SYLLABUS FOR ELECTRONICS MECHANIC TRADE			
FIRST YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 75 Hrs; Professional Knowledge 21 Hrs	Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc. observing suitable care & safety following safety precautions.	**Trade and Orientation** 1. Visit to various sections of the institute and identify location of various installations. (5 hrs) 2. Identify safety signs for danger, warning, caution & personal safety message. (3hrs) 3. Use of personal protective equipment (PPE). (5 hrs) 4. Practice elementary first aid. (5hrs) 5. Preventive measures for electrical accidents & steps to be taken in such accidents. (2 hrs) 6. Use of Fire extinguishers. (5hrs)	Familiarization with the working of Industrial Training Institute system. Importance of safety and precautions to be taken in the industry/shop floor. Introduction to PPEs. Introduction to First Aid. Response to emergencies e.g. power failure, fire, and system failure. Importance of housekeeping & good shop floor practices. Occupational Safety & Health: Health, Safety and Environment guidelines, legislations & regulations as applicable.(07 hrs.)
		Hand tools and their uses 7. Identify the different hand tools. (5 hrs) 8. Selection of proper tools for operation and precautions in operation. (7hrs) 9. Care & maintenance of trade tools. (8hrs) 10. Practice safety precautions while working in fitting jobs. (10hrs) 11. Workshop practice on filing and hacks awing. (5hrs)	Identification, specifications, uses and maintenance of commonly used hand tools. State the correct shape of files for filing different profiles. Riveting of tags and lugs, cutting and bending of sheet metals, chassis and cabinets. (14 hrs.)

		12. Practice simple sheet metal works, fitting and drilling.(5hrs) 13. Make an open box from metal sheet. (10 hrs)	
Professional Skill 50Hrs; Professional Knowledge 14 Hrs	Select and perform electrical/ electronic measurement of single range meters and calibrate the instrument.	**Basics of AC and Electrical Cables** 14. Identify the Phase, Neutral and Earth on power socket, use a testers to monitor AC power. (03hrs) 15. Construct a test lamp and use it to check mains healthiness. (03hrs) 16. Measure the voltage between phase and ground and rectify earthing. (03 hrs) 17. Identify and test different AC mains cables. (03hrs) 18. Prepare terminations, skin the electrical wires /cables using wire stripper and cutter. (03hrs) 19. Measure the gauge of the wire using SWG and outside micrometer. (03 hrs) 20. Refer table and find current carrying capacity of wires. (01hrs) 21. Crimp the lugs to wire end. (03 hrs) 22. Measure AC and DC voltages using multi meter. (03 hrs)	Basic terms such as electric charges, Potential difference, Voltage, Current, Resistance. Basics of AC & DC. Various terms such as +ve cycle, -ve cycle, Frequency, Time period, RMS, Peak, Instantaneous value. Single phase and Three phase supply. Terms like Line and Phase voltage/ currents. Insulators, conductors and semiconductor properties. Different type of electrical cables and their Specifications. Types of wires & cables, standard wire gauge (SWG). Classification of cables according to gauge (core size), number of conductors, material, insulation strength, flexibility etc. (07 hrs.)
		23. Identify the type of meters by dial and scale marking/ symbols. (3 Hrs) 24. Demonstrate various analog measuring Instruments. (3	**Single range meters** Introduction to electrical and electronic measuring instruments. Basic principle and parts of

		Hrs) 25. Find the minimum and maximum measurable range of the meter. (3 Hrs) 26. Carryout mechanical zero setting of a meter. (4Hrs) 27. Check the continuity of wires, meter probes and fuse etc. (5 Hrs) 28. Measure voltage and current using clamp meter. (5Hrs)	simple meters. Specifications, symbols used in dial and their meaning.(07 hrs.)
Professional Skill 25 Hrs; Professional Knowledge 07 Hrs	Test & service different batteries used in electronic applications and record the data to estimate repair cost.	**Cells & Batteries** 29. Identify the +ve and -ve terminals of the battery. (2 hrs) 30. Identify the rated output voltage and Ah capacity of given battery. (1 hrs) 31. Measure the voltages of the given cells/battery using analog/ digital multimeter. (3 hrs) 32. Charge and discharge the battery through load resistor. (5 hrs) 33. Maintain the secondary cells. (5 hrs) 34. Measure the specific gravity of the electrolyte using hydrometer. 3 hrs) 35. Test a battery and verify whether the battery is ready for use of needs recharging. (6 hrs)	**Cells & Batteries** Construction, types of primary and secondary cells. Materials used, Specification of cells and batteries. Charging process, efficiency, life of cell/battery. Selection of cells / Batteries etc. Use of Hydrometer. Types of electrolytes used in cells and batteries. Series/ parallel connection of batteries and purpose of such connections. (07 hrs.)
Professional Skill 50 Hrs; Professional Knowledge	Test various electronic components using proper measuring instruments and	**AC & DC measurements** 36. Use the multi meter to measure the various functions (AC V, DC V, DC I, AC I, R) (8 hrs.)	Introduction to electrical measuring instruments. Importance and classification of meters.

