SYLLABUS FOR ELECTRICIAN TRADE			
FIRST YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 150 Hrs.; Professional Knowledge 42 Hrs.	Prepare profile with an appropriate accuracy as per drawing following safety precautions.	1. Visit various sections of the institutes and location of electrical installations. (03hrs.) 2. Identify safety symbols and hazards. (02Hrs.) 3. Preventive measures for electrical accidents and practice steps to be taken in such accidents. (03hrs.) 4. Practice safe methods of fire fighting in case of electrical fire. (02hrs.) 5. Use of fire extinguishers. (05 Hrs.)	Scope of the electrician trade. Safety rules and safety signs. Types and working of fire extinguishers. (07 hrs.)
		6. Practice elementary first aid. (03hrs.) 7. Rescue a person and practice artificial respiration. (02Hrs.) 8. Disposal procedure of waste materials. (02Hrs.) 9. Use of personal protective equipment. (03hrs.) 10. Practice on cleanliness and procedure to maintain it. (05 hrs.)	First aid safety practice. Hazard identification and prevention. Personal safety and factory safety. Response to emergencies e.g. power failure, system failure and fire etc. (07 hrs.)
		11. Identify trade tools and machineries. (05Hrs.) 12. Practice safe methods of lifting and handling of tools	Concept of Standards and advantages of BIS/ISI. Trade tools specifications. Introduction to National

		& equipment. (05 Hrs.) 13. Select proper tools for operation and precautions in operation. (05 Hrs.) 14. Care & maintenance of trade tools. (05 Hrs.)	Electrical Code-2011. (07 hrs.)
		15. Operations of allied trade tools. (05 Hrs.) 16. Workshop practice on filing and hacksawing. (10Hrs.) 17. Prepare hand coil winding assembly. (5 Hrs.) 18. Practice on preparing T-joint, straight joint and dovetail joint on wooden blocks. (15Hrs.) 19. Practice sawing, planing, drilling and assembling for making a wooden switchboard. (15Hrs.)	Allied trades: Introduction to fitting tools, safety precautions. Description of files, hammers, chisels hacksaw frames, blades, their specification and grades. Marking tools description and use. Types of drills, description & drilling machines. Various wooden joints. (07 hrs.)
		20. Practice in marking and cutting of straight and curved pieces in metal sheets, making holes, securing by screw and riveting. (10 Hrs.) 21. Workshop practice on drilling, chipping, internal and external threading of different sizes. (20Hrs.) 22. Practice of making square holes in crank handle. (5 Hrs.) 23. Prepare an open box from metal sheet. (15 Hrs.)	Marking tools; calipers Dividers, Surface plates, Angle plates, Scribers, punches, surface gauges Types, Uses, Care and maintenance. Sheet metal tools: Description of marking & cutting tools. Types of rivets and riveted joints. Use of thread gauge. Description of carpenter's tools Care and maintenance of tools.(14hrs.)
Professional Skill 125 Hrs.; Professional	Prepare electrical wire joints, carry out soldering, crimping and measure	24. Prepare terminations of cable ends (02 hrs.) 25. Practice on skinning, twisting and crimping. (15	Fundamentals of electricity, definitions, units & effects of electric current. Conductors and insulators.

Knowledge 35Hrs.	insulation resistance of underground cable.	Hrs.) 26. Identify various types of cables and measure conductor size using SWG and micrometer. (8 Hrs.)	Conducting materials and their comparison. (07 hrs.)
		27. Make simple twist, married, Tee and western union joints. (18 Hrs.) 28. Make britannia straight, britannia Tee and rat tail joints. (18 Hrs.) 29. Practice in Soldering of joints / lugs. (14 Hrs.)	Joints in electrical conductors. Techniques of soldering. Types of solders and flux. (14 hrs.)
		30. Identify various parts, skinning and dressing of underground cable. (15 Hrs.) 31. Make straight joint of different types of underground cable. (15 Hrs.) 32. Test insulation resistance of underground cable using megger. (05 hrs.) 33. Test underground cables for faults and remove the fault. (15 Hrs.)	Underground cables: Description, types, various joints and testing procedure. Cable insulation & voltage grades Precautions in using various types of cables. (14 hrs.)
Professional Skill 200Hrs.; Professional Knowledge 56Hrs.	Verify characteristics of electrical and magnetic circuits.	34. Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources and analyse by drawing graphs. (10Hrs.) 35. Measure current and voltage in electrical circuits to verify Kirchhoff's Law (10 Hrs.)	Ohm's Law; Simple electrical circuits and problems. Kirchoff's Laws and applications. Series and parallel circuits. Open and short circuits in series and parallel networks. (07 hrs.)

		36. Verify laws of series and parallel circuits with voltage source in different combinations. (05Hrs.) 37. Measure voltage and current against individual resistance in electrical circuit (10 hrs.) 38. Measure current and voltage and analyse the effects of shorts and opens in series circuit. (05 Hrs.) 39. Measure current and voltage and analyse the effects of shorts and opens in parallel circuit. (05 Hrs.)	
		40. Measure resistance using voltage drop method. (03Hrs.) 41. Measure resistance using wheatstone bridge. (02 Hrs.) 42. Determine the thermal effect of electric current. (03Hrs.) 43. Determine the change in resistance due to temperature. (02Hrs.) 44. Verify the characteristics of series parallel combination of resistors. (5 Hrs.)	Laws of Resistance and various types of resistors. Wheatstone bridge; principle and its applications. Effect of variation of temperature on resistance. Different methods of measuring the values of resistance. Series and parallel combinations of resistors. (07 hrs.)
		45. Determine the poles and plot the field of a magnet bar. (05Hrs.) 46. Wind a solenoid and determine the magnetic effect of electric current. (05Hrs.) 47. Measure induced emf due to change in magnetic field.	Magnetic terms, magnetic materials and properties of magnet. Principles and laws of electro-magnetism. Self and mutually induced EMFs. Electrostatics: Capacitor- Different types, functions,

		(05hrs.) 48. Determine direction of induced emf and current. (05hrs.) 49. Practice on generation of mutually induced emf. (05hrs.) 50. Measure the resistance, impedance and determine inductance of choke coils in different combinations. (05Hrs.) 51. Identify various types of capacitors, charging / discharging and testing. (05 Hrs.) 52. Group the given capacitors to get the required capacity and voltage rating. (05 Hrs.)	grouping and uses. (14 hrs.)
		53. Measure current, voltage and PF and determine the characteristics of RL, RC and RLC in AC series circuits. (08 Hrs.) 54. Measure the resonance frequency in AC series circuit and determine its effect on the circuit. (07 hrs.) 55. Measure current, voltage and PF and determine the characteristics of RL, RC and RLC in AC parallel circuits. (08 Hrs.) 56. Measure the resonance frequency in AC parallel circuit and determine its effects on the circuit. (07 hrs.)	Inductive and capacitive reactance, their effect on AC circuit and related vector concepts. Comparison and Advantages of DC and AC systems. Related terms frequency, Instantaneous value, R.M.S. value Average value, Peak factor, form factor, power factor and Impedance etc. Sine wave, phase and phase difference. Active and Reactive power. Single Phase and three-phase system. Problems on A.C. circuits. (14 hrs.)

