20 sq mm to 250sq mm	1no	5 years	10000

	cable crimping with bits				
EQUIPMENT FOR SEMESTER IV Sl. No. 1-18 of Semester – II to be utilized					
55.	Transformer single phase	1 K.V.A. 250/100 v	2	5 years	5000.00 each
56.	Transformer Three phase (oil cooled)	5 K.V.A. 440/220 v	2	5 years	8000.00 each
57.	Transformer oil testing kit	Automatic 60kv	1	5 years	10000
58.	Autotransformer	Single phase 0-300V 1kVA	2	5 years	8000
59.	Autotransformer	Three phase 0-500V 1kVA	2	5 years	10000
60.	Current transformer	10/1, 20/1,30/1,50/5, 100/5 and 300/5A	1each	5 years	800
61.	Potential transformer	220/110, 300/110, 440/110, 600/110	1 each	5 years	1000
62.	Miniature circuit breaker(MCB)	220V/ 6 Amps	2	5 years	500
63.	Earth leakage circuit breaker (ELCB)	220V/25mA	2	5 years	1000
64.	Metal clad circuit breaker (MCCB)	220V/1A	2	5 years	2000

: WORKSHOP FURNITURES :

Sl.no	Name of the items	Quantity
1	Instructors table (Junior Executive)	1
2	Instructors chair – Full Arm, Caned Back & Seat	2
3	Metal rack 100x150x45 cm	4
4	Lockers with 16 drawers standard size with key	1
5	Steel almirah 2.5x1.20x0.50 m	2
6	White board	1
7	Computer table	1
8	Computer chair - Revolving	2
9	Printer and computer table	1
10	Work bench , 2.5x1.20x0.75meters	2
11	Steel locket standard size with 8 Drawers in each	2
12	Almirah , 1.8 x 1.2 x 0.45meters	2
13	Demonstration table , 2.5 x 1.25 x 0.75 meter	2
14	Blackboard with easel, 3’ x 6’	1
15	Stools, 1’ x 1’x 1.5’	16
16	Metal rack , 180 x 150 x 45cm	1