14 Hrs	compare the data using standard parameter.	37. Identify the different types of meter for measuring AC & DC parameters (8hrs.) 38. Identify the different controls on the CRO front panel and observe the function of each control (12hrs.) 39. Measure DC voltage, AC voltage, time period using CRO sine wave parameters (10hrs.) 40. Identify the different controls on the function generator front panel and observe the function of each controls (12 hrs.)	Forces necessary to work a meter. MC and MI meters. Range extension, need of calibration. Characteristics of meters and errors in meters. Multi meter, use of meters in different circuits. Care and maintenance of meters. Use of CRO, Function generator, LCR meter (14 hrs.)
Professional Skill 25 Hrs; Professional Knowledge 07 Hrs	Plan and execute soldering & de-soldering of various electrical components like Switches, PCB & Transformers for electronic circuits.	**Soldering/ De-soldering and Various Switches** 41. Practice soldering on different electronic components, small transformer and lugs. (5 hrs) 42. Practice soldering on IC bases and PCBs. (5 hrs) 43. Practice de-soldering using pump and wick (2 hrs) 44. Join the broken PCB track and test (3 hrs) 45. Identify and use SPST, SPDT, DPST, DPDT, tumbler, push button, toggle, piano switches used in electronic industries (5 hrs) 46. Make a panel board using different types of switches for a given application (5 hrs)	Different types of soldering guns, related to Temperature and wattages, types of tips. Solder materials and their grading. Use of flux and other materials. Selection of soldering gun for specific requirement. Soldering and De-soldering stations and their specifications. Different switches, their specification and usage. (07 hrs.)

Professional Skill 75 Hrs; Professional Knowledge 21 Hrs	Test various electronic components using proper measuring instruments and compare the data using standard parameter.	**Active and Passive Components** 47. Identify the different types of active electronic components. (3hrs). 48. Measure the resistor value by colour code and verify the same by measuring with multimeter (3hrs) 49. Identify resistors by their appearance and check physical defects. (2 hrs) 50. Identify the power rating of carbon resistors by their size. (3 hrs) 51. Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources. (9hrs) 52. Measurement of current and voltage in electrical circuits to verify Kirchhoff's Law (5Hrs) 53. Verify laws of series and parallel circuits with voltage source in different combinations. (5 hrs) 54. Measure the resistance, Voltage, Current through series and parallel connected networks using multi meter (8hrs) 55. Identify different inductors and measure the values using LCR meter (5 hrs) 56. Identify the different capacitors and measure	Ohm's law and Kirchhoff's Law. Resistors; types of resistors, their construction & specific use, color-coding, power rating. Equivalent Resistance of series parallel circuits. Distribution of V & I in series parallel circuits. Principles of induction, inductive reactance. Types of inductors, construction, specifications, applications and energy storage concept. Self and Mutual induction. Behaviour of inductor at low and high frequencies. Series and parallel combination, Q factor. Capacitance and Capacitive Reactance, Impedance. Types of capacitors, construction, specifications and applications. Dielectric constant. Significance of Series parallel connection of capacitors. Capacitor behaviour with AC and DC. Concept of Time constant of a RC circuit. Concept of Resonance and its application in RC, RL & RLC series and parallel circuit. Properties of magnets and their materials, preparation of artificial magnets, significance of electromagnetism, types of cores.

		capacitance of various capacitors using LCR meter (5 hrs) 57. Identify and test the circuit breaker and other protecting devices. (5 hrs) 58. Dismantle and identify the different parts of a relay. (5 hrs) 59. Connect a timer relay in a circuit and test for its working. (3 hrs) 60. Connect a contactor in a circuit and test for its working (2 hrs) 61. Construct and test RC time constant circuit (4 hrs) 62. Construct a RC differentiator circuit and convert triangular wave into square wave (5 hrs.) 63. Construct and test series and parallel resonance circuit (3 hrs)	Relays, types, construction and specifications etc.(21 hrs.)
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs	Assemble simple electronic power supply circuit and test for functioning.	**Power Supply Circuits** 64. Identify different types of diodes, diode modules and their specifications. (5 hrs) 65. Test the given diode using multi meter and determine forward to reverse resistance ratio. (5 hrs) 66. Measure the voltage and current through a diode in a circuit and verify its forward characteristic. (8 hrs) 67. Identify different types of transformers and test. (3 hrs) 68. Identify the primary and	Semiconductor materials, components, number coding for different electronic components such as Diodes and Zeners etc. PN Junction, Forward and Reverse biasing of diodes. Interpretation of diode specifications. Forward current and Reverse voltage. Packing styles of diodes. Different diodes, Rectifier configurations, their efficiencies, Filter components

		secondary transformer windings and test the polarity (2 hrs) 69. Construct and test a half wave, full wave and Bridge rectifier circuit. (10hrs) 70. Measure ripple voltage, ripple frequency and ripple factor of rectifiers for different load and filter capacitors. (5 hrs) 71. Identify and test Zener diode. (2 hrs) 72. Construct and test Zener based voltage regulator circuit. (5 hrs) 73. Calculate the percentage regulation of regulated power supply. (5 hrs)	and their role in reducing ripple. Working principles of Zener diode, varactor diode, their specifications and applications. Working principle of a Transformer, construction, Specifications and types of cores used. Step-up, Step down and isolation transformers with applications. Losses in Transformers. Phase angle, phase relations, active and reactive power, power factor and its importance. (14 hrs.)
Professional Skill 125 Hrs; Professional Knowledge 35 Hrs	Install, configure, interconnect given computer system(s) and demonstrate & utilize application packages for different application.	**Computer Hardware, OS, MS office and Networking** 74. Identify various indicators, cables, connectors and ports on the computer cabinet. (5 hrs) 75. Demonstrate various parts of the system unit and motherboard components. (5 hrs) 76. Identify various computer peripherals and connect it to the system. (5 hrs) 77. Disable certain functionality by disconnecting the concerned cables SATA/ PATA. (5 hrs) 78. Replace the CMOS battery and extend a memory module. (5 hrs) 79. Test and Replace the SMPS	Basic blocks of a computer, Components of desktop and motherboard. Hardware and software, I/O devices, and their working. Different types of printers, HDD, DVD. Various ports in the computer. Windows OS MS widows: Starting windows and its operation, file management using explorer, Display & sound properties, screen savers, font management, installation of program, setting and using of control panel, application of accessories, various IT tools and applications. Concept of word processing,:

		(5 hrs) 80. Replace the given DVD and HDD on the system (5 hrs) 81. Dismantle and assemble the desktop computer system. (10 hrs) 82. Boot the system from Different options (5 hrs) 83. Install OS in a desktop computer. (5 hrs) 84. Install a Printer driver software and test for print outs (5 hrs) 85. Install antivirus software, scan the system and explore the options in the antivirus software. (5 hrs) 86. Install MS office software (5 hrs) 87. Create folder and files, draw pictures using paint. (5 hrs) 88. Explore different menu/ tool/ format/ status bars of MS word and practice the options. (8 hrs) 89. Explore different menu/ tool/ format/ status bars of MS excel and practice the options. (7 hrs) 90. Prepare power point presentation on any three known topics with various design, animation and visual effects. (5 hrs) 91. Convert the given PDF File into Word file using suitable software. (5 hrs) 92. Browse search engines, create email accounts,	MS word – Menu bar, standard tool bar, editing, formatting, printing of document etc. Excel – Worksheet basics, data entry and formulae. Moving data in worksheet using tool bars and menu bars, Formatting and calculations, printing worksheet, creating multiple work sheets, creating charts. Introduction to power point Basics of preparing slides, different design aspects of slides, animation with slides etc. Concept of Internet, Browsers, Websites, search engines, email, chatting and messenger service. Downloading the Data and program files etc. **Computer Networking:-** Network features - Network medias Network topologies, protocols- TCP/IP, UDP, FTP, models and types. Specification and standards, types of cables, UTP, STP, Coaxial cables. Network components like hub, Ethernet switch, router, NIC Cards, connectors, media and firewall. Difference between PC & Server. (35 hrs.)

		practice sending and receiving of mails and configuration of email clients. (5 hrs) 93. Identify different types of cables and network components e.g. Hub, switch, router, modem etc. (5 hrs) 94. Prepare terminations, make UTP and STP cable connectors and test. (5 hrs) 95. Connect network connectivity hardware and check for its functioning. (5 hrs) 96. Configure a wireless Wi-Fi network (5 hrs)	
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs	Assemble simple electronic power supply circuit and test for functioning.	**IC Regulators** 97. Construct and test a +12V fixed voltage regulator. (5 hrs) 98. Identify the different types of fixed +ve and –ve regulator ICs and the different current ratings (78/79 series) (5 hrs) 99. Identify different heat sinks for IC based regulators. (2 hrs) 100. Observe the output voltage of different IC 723 metal/ plastic type and IC 78540 regulators by varying the input voltage with fixed load (8 hrs) 101. Construct and test a 1.2V – 30V variable output regulated power supply using IC LM317T. (5 hrs)	Regulated Power supply using 78XX series, 79XX series. Op-amp regulator, 723 regulator, (Transistorized & IC based). Voltage regulation, error correction and amplification etc. (14 hrs.)

Professional Skill 100 Hrs; Professional Knowledge 28 Hrs	Construct, test and verify the input/ output characteristics of various analog circuits.	**Transistor** 102. Identify different transistors with respect to different package type, B-E-C pins, power, switching transistor, heat sinks etc. (03hrs) 103. Test the condition of a given transistor using ohm-meter. (03hrs) 104. Measure and plot input and output characteristics of a CE amplifier. (05hrs) 105. Construct and test a transistor based switching circuit to control a relay (use Relays of different coil voltages and Transistors of different β) (05hrs)	Construction, working of a PNP and NPN Transistors, purpose of E, B & C Terminals. Significance of α, β and relationship of a Transistor. Need for Biasing of Transistor. VBE, VCB, VCE, IC, IB, Junction Temperature, junction capacitance, frequency of operation. Transistor applications as switch and amplifier. Transistor input and output characteristics. Transistor power ratings & packaging styles and use of different heat sinks. (07 hrs.)
		Amplifier 106. Construct and test fixed-bias, emitter-bias and voltage devider-bias transistor amplifier. (08hrs) 107. Construct and Test a common emitter amplifier with and without bypass capacitors (03hrs) 108. Construct and Test common base amplifier. (03hrs) 109. Construct and Test common collector/emitter follower amplifier. (03hrs) 110. Construct and Test Darlington amplifier. (5 hrs) 111. Construct and test a two	Different types of biasing, various configurations of transistor (C-B, C-E & C-C), their characteristics and applications. Transistor biasing circuits and stabilization Techniques. Classification of amplifiers according to frequency, mode of operation and methods of coupling. Voltage amplifiers - voltage gain, loading effect. Single stage CE amplifier and CC amplifier. Emitter follower circuit and its advantages. RC coupled amplifier, Distinguish between voltage and power amplifier, Push pull