		57. Measure power, energy for lagging and leading power factors in single phase circuits and compare characteristic graphically. (08 Hrs.) 58. Measure Current, voltage, power, energy and power factor in three phase circuits. (07 hrs.) 59. Practice improvement of PF by use of capacitor in three phase circuit.(05 Hrs.)	
		60. Ascertain use of neutral by identifying wires of a 3-phase 4 wire system and find the phase sequence using phase sequence meter. (10 Hrs.) 61. Determine effect of broken neutral wire in three phase four wire system.(05 hrs.) 62. Determine the relationship between Line and Phase values for star and delta connections. (10Hrs.) 63. Measure the Power of three phase circuit for balanced and unbalanced loads. (15 Hrs.) 64. Measure current and voltage of two phases in case of one phase is short-circuited in three phase four wire system and compare with healthy system.(10 hrs.)	Advantages of AC poly-phase system. Concept of three-phase Star and Delta connection. Line and phase voltage, current and power in a 3 phase circuits with balanced and unbalanced load. Phase sequence meter. (14 hrs.)
Professional	Install, test and	65. Use of various types of cells.	Chemical effect of electric

Skill 50 Hrs.; Professional Knowledge 14 Hrs.	maintenance of batteries and solar cell.	(08 Hrs.) 66. Practice on grouping of cells for specified voltage and current under different conditions and care. (12 Hrs.) 67. Prepare and practice on battery charging and details of charging circuit. (12 Hrs.) 68. Practice on routine, care/ maintenance and testing of batteries. (08 Hrs.) 69. Determine the number of solar cells in series / parallel for given power requirement. (10 Hrs.)	current and Laws of electrolysis. Explanation of Anodes and cathodes. Types of cells, advantages / disadvantages and their applications. Lead acid cell; Principle of operation and components. Types of battery charging, Safety precautions, test equipment and maintenance. Basic principles of Electro-plating and cathodic protection Grouping of cells for specified voltage and current. Principle and operation of solar cell. (14 hrs.)
Professional Skill 175 Hrs.; Professional Knowledge 49 Hrs.	Estimate, Assemble, install and test wiring system.	70. Identify various conduits and different electrical accessories. (8 Hrs.) 71. Practice cutting, threading of different sizes & laying Installations. (17 Hrs.) 72. Prepare test boards / extension boards and mount accessories like lamp holders, various switches, sockets, fuses, relays, MCB, ELCB, MCCB etc. (25 Hrs.)	I.E. rules on electrical wiring. Types of domestic and industrial wirings. Study of wiring accessories e.g. switches, fuses, relays, MCB, ELCB, MCCB etc. Grading of cables and current ratings. Principle of laying out of domestic wiring. Voltage drop concept. (14 hrs.)
		73. Draw layouts and practice in PVC Casing-capping, Conduit wiring with minimum to more number of points of minimum 15 mtr length. (15 Hrs.)	PVC conduit and Casing-capping wiring system. Different types of wiring - Power, control, Communication and entertainment wiring.

		74. Wire up PVC conduit wiring to control one lamp from two different places. (10 Hrs.) 75. Wire up PVC conduit wiring to control one lamp from three different places. (10 Hrs.) 76. Wire up PVC conduit wiring and practice control of sockets and lamps in different combinations using switching concepts. (15 Hrs.)	Wiring circuits planning, permissible load in sub-circuit and main circuit. (14 hrs.)
		77. Wire up the consumers main board with ICDP switch and distribution fuse box. (10 Hrs.) 78. Prepare and mount the energy meter board. (10 Hrs.) 79. Estimate the cost/bill of material for wiring of hostel/ residential building and workshop. (10 Hrs.) 80. Practice wiring of hostel and residential building as per IE rules. (15 Hrs.) 81. Practice wiring of institute and workshop as per IE rules. (15 Hrs.) 82. Practice testing / fault detection of domestic and industrial wiring installation and repair. (15 Hrs.)	Estimation of load, cable size, bill of material and cost. Inspection and testing of wiring installations. Special wiring circuit e.g. godown, tunnel and workshop etc. (21 hrs.)
Professional Skill 25 Hrs.; Professional	Plan and prepare Earthing installation.	83. Prepare pipe earthing and measure earth resistance by earth tester / megger. (10 Hrs.)	Importance of Earthing. Plate earthing and pipe earthing methods and IEE regulations.

Knowledge 07 Hrs.		84. Prepare plate earthing and measure earth resistance by earth tester / megger. (10 Hrs.) 85. Test earth leakage by ELCB and relay. (5 Hrs.)	Earth resistance and earth leakage circuit breaker. (07 hrs.)
Professional Skill 50 Hrs.; Professional Knowledge 14 Hrs.	Plan and execute electrical illumination system and test.	86. Install light fitting with reflectors for direct and indirect lighting. (10 Hrs.) 87. Group different wattage of lamps in series for specified voltage. (5 Hrs.) 88. Practice installation of various lamps e.g. fluorescent tube, HP mercury vapour, LP mercury vapour, HP sodium vapour, LP sodium vapour, metal halide etc. (18 Hrs.) 89. Prepare decorative lamp circuit using drum switches. (5 Hrs.) 90. Prepare decorative lamp circuit to produce rotating light effect/running light effect. (6 Hrs.) 91. Install light fitting for show case lighting. (6 Hrs.)	Laws of Illuminations. Types of illumination system. Illumination factors, intensity of light. Type of lamps, advantages/ disadvantages and their applications. Calculations of lumens and efficiency. (14 hrs.)
02 Weeks (Professional Skill 50 Hrs.; Professional Knowledge 14 Hrs.)	Select and perform measurements using analog / digital instruments	92. Practice on various analog and digital measuring Instruments. (5 Hrs.) 93. Practice on measuring instruments in single and three phase circuits e.g. multi-meter, Wattmeter, Energy meter, Phase sequence meter and Frequency meter etc. (15 Hrs.)	Classification of electrical instruments and essential forces required in indicating instruments. PMMC and Moving iron instruments. Measurement of various electrical parameters using different analog and digital instruments. Measurement of energy in

		94. Measure power in three phase circuit using two wattmeter methods. (8 Hrs.) 95. Measure power factor in three phase circuit by using power factor meter and verify the same with voltmeter, ammeter and wattmeter readings. (12 Hrs.) 96. Measure electrical parameters using tong tester in three phase circuits. (10 Hrs.)	three phase circuit. (14 hrs.)
Professional Skill 25 Hrs.; Professional Knowledge 07 Hrs.	Perform testing, verify errors and calibrate instruments.	97. Practice for range extension and calibration of various measuring instruments. (10 Hrs.) 98. Determine errors in resistance measurement by voltage drop method. (8 Hrs.) 99. Test single phase energy meter for its errors. (7 Hrs.)	Errors and corrections in measurement. Loading effect of voltmeter and voltage drop effect of ammeter in circuits. Extension of range and calibration of measuring instruments. (07 hrs.)
Professional Skill 75 Hrs.; Professional Knowledge 21 Hrs.	Plan and carry out installation, fault detection and repairing of domestic appliances.	100. Dismantle and assemble electrical parts of various electrical appliances e.g. cooking range, geyser, washing machine and pump set. (25 Hrs.) 101. Service and repair of bell/ buzzer. (5 Hrs.) 102. Service and repair of electric iron, electric kettle, cooking range and geyser. (12 Hrs.) 103. Service and repair of induction heater and oven. (10 Hrs.)	Working principles and circuits of common domestic equipment and appliances. Concept of Neutral and Earth. (21 hrs.)

