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			