		stage RC Coupled amplifier. (04hrs) 112. Construct and test a Class B complementary push pull amplifier. (8 hrs) 113. Construct and test class C Tuned amplifier. (5 hrs)	amplifier and class C tuned amplifier. Alpha, beta, voltage gain, Concept of dB dBm. Feedback and its types. (14 hrs.)
		Oscillators 114. Demonstrate Colpitts oscillator, Hartley oscillator circuits and compare the output frequency of the oscillator by CRO. (05hrs) 115. Construct and test a RC phase shift oscillator circuits. (5 hrs) 116. Construct and test a crystal oscillator circuits. (5 hrs) 117. Demonstrate Astable, monostable, bistable circuits using transistors. (05hrs)	Introduction to positive feedback and requisites of an oscillator. Study of Colpitts, Hartley, Crystal and RC oscillators. Types of multi vibrators and study of circuit diagrams. (07 hrs.)
		Wave shaping circuits 118. Construct and test shunt clipper. (6 hrs) 119. Construct and test series and dual clipper circuit using diodes. (7 hrs) 120. Construct and test clamper circuit using diodes. (5 hrs) 121. Construct and test Zener diode as a peak clipper. (7 hrs)	Diode shunt clipper circuits, Clamping / limiting circuits and Zener diode as peak clipper, uses their applications. (07 hrs.)
Professional Skill 75 Hrs; Professional	Plan and construct different power electronic circuits and analyse the	**Power Electronic Components** 122. Identify different power electronic components, their specification and	Construction of FET & JFET, difference with BJT. Purpose of Gate, Drain and source terminals and voltage /

Knowledge 21 Hrs	circuit functioning.	terminals. (6 hrs) 123. Construct and test a FET Amplifier. (6 hrs) 124. Construct a test circuit of SCR using UJT triggering. (7 hrs) 125. Identify different heat sinks used in SCRs. (3 hrs) 126. Construct a snubber circuit for protecting SCR use freewheeling diode to reduce back emf. (7 hrs) 127. Construct a jig circuit to test DIAC. (7 hrs) 128. Construct a simple dimmer circuit using TRIAC. (7 hrs) 129. Construct UJT based free running oscillator and change its frequency. (7 hrs)	current relations between them and Impedances between various terminals. Heat Sink- Uses & purpose. Suitability of FET amplifiers in measuring device applications. Working of different power electronic components such as SCR, TRIAC, DIAC and UJT. (14 hrs.)
		MOSFET & IGBT 130. Identify various Power MOSFET by its number and test by using multimeter. (5 hrs) 131. Identify different heat sinks used with various power MOSFET devices. (5 hrs) 132. Construct MOSFET test circuit with a small load. (5 hrs) 133. Identify IGBTs by their numbers and test by using multimeter. (5 hrs) 134. Construct IGBT test circuit with a small load. (5 hrs)	MOSFET, Power MOSFET and IGBT, their types, characteristics, switching speed, power ratings and protection. Differentiate FET with MOSFET. Differentiate Transistor with IGBT. (07 hrs.)
Professional Skill 50 Hrs;	Select the appropriate opto	**Opto Electronics** 135. Test LEDs with DC supply	Working and application of LED, IR LEDs, Photo diode,

Professional Knowledge 14 Hrs	electronics components and verify the characteristics in different circuit.	and measure voltage drop and current using multimeter. (5 hrs) 136. Construct a circuit to test photo voltaic cell. (5 hrs) 137. Construct a circuit to switch a lamp load using photo diode. (5 hrs) 138. Construct a circuit to switch a lamp load using photo transistor. (5 hrs) 139. Identify opto coupler input and output terminals and measure the quantum of isolation between input/output terminals and operate a relay by connecting a switch. (5 hrs)	photo transistor, their characteristics and applications. Optical sensor, opto-couplers, circuits with opto isolators. Characteristics of LASER diodes. (14 hrs.)
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs	Assemble, test and troubleshoot various digital circuits.	**Basic Gates** 140. Identify different Logic Gates (AND, OR, NAND, NOR, EX-OR, EX-NOR, NOT ICs) by the number printed on them. (05hrs) 141. Verify the truth tables of all Logic Gate ICs by connecting switches and LEDs. (05hrs) 142. Construct and verify the truth table of all the gates using NAND and NOR gates. (04hrs) 143. Use digital IC tester to test the various digital ICs (TTL and CMOS). (03hrs)	Introduction to Digital Electronics. Difference between analog and digital signals. Logic families and their comparison, logic levels of TTL and CMOS. Number systems (Decimal, binary, octal, Hexadecimal). BCD code, ASCII code and code conversions. Various Logic Gates and their truth tables.(05 hrs.)
		Combinational Circuits 144. Construct Half Adder circuit using ICs and verify the truth table. (3 hrs)	Combinational logic circuits such as Half Adder, Full adder, Parallel Binary adders, 2-bit