		104. Service and repair of mixer and grinder. (10 Hrs.) 105. Service and repair of washing machine. (13Hrs.)	
Professional Skill 75 Hrs.; Professional Knowledge 21 Hrs.	Execute testing, evaluate performance and maintenance of transformer.	106. Verify terminals, identify components and calculate transformation ratio of single-phase transformers. (8 Hrs.) 107. Perform OC and SC test to determine and efficiency of single-phase transformer. (12Hrs.) 108. Determine voltage regulation of single-phase transformer at different loads and power factors. (12 Hrs.) 109. Perform series and parallel operation of two single phase transformers. (12 Hrs.) 110. Verify the terminals and accessories of three phase transformer HT and LT side. (6Hrs.)	Working principle, construction and classification of transformer. Single phase and three phase transformers. Turn ratio and e.m.f. equation. Series and parallel operation of transformer. Voltage Regulation and efficiency. Auto Transformer and instrument transformers (CT & PT). (14 hrs.)
		111. Perform 3 phase operation (i) delta-delta (ii) delta-star (iii) star-star (iv) star-delta by use of three single phase transformers. (6 Hrs.) 112. Perform testing of transformer oil. (6 Hrs.) 113. Practice on winding of	Method of connecting three single phase transformers for three phase operation. Types of Cooling, protective devices, bushings and termination etc. Testing of transformer oil. Materials used for winding and winding wires in small transformer. (07 hrs.)

		small transformer. (8 Hrs.) 114. Practice of general maintenance of transformer. (5 Hrs.)	

Project work / Industrial visit

Broad Areas:

a) Overload protection of electrical equipment
b) Automatic control of streetlight/night lamp
c) Fuse and power failure indicator using relays
d) Door alarm/indicator
e) Decorative light with electrical flasher

SYLLABUS FOR ELECTRICIAN TRADE			
SECONDYEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 50 Hrs.; Professional Knowledge 18 Hrs.	Plan, execute commissioning and evaluate performance of DC machines.	115. Identify terminals, parts and connections of different types of DC machines. (10 Hrs.) 116. Measure field and armature resistance of DC machines. (10 Hrs.) 117. Determine build up voltage of DC shunt generator with varying field excitation and performance analysis on load. (15 Hrs.) 118. Test for continuity and insulation resistance of DC machine. (5 Hrs.) 119. Start, run and reverse direction of rotation of DC series, shunt and compound motors. (10 Hrs.)	General concept of rotating electrical machines. Principle of DC generator. Use of Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, slip ring and Brushes, Laminated core etc. E.M.F. equation Separately excited and self-excited generators. Series, shunt and compound generators.(18 hrs.)
Professional Skill 100 Hrs.; Professional Knowledge 36 Hrs.	Execute testing, and maintenance of DC machines and motor starters.	120. Perform no load and load test and determine characteristics of series and shunt generators. (12 Hrs.) 121. Perform no load and load test and determine characteristics of compound generators (cumulative and differential). (13 Hrs.) 122. Practice dismantling and assembling in DC shunt	Armature reaction, Commutation, inter poles and connection of inter poles. Parallel Operation of DC Generators. Load characteristics of DC generators. Application, losses & efficiency of DC Generators. Routine & maintenance. (18hrs.)

		motor. (12 Hrs.) 123. Practice dismantling and assembling in DC compound generator. (13 Hrs.)	
		124. Conduct performance analysis of DC series, shunt and compound motors. (15 Hrs.) 125. Dismantle and identify parts of three point and four-point DC motor starters. (10 Hrs.) 126. Assemble, Service and repair three point and four-point DC motor starters. (15 Hrs.) 127. Practice maintenance of carbon brushes, brush holders, Commutator and sliprings. (10 Hrs.)	Principle and types of DC motor. Relation between applied voltage back e.m.f., armature voltage drop, speed and flux of DC motor. DC motor Starters, relation between torque, flux and armature current. Changing the direction of rotation. Characteristics, Losses & Efficiency of DC motors. Routine and maintenance. (18hrs.)
Professional Skill 50 Hrs.; Professional Knowledge 18Hrs.	Distinguish, organise and perform motor winding.	128. Perform speed control of DC motors - field and armature control method. (10 Hrs.) 129. Carry out overhauling of DC machines. (15 Hrs.) 130. Perform DC machine winding by developing connection diagram, test on growler and assemble. (25 Hrs.)	Methods of speed control of DC motors. Lap and wave winding and related terms. (18hrs.)
Professional Skill 100 Hrs.; Professional Knowledge 36 Hrs.	Plan, Execute commissioning and evaluate performance of AC motors. Execute testing, and	131. Identify parts and terminals of three phase AC motors. (5 Hrs.) 132. Make an internal connection of automatic star-delta starter with three contactors. (10 Hrs.)	Working principle of three phase induction motor. Squirrel Cage Induction motor, Slip-ring induction motor; construction, characteristics, Slip and Torque. Different types of starters for

	maintenance of AC motors and starters.	133. Connect, start and run three phase induction motors by using DOL, star-delta and auto-transformer starters. (20 Hrs.) 134. Connect, start, run and reverse direction of rotation of slip-ring motor through rotor resistance starter and determine performance characteristic. (15 Hrs.)	three phase induction motors, its necessity, basic contactor circuit, parts and their functions. (18hrs.)
		135. Determine the efficiency of squirrel cage induction motor by brake test. (8 Hrs.) 136. Determine the efficiency of three phase squirrel cage induction motor by no load test and blocked rotor test. (8 Hrs.) 137. Measure slip and power factor to draw speed-torque (slip/torque) characteristics. (14 Hrs.) 138. Test for continuity and insulation resistance of three phase induction motors. (5 Hrs.) 139. Perform speed control of three phase induction motors by various methods like rheostatic control, autotransformer etc. (15 Hrs.)	Single phasing prevention. No load test and blocked rotor test of induction motor. Losses & efficiency. Various methods of speed control. Braking system of motor. Maintenance and repair. (18hrs.)
Professional Skill 25 Hrs.; Professional	Distinguish, organise and perform motor winding.	140. Perform winding of three phase AC motor by developing connection diagram, test and	Concentric/ distributed, single/ double layer winding and related terms.(09Hrs.)