		145. Construct Full adder with two Half adder circuit using ICs and verify the truth table. (03hrs) 146. Construct the adder cum subtractor circuit and verify the result. (03hrs) 147. Construct and Test a 2 to 4 Decoder. (3 hrs) 148. Construct and Test a 4 to 2 Encoder. (3 hrs) 149. Construct and Test a 4 to 1 Multiplexer. (3 hrs) 150. Construct and Test a 1 to 4 De Multiplexer. (3 hrs)	and four bit full adders. Magnitude comparators. Half adder, full adder ICs and their applications for implementing arithmetic operations. Concept of encoder and decoder. Basic Binary Decoder and four bit binary decoders. Need for multiplexing of data. 1:4 line Multiplexer / De-multiplexer. (04 hrs.)
		Flip Flops 151. Identify different Flip-Flop (ICs) by the number printed on them. (03hrs) 152. Construct and test four bit latch using 7475. (03hrs) 153. Construct and test R-S flip-flop using IC7400 with clock and without clock pulse. (03hrs) 154. Verify the truth tables of Flip-Flop ICs (RS, D, T, JK, MSJK) by connecting switches and LEDs. (03hrs)	Introduction to Flip-Flop. S-R Latch, Gated S-R Latch, D-Latch. Flip-Flop: Basic RS Flip Flop, edge triggered D Flip Flop, JK Flip Flop, T Flip Flop. Master-Slave flip flops and Timing diagrams. Basic flip flop applications like data storage, data transfer and frequency division. (05 hrs.)
Professional Skill 50 Hrs; Professional Knowledge 14 Hrs	Simulate and analyze the analog and digital circuits using Electronic simulator software.	**Electronic circuit simulator** 155. Prepare simple digital and electronic circuits using the software (10 hrs) 156. Simulate and test the prepared digital and analog circuits (16 hrs) 157. Convert the prepared circuit into a layout diagram. (10 hrs) 158. Prepare simple, power	Study the library components available in the circuit simulation software. Various resources of the software. (14 hrs.)

		electronic and domestic electronic circuit using simulation software. (14 hrs)	
Professional Skill 75 Hrs; Professional Knowledge 21 Hrs	Assemble, test and troubleshoot various digital circuits.	**Counter & shift Registers** 159. Construct and test a four bit asynchronous binary counter using 7493 (6hrs) 160. Construct and test 7493 as a modulus-12 counter. (6hrs) 161. Construct and test a four bit Synchronous binary counter using 74163. (8hrs) 162. Construct and test synchronous Decade counter. (6hrs) 163. Construct and test an up/down synchronous decade counter using 74190 and monitor the output on LEDs. (8hrs) 164. Identify and test common anode and common cathode seven segment LED display using multi meter. (5hrs) 165. Display the two digit count value on seven segment display using decoder/driver ICs. (6hrs) 166. Construct a shift register using RS/D/JK flip flop and verify the result. (6hrs) 167. Construct and test four bit SIPO register. (8hrs) 168. Construct and test four bit PIPO register. (8hrs) 169. Construct and test bidirectional shift registers. (8hrs)	Basics of Counters, types, two bit and three bit Asynchronous binary counters and decade counters with the timing diagrams. 3-bit Synchronous counters and synchronous decade counters. Types of seven segment display. BCD display and BCD to decimal decoder. BCD to 7 segment display circuits. Basics of Register, types and application of Registers. (21 hrs.)
Professional Skill 75 Hrs;	Construct and test different circuits using ICs	**Op – Amp & Timer 555 Applications** 170. Use analog IC tester to	Block diagram and Working of Op-Amp, importance, Ideal

Professional Knowledge 21 Hrs	741operational amplifiers & ICs 555 linear integrated circuits and execute the result.	test the various analog ICs. (5 hrs) 171. Construct and test various Op-Amp circuits Inverting, Non-inverting and Summing Amplifiers. (10hrs) 172. Construct and test Differentiator and Integrator (10 hrs) 173. Construct and test a zero crossing detector. (5 hrs) 174. Construct and test Instrumentation amplifier (10 hrs) 175. Construct and test a Binary weighted and R-2R Ladder type Digital-to-Analog Converters (10hrs.) 176. Construct and test Astable timer circuit using IC 555 (05hrs) 177. Construct and test mono stable timer circuit using IC 555. (05hrs) 178. Construct and test VCO (V to F Converter) using IC 555. (05hrs) 179. Construct and test 555 timers as pulse width modulator. (10 hrs)	characteristics, advantages and applications. Schematic diagram of 741, symbol. Non-inverting voltage amplifier, inverting voltage amplifier, summing amplifier, Comparator, zero cross detector, differentiator, integrator and instrumentation amplifier, other popular Op-Amps. Block diagram of 555, functional description w.r.t. different configurations of 555 such as monostable, astable and VCO operations for various application. (28 hrs.)
Project work / Industrial visit **Broad Areas:** a) Delayed automatic power on circuit. b) Neon flasher circuit using IC 741 c) UJT act as a relaxation oscillator d) Up/down synchronous decade counter e) Portable continuity cum capacitor tester			

SYLLABUS FOR ELECTRONICS MECHANIC TRADE			
SECOND YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 25 Hrs; Professional Knowledge 09 Hrs	Measure the various parameters by DSO and execute the result with standard one.	**Digital Storage Oscilloscope** 180. Identify the different front panel control of a DSO. (5 hrs) 181. Measure the Amplitude, Frequency and time period of typical electronic signals using DSO. (7 hrs) 182. Take a print of a signal from DSO by connecting it to a printer and tally with applied signal. (6 hrs) 183. Construct and test function generator using IC 8038. (7 hrs)	Advantages and features of DSO. Block diagram of Digital storage oscilloscope (DSO)/ CRO and applications. Applications of digital CRO. Block diagram of function generator. Differentiate a CRO with DSO. (09 hrs.)
Professional Skill 75 Hrs; Professional Knowledge 27 Hrs	Identify, place, solder and desolder and test different SMD discrete components and ICs package with due care and following safety norms using proper tools/setup.	**Basic SMD (2, 3, 4 terminal components)** 184. Identification of 2, 3, 4 terminal SMD components. (5 hrs) 185. De-solder the SMD components from the given PCB. (5 hrs) 186. Solder the SMD components in the same PCB. (5 hrs) 187. Check for cold continuity of PCB. (3 hrs) 188. Identification of loose /dry solder, broken tracks on printed wired assemblies. (7 hrs)	Introduction to SMD technology Identification of 2, 3, 4 terminal SMD components. Advantages of SMD components over conventional lead components. Soldering of SM assemblies - Reflow soldering. Tips for selection of hardware, Inspection of SM. (09 hrs.)

		SMD Soldering and De-soldering 189. Identify various connections and setup required for SMD Soldering station. (5 hrs) 190. Identify crimping tools for various IC packages. (3 hrs) 191. Make the necessary settings on SMD soldering station to de-solder various ICs of different packages (at least four) by choosing proper crimping tools. (14 hrs) 192. Make the necessary settings on SMD soldering station to solder various ICs of different packages (at least four) by choosing proper crimping tools. (14 hrs) 193. Make the necessary setting rework of defective surface mount component used soldering / de-soldering method. (14 hrs)	Introduction to Surface Mount Technology (SMT). Advantages, Surface Mount components and packages. Introduction to solder paste (flux). Soldering of SM assemblies, reflow soldering. Tips for selection of hardware, Inspection of SM. Identification of Programmable Gate array (PGA) packages. Specification of various tracks, calculation of track width for different current ratings. Cold/ Continuity check of PCBs. Identification of lose / dry solders, broken tracks on printed wiring assemblies. Introduction to Pick place Machine, Reflow Oven, Preparing stencil,& stencil printer (18 hrs.)
Professional Skill 50 Hrs; Professional Knowledge 18 Hrs	Rework on PCB after identifying defects from SMD soldering and de-soldering.	**PCB Rework** 194. Checked and Repair Printed Circuit Boards single, Double layer, and important tests for PCBs. (12 hrs) 195. Inspect soldered joints, detect the defects and test the PCB for rework. (8 hrs) 196. Remove the conformal	Introduction to Static charges, prevention, handling of static sensitive devices, various standards for ESD. Introduction to non-soldering interconnections. Construction of Printed Circuit Boards (single, Double, multi-layer), Important tests for PCBs.

		coatings by different methods. (8 hrs) 197. Perform replacement of coating. (8 hrs) 198. Perform baking and preheating. (8 hrs) 199. Repair solder mask and damage pad. (6 hrs)	Introduction to rework and repair concepts. Repair of damaged track. Repair of damaged pad and plated through hole. Repair of solder mask. (18 hrs.)
Professional Skill 50 Hrs; Professional Knowledge 18 Hrs	Construct different electrical control circuits and test for their proper functioning with due care and safety.	**Protection devices** 200. Identify different types of fuses along with fuse holders, overload (no volt coil), current adjust (Biometric strips to set the current). (9 hrs) 201. Test the given MCBs. (8 hrs) 202. Connect an ELCB and test the leakage of an electrical motor control circuit. (8 hrs)	Necessity of fuse, fuse ratings, types of fuses, fuse bases. Single/ three phase MCBs, single phase ELCBs. Types of contactors, relays and working voltages. Contact currents, protection to contactors and high current applications. (09 hrs.)
		Electrical control circuits 203. Measure the coil winding resistance of the given motor. (6 hrs.) 204. Prepare the setup of DOL starter and Control an induction motor. (7 hrs) 205. Construct a direction control circuit to change direction of an induction motor. (6 hrs.) 206. Connect an overload relay and test for its proper functioning. (6 hrs)	Fundamentals of single phase Induction motors, synchronous speed, slip, rotor frequency. Torque-speed characteristics, Starters used for Induction motors. (09 hrs.)
Professional Skill 50 Hrs; Professional Knowledge	Prepare, crimp, terminate and test various cables used in different electronics	**Electronic Cables & Connectors** 207. Identify various types of cables viz. RF coaxial feeder, screened cable, ribbon cable, RCA	Cable signal diagram conventions Classification of electronic cables as per the application

18 Hrs	industries.	connector cable, digital optical audio, video cable, RJ45, RJ11, Ethernet cable, fibre optic cable splicing, fibre optic cable mechanical splices, insulation, gauge, current capacity, flexibility etc. used in various electronics products, different input output sockets. (15 hrs) 208. Identify suitable connectors, solder/crimp /terminate & test the cable sets. (10 hrs) 209. Check the continuity as per the marking on the connector for preparing the cable set. (10 hrs) 210. Identify and select various connectors and cables inside the CPU cabinet of PC. (10 hrs) 211. Identify the suitable connector and cable to connect a computer with a network switch and prepare a cross over cable to connect two network computers. (5 hrs)	w.r.t. insulation, gauge, current capacity, flexibility etc. Different types of connector & their terminations to the cables. Male / Female type DB connectors. Ethernet 10 Base cross over cables and pin out assignments, UTP and STP, SCTP, TPC, coaxial, types of fibre optical Cables and Cable trays. Different types of connectors Servo 0.1" connectors, FTP, RCA, BNC, HDMI Audio/video connectors like XLR, RCA (phono), 6.3 mm PHONO, 3.5 / 2.5 mm PHONO, BANTAM, SPEAKON, DIN, mini DIN, RF connectors, USB, Fire wire, SATA Connectors, VGA, DVI connectors, MIDI and RJ45,RJ11 etc. (18 hrs.)
Professional Skill 75 Hrs; Professional Knowledge 27 Hrs	Assemble and test a commercial AM/ FM receiver and evaluate performance.	**Communication electronics** 212. Modulate and Demodulate various signals using AM and FM on the trainer kit and observe waveforms (10hrs) 213. Construct and test IC based AM Receiver (10hrs)	Radio Wave Propagation – principle, fading. Need for Modulation, types of modulation and demodulation. Fundamentals of Antenna, various parameters, types of Antennas & application. Introduction to AM, FM & PM,