Knowledge 09 Hrs.		assemble. (20 Hrs.) 141. Maintain, service and troubleshoot the AC motor starter. (05 Hrs.)	
Professional Skill 50 Hrs.; Professional Knowledge 18 Hrs.	Plan, Execute commissioning and evaluate performance of AC motors. Execute testing, and maintenance of AC motors and starters.	142. Identify parts and terminals of different types of single-phase AC motors. (5 Hrs.) 143. Install, connect and determine performance of single-phase AC motors. (15 Hrs.) 144. Start, run and reverse the direction of rotation of single-phase AC motors. (10 Hrs.) 145. Practice on speed control of single phase AC motors. (10 Hrs.) 146. Compare starting and running winding currents of a capacitor run motor at various loads and measure the speed. (10 Hrs.)	Working principle, different method of starting and running of various single phase AC motors. Domestic and industrial applications of different single phase AC motors. Characteristics, losses and efficiency. (18hrs.)
Professional Skill 50 Hrs.; Professional Knowledge 18 Hrs.	Distinguish, organise and perform motor winding.	147. Carry out maintenance, service and repair of single-phase AC motors. (10 Hrs.) 148. Practice on single/double layer and concentric winding for AC motors, testing and assembling. (25 Hrs.) 149. Connect, start, run and reverse the direction of rotation of universal motor. (10 Hrs.) 150. Carry out maintenance and servicing of universal	Concentric/ distributed, single/ double layer winding and related terms. Troubleshooting of single phase AC induction motors and universal motor. (18hrs.)

		motor. (05 Hrs.)	
Professional Skill 100Hrs.; Professional Knowledge 36Hrs.	Plan, execute testing, evaluate performance and carry out maintenance of Alternator / MG set. Execute parallel operation of alternators.	151. Install an alternator, identify parts and terminals of alternator. (10 Hrs.) 152. Test for continuity and insulation resistance of alternator. (5 Hrs.) 153. Connect, start and run an alternator and build up the voltage. (10 Hrs.) 154. Determine the load performance and voltage regulation of three phase alternator. (10 Hrs.) 155. Parallel operation and synchronization of three phase alternators. (15 Hrs.)	Principle of alternator, e.m.f. equation, relation between poles, speed and frequency. Types and construction. Efficiency, characteristics, regulation, phase sequence and parallel operation. Effect of changing the field excitation and power factor correction. (18hrs.)
		156. Install a synchronous motor, identify its parts and terminals. (10 Hrs.) 157. Connect, start and plot V-curves for synchronous motor under different excitation and load conditions. (15 Hrs.)	Working principle of synchronous motor. Effect of change of excitation and load. V and anti V curve. Power factor improvement. (09hrs.)
		158. Identify parts and terminals of MG set. (5 Hrs.) 159. Start and load MG set with 3 phase induction motor coupled to DC shunt generator. (20 Hrs.)	Rotary Converter, MG Set description and Maintenance. (09hrs.)
Professional Skill 150 Hrs.; Professional Knowledge 54 Hrs.	Assemble simple electronic circuits and test for functioning.	160. Determine the value of resistance by colour code and identify types. (10 Hrs.) 161. Test active and passive electronic components and	Resistors – colour code, types and characteristics. Active and passive components. Atomic structure and semiconductor theory. (09hrs.)

		its applications. (10Hrs.)	
		162. Determine V-I characteristics of semiconductor diode. (10 Hrs.) 163. Construct half wave, full wave and bridge rectifiers using semiconductor diode. (10 Hrs.) 164. Check transistors for their functioning by identifying its type and terminals. (10 Hrs.) 165. Bias the transistor and determine its characteristics. (05Hrs.) 166. Use transistor as an electronic switch and series voltage regulator. (05Hrs.)	P-N junction, classification, specifications, biasing and characteristics of diodes. Rectifier circuit - half wave, full wave, bridge rectifiers and filters. Principle of operation, types, characteristics and various configuration of transistor. Application of transistor as a switch, voltage regulator and amplifier. (18hrs.)
		167. Operate and set the required frequency using function generator. (10Hrs.) 168. Make a printed circuit board for power supply. (10 Hrs.) 169. Construct simple circuits containing UJT for triggering and FET as an amplifier. (10Hrs.) 170. Troubleshoot defects in simple power supplies. (15Hrs.)	Basic concept of power electronics devices. IC voltage regulators Digital Electronics - Binary numbers, logic gates and combinational circuits. (09hrs.)
		171. Construct power control circuit by SCR, Diac, Triac and IGBT. (15 Hrs.) 172. Construct variable DC stabilized power supply	Working principle and uses of oscilloscope. Construction and working of SCR, DIAC, TRIAC and IGBT. Principle, types and applications

		using IC. (10 Hrs.) 173. Practice on various logics by use of logic gates and circuits. (10Hrs.) 174. Generate and demonstrate wave shapes for voltage and current of rectifier, single stage amplifier and oscillator using CRO. (10 Hrs.)	of various multivibrators. (18hrs.)
Professional Skill 100 Hrs.; Professional Knowledge 36 Hrs.	Assemble accessories and carry out wiring of control cabinets and equipment.	175. Design layout of control cabinet, assemble control elements and wiring accessories for: (i) Local and remote control of induction motor. (15 Hrs.) (ii) Forward and reverse operation of induction motor. (10 Hrs.) (iii) Automatic star-delta starter with change of direction of rotation. (15 Hrs.) (iv) Sequential control of three motors. (10 Hrs.)	Study and understand Layout drawing of control cabinet, power and control circuits. Various control elements: Isolators, pushbuttons, switches, indicators, MCB, fuses, relays, timers and limit switches etc. (18hrs.)
		176. Carry out wiring of control cabinet as per wiring diagram, bunching of XLPE cables, channeling, tying and checking etc. (15 Hrs.) 177. Mount various control elements e.g. circuit breakers, relays, contactors and timers etc. (10 Hrs.) 178. Identify and install required measuring instruments and sensors in	Wiring accessories: Race ways/ cable channel, DIN rail, terminal connectors, thimbles, lugs, ferrules, cable binding strap, buttons, cable ties, sleeves, gromats and clips etc. Testing of various control elements and circuits. (18hrs.)

		control panel. (10 Hrs.) 179. Test the control panel for its performance. (15 Hrs.)	
Professional Skill 50 Hrs.; Professional Knowledge 18Hrs.	Perform speed control of AC and DC motors by using solid state devices.	180. Perform speed control of DC motor using thyristors / DC drive. (18 Hrs.) 181. Perform speed control and reversing the direction of rotation of AC motors by using thyristors / AC drive. (18 Hrs.) 182. Construct and test a universal motor speed controller using SCR. (14 Hrs.)	Working, parameters and applications of AC / DC drive. Speed control of 3 phase induction motor by using VVVF/AC Drive. (18hrs.)
Professional Skill 50 Hrs.; Professional Knowledge 18Hrs.	Detect the faults and troubleshoot inverter, stabilizer, battery charger, emergency light and UPS etc.	183. Assemble circuits of voltage stabilizer and UPS. (10 Hrs.) 184. Prepare an emergency light. (10 Hrs.) 185. Assemble circuits of battery charger and inverter. (10Hrs.) 186. Test, analyze defects and repair voltage stabilizer, emergency light and UPS. (05Hrs.) 187. Maintain, service and troubleshoot battery charger and inverter. (07Hrs.) 188. Install an Inverter with battery and connect it in domestic wiring for operation. (08Hrs.)	Basic concept, block diagram and working of voltage stabilizer, battery charger, emergency light, inverter and UPS. Preventive and breakdown maintenance. (18hrs.)
Professional Skill 25 Hrs.; Professional	Erect overhead domestic service line and outline various power plant	189. Draw layout of thermal power plant and identify function of different layout elements. (5 Hrs.)	Conventional and non-conventional sources of energy and their comparison. Power generation by thermal and

Knowledge 09 Hrs.	layout.	190. Draw layout of hydel power plant and identify functions of different layout elements. (5 Hrs.) 191. Visit to transmission / distribution substation. (10 Hrs.) 192. Draw actual circuit diagram of substation visited and indicate various components. (5 Hrs.)	hydel power plants. (09hrs.)
Professional Skill 25 Hrs.; Professional Knowledge 09 Hrs.	Plan, assemble and install solar panel.	193. Prepare layout plan and Identify different elements of solar power system. (05 Hrs.) 194. Prepare layout plan and Identify different elements of wind power system. (05 Hrs.) 195. Assemble and connect solar panel for illumination. (15 Hrs.)	Various ways of electrical power generation by non-conventional methods. Power generation by solar and wind energy. Principle and operation of solar panel. (08 hrs.)
Professional Skill 50 Hrs.; Professional Knowledge 18 Hrs.	Erect overhead domestic service line and outline various power plant layout.	196. Practice installation of insulators used in HT/LT line for a given voltage range. (5 hrs.) 197. Draw single line diagram of transmission and distribution system. (5 Hrs.) 198. Measure current carrying capacity of conductor for given power supply. (5 hrs.) 199. Fasten jumper in pin, shackle and suspension type insulators. (10 Hrs.)	Transmission and distribution networks. Line insulators, overhead poles and method of joining aluminum conductors. (09hrs.)
		200. Erect an overhead service line pole for single phase	Safety precautions and IE rules pertaining to domestic service

		230V distribution system in open space. (10 Hrs.) 201. Practice on laying of domestic service line. (10 Hrs.) 202. Install bus bar and bus coupler on LT line. (5 Hrs.)	connections. Various substations. Various terms like – maximum demand, average demand, load factor, diversity factor, plant utility factor etc. (09hrs.)
Professional Skill 25 Hrs.; Professional Knowledge 09 Hrs.	Examine the faults and carry out repairing of circuit breakers.	203. Identify various parts of relay and ascertain the operation. (5 Hrs.) 204. Practice setting of pick up current and time setting multiplier for relay operation. (5 hrs.) 205. Identify the parts of circuit breaker, check its operation. (5Hrs.) 206. Test tripping characteristic of circuit breaker for over current and short circuit current. (5 hrs.) 207. Practice on repair and maintenance of circuit breaker. (5 hrs.)	Types of relays and its operation. Types of circuit breakers, their applications and functioning. Production of arc and quenching. (09hrs.)

Project work / Industrial visit:

a) Battery charger/Emergency light
b) Control of motor pump with tank level
c) DC voltage converter using SCRs
d) Logic control circuits using relays
e) Alarm/indicator circuits using sensors

SYLLABUS FOR CORE SKILLS
1. Workshop Calculation & Science (Common for two year course) (80Hrs. + 80 Hrs.)
2. Engineering Drawing (Common for Group –II (Electrical, Electronics & IT Trade Group)) (80Hrs. + 80 Hrs.)
3. Employability Skills (Common for all CTS trades) (160Hrs. + 80 Hrs.)

Learning outcomes, assessment criteria, syllabus and Tool List of Core Skills subjects which is common for a group of trades, provided separately inwww.bharatskills.gov.in

7. TRADE SYLLABUS

SYLLABUS FOR WIREMAN TRADE			
FIRST YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 125 Hrs; Professional Knowledge 35 Hrs	Make good quality electrical wire joints for single and multi strand conductors suitable for applications with soldering following electrical safety precautions.	1. Implementation in the shop floor of the various safety measures. (2 hrs.) 2. Visit to the different sections of the Institute. (3 hrs.) 3. Demonstration on elementary first aid. Artificial Respiration. (2 hrs.) 4. Practice on use of fire extinguishers. (3 hrs.) 5. Occupational Safety & Health Importance of housekeeping & good shop floor practices. (3 hrs.) 6. Health, Safety and Environment guidelines, legislations & regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. (4 hrs.) 7. Basic safety introduction, Personal protective Equipment (PPE):- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution &	**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. Concept of Standard Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept & its application. Response to emergencies eg; power failure, fire, and system failure. (07 Hrs)

		personal safety message. (3 hrs.) 8. Preventive measures for electrical accidents & steps to be taken in such accidents. (5 hrs.)	
		9. Demonstration of Trade hand tools. (6 hrs.) 10. Identification of simple types-screws, nuts & bolts, chassis, clamps, rivets etc. (7 hrs.) 11. Use, care & maintenance of various hand tools. Familiarization with signs and symbols of Electrical accessories. (12 hrs.)	Identification of Trade-Hand tools-Specifications. (07 hrs)
		12. Practice in using cutting pliers, screw drivers etc. skinning the cables, and joint practice on single strand. (20 hrs.) 13. Demonstration & Practice on bare conductors joints--such as rat tail, Britannia, straight, Tee, Western union Joints. (30 hrs.)	Fundamental of electricity. Electron theory- free electron, Fundamental terms, definitions, units & effects of electric current. (14 hrs)
		14. Practice in soldering & brazing- measurement of Resistant and measurement of specific resistant. (15 hrs.) 15. Application of Wheatstone bridge in measurement of resistance. (10 hrs.)	Solders, flux and soldering technique. Resistors types of resistors & properties of resistors. (07 hrs)
Professional Skill 50 Hrs; Professional Knowledge	Draw and set up DC and AC circuits including R-L-C circuits with accurate	16. Demonstration and identification of types of cables. (6 hrs.) 17. Demonstration & practice on using standard wire gauge &	Introduction of National Electrical Code 2011 Explanation, Definition and properties of conductors, insulators and semi-conductors. Voltage grading of different types

14 Hrs	measurement of voltage, current, resistance, power, power factor and energy using ammeter, voltmeter, ohm-meter, watt-meter, energy meter, power factor meter and phase sequence tester with proper care and safety.	micrometer. (6 hrs.) 18. Practice on crimping thimbles, Lugs. (5 hrs.) 19. Examination and checking of cables and conductors and verification of materials according to the span. (8 hrs.)	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. (07 hrs)
		20. Verification of Ohm's Law. (2 hrs.) 21. Verification of Kirchhoff's Laws. (3 hrs.) 22. Verification of laws of series and parallel circuits. (4 hrs.) 23. Verification of open circuit and closed circuit network. (3 hrs.) 24. Measuring unknown resistance using Wheatstone bridge, voltage drop method. (6 hrs.) 25. Experiment to demonstrate the variation of resistance of a metal with the change in temperature. (7 hrs.)	**Ohm's Law -** Simple electrical circuits and problems. Reading of simple Electrical Layout. **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. (07 hrs)
Professional Skill 25 Hrs; Professional Knowledge 07 Hrs	Plan, draw, estimate material, wire up and test different type of domestic wiring circuits as per Indian Electricity rules and taking care of quality. Construction and working of MCB &	26. Practice on installation and overhauling **common electrical accessories** as per simple Electrical circuit / Layout. (10 hrs.) 27. Fixing of switches, holder plugs etc. in T.W. boards. (8 hrs.) 28. Identification and use of **wiring** accessories concept of switching. (7 hrs.)	**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. (07 hrs)