		214. Construct and test IC based FM transmitter (10hrs) 215. Construct and test IC based AM transmitter and test the transmitter power. Calculate the modulation index. (10hrs) 216. Dismantle the given FM receiver set and identify different stages (AM section, audio amplifier section etc) (10hrs) 217. Modulate two signals using AM kit draw the way from and calculate percent (%) of modulation. (10hrs) 218. Modulate and Demodulate a signal using PAM, PPM, PWM Techniques (15hrs)	SSB-SC & DSB-SC. Block diagram of AM and FM transmitter. FM Generation & Detection. Digital modulation and demodulation techniques, sampling, quantization & encoding. Concept of multiplexing and de multiplexing of AM/ FM/ PAM/ PPM /PWM signals. ***A simple block diagram approach to be adopted for explaining the above mod/demod techniques.*** (27 hrs.)
Professional Skill 75 Hrs; Professional Knowledge 27 Hrs	Test, service and troubleshoot the various components of different domestic/ industrial programmable systems.	**Microcontroller (8051)** 219. Identify various ICs & their functions on the given Microcontroller Kit. (5hrs) 220. Identify the address range of RAM & ROM. (5hrs) 221. Measure the crystal frequency, connect it to the controller. (5hrs) 222. Identify the port pins of the controller & configure the ports for Input & Output operation. (7hrs) 223. Use 8051 microcontroller, connect 8 LED to the port, blink the LED with a switch. (10hrs) 224. Perform the initialization,	Introduction Microprocessor & 8051Microcontroller, architecture, pin details & the bus system. Function of different ICs used in the Microcontroller Kit. Differentiate microcontroller with microprocessor. Interfacing of memory to the microcontroller. Internal hardware resources of microcontroller. I/O port pin configuration. Different variants of 8051 & their resources. Register banks & their functioning. SFRs & their

		load & turn on a LED with delay using Timer. (8hrs) 225. Perform the use of a Timer as an Event counter to count external events. (10 hrs) 226. Demonstrate entering of simple programs, execute & monitor the results. (10 hrs) 227. Perform with 8051 microcontroller assembling language program, check the reading of an input port and sending the received bytes to the output port of the microcontroller, used switches and LCD for the input and output. (15hrs)	configuration for different applications. Comparative study of 8051 with 8052. Introduction to PIC Architecture. (27 hrs.)
Professional Skill 75 Hrs; Professional Knowledge 27 Hrs	Execute the operation of different process sensors, identify, wire & test various sensors of different industrial processes by selecting appropriate test instruments.	**Sensors, Transducers and Applications** 228. Identify sensors used in process industries such as RTDs, Temperature ICs, Thermocouples, proximity switches (inductive, capacitive and photo electric), load cells, strain gauge. LVDT PT 100 (platinum resistance sensor), water level sensor, thermostat float switch, float valve by their appearance (15hrs) 229. Measure temperature of a lit fire using a Thermocouple and record the readings referring to	Basics of passive and active transducers. Role, selection and characteristics. Sensor voltage and current formats. Thermistors/ Thermocouples - Basic principle, salient features, operating range, composition, advantages and disadvantages. Strain gauges/ Load cell – principle, gauge factor, types of strain gauges. Inductive/ capacitive

		data chart. (15hrs) 230. Measure temperature of a lit fire using RTD and record the readings referring to data chart (15 hrs.) 231. Measure the DC voltage of a LVDT (15hrs) 232. Detect different objectives using capacitive, inductive and photoelectric proximity sensors (15hrs)	transducers - Principle of operation, advantages and disadvantages. Principle of operation of LVDT, advantages and disadvantages. Proximity sensors – applications, working principles of eddy current, capacitive and inductive proximity sensors (27 hrs.)
Professional Skill 100 Hrs; Professional Knowledge 36 Hrs	Plan and carry out the selection of a project, assemble the project and evaluate performance for a domestic/commercial applications.	**Analog IC Applications** 233-237 Make simple projects/ Applications using ICs 741, 723, 555, 7106, 7107 Sample projects: • Laptop protector • Mobile cell phone charger • Battery monitor • Metal detector • Mains detector • Lead acid battery charger • Smoke detector • Solar charger • Emergency light • Water level controller • Door watcher **(Instructor will pick up any five of the projects for implementation)** (50Hrs)	Discussion on the identified projects with respect to data of the concerned ICs. Components used in the project. (18 hrs.)
		Digital IC Applications 238-242 Make simple projects/Applications	Discussion on the identified projects with respect to data of the concerned ICs.

		using various digital ICs (digital display, event counter, stepper motor driver etc) • Duty cycle selector • Frequency Multiplier • Digital Mains Resumption Alarm • Digital Lucky Random number generator • Dancing LEDs • Count down timer • Clap switch • Stepper motor control • Digital clock • Event counter • Remote jammer **(Instructor will pick up any five of the projects for implementation)** (50 Hrs)	Components used in the project. (18 hrs.)
Professional Skill 25 Hrs; Professional Knowledge 09 Hrs	Prepare fibre optic setup and execute transmission and reception.	**Fiber optic communication** 243. Identify the resources and their need on the given fiber optic trainer kit (3 hrs) 244. Make optical fiber setup to transmit and receive analog and digital data (4 hrs) 245. Set up the OFC trainer kit to study AM, FM, PWM modulation and demodulation. (6 hrs) 246. Perform FM modulation and demodulation using OFC trainer kit using audio signal and voice link (4 hrs)	Introduction to optical fiber, optical connection and various types optical amplifier, its advantages, properties of optic fiber, testing, losses, types of fiber optic cables and specifications. Encoding of light. Fiber optic joints, splicing, testing and the related equipment/ measuring tools. Precautions and safety aspects while handling optical cables. (09 hrs.)