	ELCB. Test a domestic wiring installation using Megger.		
Professional Skill 75 Hrs; Professional Knowledge 21 Hrs	Identify the type of batteries, construction, working and application of Ni-cadmium, lithium cell, lead acid cell etc. Demonstrate their charging and discharging, choosing appropriate method and carryout the installation and routine maintenance with due care and safety.	29. Assembly of Dry cell-Electrodes-Electrolytes. (4 hrs.) 30. Grouping of Dry cells for a specified voltage and current, Ni cadmium & Lithium cell. (4 hrs.) 31. Practice on Battery Charging, preparation of battery charging. (4 hrs.) 32. Testing of cells, Installation of batteries, Charging of batteries by different methods. (8 hrs.) 33. Practice on Electroplating and anodizing, Cathodic protection. (5 hrs.)	**Chemical** effect of electric current-Principle of electrolysis. Faraday's Law of electrolysis. Basic principles of Electro-plating 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, Anodizing. Different types of lead acid cells. (07 hrs)
		34. Routine care & maintenance of Batteries. (25 hrs.)	Rechargeable dry cell, description advantages and disadvantages. Care and maintenance of cells Grouping of cells of specified voltage & current, Sealed Maintenance free Batteries, Solar battery. (07 hrs)
		35. Charging of a Lead acid cell, filling of electrolytes- Testing of charging checking of discharged and fully charged battery. (25 hrs.)	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. (07 hrs)
Professional Skill 100 Hrs; Professional	Make choices to carry out basic jobs of marking out the components for	36. Marking use of chisels and hacksaw on flats, sheet metal filing practice, filing true to line. (26 hrs.)	**ALLIED TRADES:** Introduction of fitting trade. Safety precautions to be observed Description of files, hammers,

Knowledge 28 Hrs	filing, drilling, and riveting, fitting and assembled using different components independently.	37. Sawing and planning practice. Practice in using firmer chisel and preparing simple half lap joint. (24 hrs.)	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. (14 hrs)
		38. Drilling practice in hand drilling & power drilling machines. Grinding of drill bits. (8 hrs.) 39. Practice in using taps & dies, threading hexagonal & square nuts etc. (8 hrs.) 40. Cutting external threads on stud and on pipes, riveting practice. (9 hrs.)	Types of drills description & drilling machines, proper use, care and maintenance. Description of taps & dies, types in rivets & riveted joints. Use of thread gauge. (07 hrs)
		41. Practice in using snips, marking & cutting of straight & curved pieces in sheet metals. (6 hrs.) 42. Bending the edges of sheets metals. (6 hrs.) 43. Riveting practice in sheet metal. Practice in making different joints in sheet metal in soldering the joints. (13 hrs.)	Description of marking & 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. (07 hrs)
Professional Skill 100 Hrs; Professional Knowledge	Draw and set up DC and AC circuits including R-L-C circuits with accurate measurement of	44. Trace the magnetic field. (8 hrs.) 45. Assembly / winding of a simple electro magnet. (12 hrs.) 46. Use of magnetic compass. (6	**Magnetism –** Classification of magnets, methods of magnetising, magnetic materials. Properties, care and maintenance. Para and Diamagnetism and

28 Hrs	voltage, current, resistance, power, power factor and energy using ammeter, voltmeter, ohm-meter, watt-meter, energy meter, power factor meter and phase sequence tester with proper care and safety.	hrs.) 47. Identification of different types of Capacitors. (10 hrs.) 48. Charging and discharging of capacitor. (8 hrs.) 49. Testing of Capacitors using DC voltage and lamp. (8 hrs.)	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. (14 hrs)
		50. Determine the characteristics of RL, RC and RLC in A.C. Circuits both in series and parallel. (13 hrs.) 51. Experiment on poly phase circuits. (8 hrs.) 52. Current, voltage, power and power factor measurement in single & poly- phase circuits. (15 hrs.) 53. Measurement of energy in single and poly-phase circuits. (8 hrs.) 54. Use of phase sequence meter. (6 hrs.)	**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 (p.f). Active and Reactive power, Simple problems on 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. (14 hrs)

Professional Skill 25 Hrs; Professional Knowledge 07 Hrs	Plan and install Pipe & Plate earthing. Measure earth resistance by earth tester.	55. **Practice on Earthing** – different methods of earthing.(13 hrs.) 56. Measurement of Earth resistance by earth tester.(6 hrs.) 57. Testing of Earth Leakage by ELCB and relay. (6 hrs.)	**Earthing**- Principle of different methods of earthing. 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. (07 hrs)
Professional Skill 75 Hrs; Professional Knowledge 21 Hrs	Select and perform electrical/ electronic measurements with appropriate instrument.	58. Determine the resistance by Colour coding. (4 hrs.) 59. Identification of active/passive components. (5 hrs.) 60. **Diodes**-symbol - Tests - Construct & Test Half wave rectifier ckt. (8 hrs.) 61. Full wave rectifier ckt. Bridge rectifier ckt. (8 hrs.)	**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 PIV rating. Explanation and importance of D.C. rectifier circuit. Half wave, Full wave and Bridge circuit. Filter circuits-passive filter. (07 hrs)
		ELECTRICAL MEASURING INSTRUMENTS- 62. Measurement of voltage, current & resistance in different circuits. (5 hrs.) 63. Direct & indirect measurement of electrical power & energy. (6 hrs.) 64. Calibration of energy meters. (6 hrs.) 65. Measurement of current and voltage using CT & PT, Measurement of 3 Phase energy using CT & PT. Phase	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. (14 hrs)

		sequence meter, measure current and voltage using Tong tester. (12 hrs.) 66. Power measurement by Two & Three watt meter method Insulation resistance test by Megger. (7 hrs.) 67. Measurement of earth resistance by earth tester. (4 hrs.) 68. Calibration of indicating type analogue instruments: voltmeter, ammeter, and wattmeter. Measurement of soil conductivity. Introduction of Digital meters. (10 hrs.)	
Professional Skill 150 Hrs; Professional Knowledge 42 Hrs	Plan, draw, estimate material, wire up and test different type of domestic wiring circuits as per Indian Electricity rules and taking care of quality. Construction and working of MCB & ELCB. Test a domestic wiring installation using Megger.	**DOMESTIC WIRING - METHODS, INSTALLATION & TESTING-** 69. Demonstration & Practice on connecting **common electrical accessories** in circuits and testing them in series board. (8 hrs.) 70. Demonstration on Testing & replacement of different types of fuses. (6 hrs.) 71. Identification of different **wiring** materials and their specifications. (6 hrs.) 72. Removing of insulation from assorted wires and cables. (10 hrs.) 73. Demonstration and practice crimping thimbles/lugs of various sizes. (8 hrs.) 74. Jointing practice with single and multi-stranded conductors of different wires	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. (07 hrs)

		and cables. (12 hrs.)	
		75. Layout on **wiring** boards. (5 hrs.) 76. Practice in P.V.C. insulated cable **wiring** on wood buttons with distribution board and number of points. (10 hrs.)	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. (07 hrs)
		77. 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. (15 hrs.)	Description of different electrical fittings and accessories such as lamp holders, switches, plugs brackets, ceiling rose, cut out etc. IS 732- 1863.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. (07 hrs)
		78. Demonstration and practice of using Rowel tools. (8 hrs.) 79. Demonstration and practice of casing and capping wiring. (10 hrs.) 80. Testing of wiring installation by using Megger. (7 hrs.)	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. (07 hrs)
		81. Demonstration and practice in cutting and threading conduit pipes. (6 hrs.) 82. Cold and hot bending of pipes. (6 hrs.)	Conduit pipe wiring materials and accessories, types and sizes of conduit. (07 hrs)

		83. Fitting of conduit accessories. (13 hrs.)	
		84. 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. (20 hrs.)	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 732-1863. (07 hrs)
Professional Skill 25 Hrs; Professional Knowledge 07 Hrs	Plan and execute electrical illumination system viz. FL tube, HPMV lamp, HPSV lamp, Halogen & metal halide lamp, CFL, LED lamp etc.	**ILLUMINATION:-** 85. Installation of - Neon Sign tube, Mercury vapour (H.P. & L.P.), Sodium vapour, Halogen Lamps, single tube, double tube, Metal halide lamps. Emergency light. (9 hrs.) 86. Practice on decoration lighting. (7 hrs.) 87. Practice on using LUX Meter. (4 hrs.) 88. Installation and testing of CFL Lamps and LED Lamps (5 hrs.)	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. (07 hrs)
Professional Skill 75 Hrs; Professional Knowledge 21 Hrs	Plan, draw, estimate material, wire up and test different type of industrial wiring circuits as per Indian Electricity rules and taking care of quality.	**INDUSTRIAL WIRING-** 89. Tests on insulating materials. (15 hrs.) 90. Measurement of insulation resistance, of commercial and industrial installation Additional practice in conduit wiring. (30 hrs.) 91. Industrial power wiring involving single phase & 3phase motors with switches & starters. (30 hrs.)	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. Wiring methods & types in workshop & factories. (21 hrs)
Professional Skill 75 Hrs;	Plan, draw, estimate material, wire up and test	**COMMERCIAL WIRING-** 92. Inverter wiring./ Control panel wiring / multi-storeyed	Wiring in commercial building- their special precautions as per I.E. rules.

Professional Knowledge 21 Hrs	different type of commercial and computer networking wiring circuits as per Indian Electricity rules and taking care of quality.	building wiring. (15 hrs.) 93. Introduction to LAN wiring. (7 hrs.)	Introduction to LAN wiring. (07 hrs)
		94. Installation of 1 ph. and 3 ph. on line / off line UPS wiring. (15 hrs.) 95. Testing of Industrial wiring and UPS wiring installation. (20 hrs.)	Power drives - Introduction, types, advantages & disadvantages. UPS- Introduction, types, Load calculation, Backup time calculation. (07 hrs)
		96. Straight and cross crimping of RJ-45 cable. (08 hrs.) 97. Crimping of co-axial cable, proper installation of co-axial cable from dish antenna to Television set. (10 hrs.)	Computer networking - Identification of network hardware / component. CAT-6 cable, RJ-45. DTH- Introduction of direct to home system, Music channel wiring/interconnecting couplers. (07 hrs)
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs	Plan, draw, estimate material, wire up and test different type of industrial wiring circuits as per Indian Electricity rules and taking care of quality.	98. Industrial wiring installations for mixed load, both light and power. (9 hrs.) 99. Layout of L.V. AC/DC machines and their panels. (3 hrs.) 100. Wiring of Low power A.C./ D.C. machines in metal conduit system as per I.E. Rules. (10 hrs.) 101. Testing of wiring installation. (3 hrs.)	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. (07 hrs)
		102. Wiring of different circuit using Single core cable use for 2 ways, intermediate master switches etc. (20 hrs.) 103. Testing of wiring installation. (5 hrs.)	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. (07 hrs)
Professional	Plan, draw, estimate material,	**COMPUTER AWARENESS:** 104. Identification of Computer	Block diagram of computer, main parts inside the system unit, ports

Skill 50 Hrs; Professional Knowledge 14 Hrs	wire up and test different type of commercial and computer networking wiring circuits as per Indian Electricity rules and taking care of quality.	Parts, Switching ON/OFF of PC, Safety Precautions. (5 hrs.) 105. Identifying and using Windows, like folders, files, Editing and saving. (12 hrs.) 106. Windows Explorer, Notepad, Paint and calculator. (12 hrs.) **OFFICE PACKAGE& INTERNET:** 107. Using /Practicing WORD, EXCEL, POWER POINT for communication. (16 hrs.) 108. Documentation. (2 hrs.) 109. Internet Practicing – Browsing/ Creating Email, Downloading. (3 hrs.)	& 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. (14 hrs)
In plant training / Project work			

Industrial Training Institute
Wireman

SYLLABUS FOR WIREMAN TRADE			
SECOND YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 100 Hrs; Professional Knowledge 36 Hrs	Construct and test Half–wave, full-wave, and bridge rectifiers with filter & without filter. Trouble shoot and service of DC regulated power supply.	110. Identify the terminals of LED, Diode, transistor, Zener diode, UJT, SCR, regulator ICs and test it. (25 hrs.)	LED, Diode, types of transistor, UJT, SCR, regulator ICs and Zener diode uses and its application. (09 hrs)
		111. Construct and test variable DC power supply and trouble shoot the defects in a simple power supply. (25 hrs.)	IC- voltage regulator pin configurations and applications. (09 hrs)
		112. Construction & testing of various electrical circuits with different accessories. (15 hrs.) 113. Connection of Calling Bell, Buzzer, Electric Iron, Heater, Light & Fan etc. (15 hrs.) 114. Practice in **soldering** and brazing by following Indian Electricity rules. (20 hrs.)	**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. (18 hrs)
Professional Skill 150 Hrs; Professional Knowledge 54 Hrs	Interpret the constructional features, working principles of DC machine. Starting with suitable starter, running,	**D.C. GENERATORS,** 115. Identification of the parts of D.C. Generators. (5 hrs.) 116. Testing and measuring the field and Armature resistances. (5 hrs.) 117. Dismantle the D.C.	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. (09 hrs)

	forward and reverse operation and speed control of DC motors. Conduct the load performance test of DC machine with due care and safety. Maintain and troubleshoot of DC machines.	Generator and Reassemble and test for its working. (15 hrs.)	
		118. Identification of different parts of generators testing fields & Apparatus. (12 hrs.) 119. Insulation resistance measurements. (8 hrs.) 120. Building up of voltage and loading generators. (10 Hrs.) 121. Servicing of generators including replacing of carbon brushes. (20 hrs.)	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. (18 hrs)
		MOTORS & STARTER: 122. Practice in connecting generators- Generators- Testing of D.C. Machines by Megger. (12 hrs.) 123. General maintenance of D.C. machines. (13 hrs.)	Introduction 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. (09 hrs)
		124. Testing of D.C. Motors - connect run and change direction of rotation. (12 hrs.) 125. Study of DC starters- 2 point 3 point and 4 point speed control of D.C. Motors and speed measurement. (13 hrs.) 126. Use Revolution counter. (6 hrs.) 127. Trouble shooting and fault rectification. Identify and test different types of D.C motors. (19 hrs.)	Necessity of starter- Types of starters, 2 point 3 point and 4 point starters, Protective devices used. Methods of speed control, advantages, disadvantages & Industrial applications. Trouble shooting and fault rectification. (18 hrs)
Professional Skill 50 Hrs;	Interpret the constructional features, working	128. Tests on 3 phase circuit. (10 hrs.) 129. Current and voltage	Introduction to A.C. Poly phase systems- advantages, 3 phase star delta. Terms used in 3Ø systems,

Professional Knowledge 18 Hrs	principles of single phase and 3 phase AC motors. Starting with suitable starter, running, forward and reverse operation and speed control of AC motors with due care and safety.	measurement in star and delta connections. (12 hrs.) 130. Measurement A.C. 3 ph. power. (18 hrs.) 131. Determine the V and I relation in Star/Delta connections in a 3-Ph motor. (10 hrs.)	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 (18 hrs)
Professional Skill 50 Hrs; Professional Knowledge 18 Hrs	Interpret the constructional features, working principles of Alternator set. Test, Wire-up and run alternator. Synchronization of Alternator with due care and safety.	**A.C. GENERATORS, MOTORS & STARTERS** 132. Identification of Alternator of parts. (10 hrs.) 133. Running of Alternator by prime mover and loading it to find out regulation at different loads. Testing of alternators (IR tests). (28 hrs.) 134. Connect and test Parallel operation of alternators. (12 hrs.)	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. (18 hrs)
Professional Skill 175 Hrs; Professional Knowledge 63 Hrs	Interpret the constructional features, working principles of single phase and 3 phase AC motors. Starting with suitable starter, running, forward and reverse operation and speed control of AC motors with due care and safety.	135. Demonstration and practice on A.C single phase motors starting and running for specific requirements. (25 hrs.)	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. (09 hrs)
		136. Constructional details of three phase squirrel cage induction motor and slip ring induction motor. (12 hrs.) 137. Determination of slip and efficiency. (8 hrs.) 138. Familiarization of DOL	**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.

		starter, Star- delta starter, Autotransformer starter and slip ring IM starter. (15 hrs.) 139. Phase sequence test on three phase IM motors, Single phasing preventer. (14 hrs.) 140. Identification of A.C and D.C motors (identify motors from the stock/scrap). (8 hrs.) 141. Construction of simple control circuits using push button and contactors. (18 hrs.)	Effect of variation in applied voltage. Starting methods. Speed control methods. Importance of phase sequence in three phase induction motor. Single phasing preventer. (27 hrs)
		142. Connect and run the A.C single phase and 3-Ph motors by using starters. (25 hrs.)	Starters - DOL starter, Star – delta starter and Auto transformer starter. (09 hrs)
		143. A.C. motor panel wiring (slip ring Induction type) (13 hrs.) **POWER WIRING FOR DC & AC MOTORS** 144. Practice power and control circuits on boards. (10 hrs.) 145. Assembly & testing of the frame for a panel – suitable for motor generator set. I.S. 3072 Part-II of 1861. (15 hrs.) 146. Erection of panel board, fixing of controlling and starting equipment, necessary meters. (12 hrs.)	Description of starter delta starter (manual, semi and Auto). Formative 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. (18 hrs)
Professional Skill 75 Hrs; Professional	Interpret the types, constructional features, working principles of	147. Identification of types of transformers. (15 hrs.) 148. Test / check the polarity of single phase transformer.	**TRANSFORMERS –** Power Transformer – Its construction, working, performance, parallel operation of

Knowledge 27 Hrs	transformer (single & three phase) Connect and test Transformer.	(10 hrs.) 149. Insulation testing of single phase and Three Phase. (10 hrs.) 150. Conducting No-load/O.C. & short circuit tests. (10hrs.) 151. Connection of transformers, efficiencies of transformers, parallel operation of transformer. (20 hrs.) 152. Ratio test and voltage regulation. (10 hrs.)	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. (27 hrs)
Professional Skill 225 Hrs; Professional Knowledge 81 Hrs	Prepare single line diagram and layout plan of electrical transmission & distribution systems and power plants with knowledge of principle applied. Make and test power connection to substation equipments with care and safety.	153. Familiarize and practice operation of OH line components. (20 hrs.) 154. Visit to generating station (Thermal/ Hydro/Nuclear) Visit to a sub-station to familiarize OH line components. (41 hrs.) 155. Prepare a line diagram of the institute/ ITI supply system. (20 hrs.)	**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. (27 hrs)
		156. Demonstration, testing and use of line protecting	Types of Distribution, Explanation of line protecting devices and

		devices as per I.E. Rules. (10 hrs.) 157. Visit to Distribution - station. (15 hrs.)	their general principle. Brief description of connection of places of use. (09 hrs)
		158. Familiarization and operation of various CBs ACB, VCB, SF6, OCB etc. (15 hrs.) 159. Visit to sub-station. (20 hrs.) 160. Demonstration and Tests on Multi range switches, Rotary switches. (12 hrs.) 161. Cooker control Panel, Power circuit switches Thermostats. Mercury switches, visit/in plant training in a industry. (12 hrs.)	**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. (27 hrs)
		162. Familiarize the parts of substations low and high voltages. (20 hrs.)	**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) (09 hrs)
		163. Demonstration and practice in terminating an U.G. cable to a bus bar chamber. (20 hrs.) 164. Crimping lugs to the conductors of U.G. cable and connection to bus bar Loop connection for other circuit. (20 hrs.)	**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. (18 hrs)

Professional Skill 25 Hrs; Professional Knowledge 09 Hrs	Interpret the constructional features, working principles of Alternator set. Test, Wire-up and run alternator. Synchronization of Alternator with due care and safety.	**Synchronizing** 165. Building up the alternator output voltage, synchronizing of bus bar voltage with generated voltage. (25 hrs.)	Need of Synchronizing, various methods, precautions to be observed while Synchronizing. (09 hrs)
Professional Skill 75 Hrs; Professional Knowledge 27 Hrs	Select, assemble, test and wire-up control panel.	**Control panel wiring** 166. Preparation of control panel board and its layout fixing of indicating meters /Instruments, Control devices, Protection devices. (35 hrs.) 167. Fixing of cable entry and exit points (15 hrs.)	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 using ferrules. (09 hrs)
		168. Preventive maintenance and routine tests. (8 hrs.) 169. Fault location and remedy practice both in domestic and industrial wirings. (10 hrs.) 170. Practice in fixing conduit along with the girder, steel structures station etc. (7 hrs.)	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. (09 hrs)
Professional Skill 75 Hrs; Professional Knowledge 27 Hrs	Plan, estimate and costing of different types of wiring system as per Indian Electricity rule.	**Planning, Estimation and Costing of Wiring-** 171. Planning and Preparation of layout for domestic, commercial, Multi storied building wiring and workshop electrical wiring. (50 hrs.)	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. (27 hrs)

		172. Estimation and costing of Labour, materials and accessories as per layout. (25 hrs.)	

Project Work (work in a team)

(i) Over hauling and Testing of 3 phase Induction motor
(ii) Over hauling and testing of Ceiling / Table Fan.
(iii) Preparation of series test board with indicating digital metres.
(iv) Construction and test regulated power supply of 6-12 Volt DC.
(v) Construct and Test Decorative running LED lamp assembly.
(vi) Installation of Pump set.

SYLLABUS FOR CORE SKILLS
1. Workshop Calculation & Science (Common for two years courses) (80 Hrs + 80 Hrs)
2. Engineering Drawing (Group II (Electrical, Electronics & IT trade Group)) (80 Hrs + 80 Hrs)
3. Employability Skills (Common for all CTS trades) (160 Hrs + 80 Hrs)

Learning outcomes, assessment criteria, syllabus and Tool List of Core Skills subjects which is common for a group of trades, provided separately inwww.bharatskills.gov.in.