		247. Perform PWM modulation and demodulation using OFC trainer kit using audio signal and voice link (4 hrs) 248. Perform PPM modulation and demodulation using OFC trainer kit using audio signal and voice link (4 hrs)	
Professional Skill 50 Hrs; Professional Knowledge 18 Hrs	Plan and Interface the LCD, LED DPM panels to various circuits and evaluate performance.	**Digital panel Meter** 249. Identify LED Display module and its decoder/driver ICs (6 hrs) 250. Display a word on a two line LED (8 hrs) 251. Measure/current flowing through a resistor and display it on LED Module (10 hrs) 252. Measure/current flowing through a sensor and display it on a LED module(DPM) (10 hrs) 253. Identify LCD Display module and its decoder/driver ICs (8 hrs) 254. Measure/current flowing through a resistor and display it. (8 hrs)	Different types of seven segment displays, decoders and driver ICs. Concept of multiplexing and its advantages. Block diagrams of 7106 and 7107 and their configuration for different measurements. Use of DPM with seven segment display. Principles of working of LCD. Different sizes of LCDs. Decoder/ driver ICs used with LCDs and their pin diagrams. Use of DPM with LCD to display different voltage & current signals. (18 hrs.)
Professional Skill 150Hrs; Professional Knowledge 54 Hrs	Detect the faults and troubleshoot SMPS, UPS and inverter.	**SMPS and Inverter** 255. Identify the components/devices and draw their corresponding symbols (4 hrs) 256. Dismantle the given stabilizer and find major sections/ ICs components. (6 hrs) 257. List the defect and	Concept and block diagram of manual, automatic and servo voltage stabilizer, o/p voltage adjustment. Voltage cut-off systems, relays used in stabilizer. Block Diagram of different types of Switch mode power supplies and their working

		symptom in the faulty SMPS. (5 hrs) 258. Measure / Monitor major test points of computer SMPS. (8 hrs) 259. Troubleshoot the fault in the given SMPS unit. Rectify the defect and verify the output with load. Record your procedure followed for trouble shooting the defects (10 hrs) 260. Use SMPS used in TVs and PCs for Practice. (6 hrs) 261. Install and test the SMPS in PC (6 hrs) 262. Install and test an inverter. (6 hrs) 263. Troubleshoot the fault in the given inverter unit. Rectify the defects and verify the output with load. (6 hrs) 264. Construct and test IC Based DC-DC converter for different voltages (6 hrs) 265. Construct and test a switching step down regulator using LM2576 (6 hrs) 266. Construct and test a switching step up regulator using MC 34063 (6 hrs)	principles. Various types of chopper circuits. Inverter; principle of operation, block diagram, power rating, change over period. Installation of inverters, protection circuits used in inverters. Battery level, overload, over charging etc. Various faults and its rectification in inverter. Block diagram of DC-DC converters and their working principals. (27 hrs.)
		UPS 267. Connect battery stack to the UPS. (4 hrs) 268. Identify front panel	Concept of Uninterrupted power supply. Difference between Inverters

		control & indicators of UPS. (4 hrs) 269. Connect Battery & load to UPS & test on battery mode. (6 hrs) 270. Open top cover of a UPS; identify its isolator transformers, the UPS transformer and various circuit boards in UPS. (10 hrs) 271. Identify the various test point and verify the voltages on these (7 hrs.) 272. Identify various circuit boards in UPS and monitor voltages at various test points (7 hrs) 273. Perform load test to measure backup time. (7 hrs) 274. Perform all above experiment for three phase UPS. (30 hrs)	and UPS. Basic block diagram of UPS & operating principle. Types of UPS : Off line UPS, On line UPS, Line interactive UPS & their comparison UPS specifications. Load power factor & types of indications & protections UPS circuit description and working - controlling circuits, Micro controller circuits, power circuits, charging circuits, alarm circuits, Indicator circuits. Installation of single phase & three phase UPS. (27 hrs.)
Professional Skill 75 Hrs; Professional Knowledge 27 Hrs	Install a solar panel, execute testing and evaluate performance by connecting the panel to the inverter.	**Solar Power (Renewable Energy System)** 275. Install a solar panel to a roof. (25 hrs) 276. Wire a solar controller to a battery storage station. (5 hrs) 277. Install solar power 500 panel to directly 12 V DC appliances (15 hrs) 278. Connect storage batteries to a power inverter (5 hrs) 279. Connect and test solar panel to the Inverter and run the load. (5 hrs) 280. Install a solar power to	Need for renewable energy sources, Solar energy as a renewable resource. Materials used for solar cells. Principles of conversion of solar light into electricity. Basics of photovoltaic's cell. Module, panel and Arrays. Factors that influence the output of a PV module. SPV systems and the key benefits. Difference between SPV and conventional power. Solar charge controller or regulator and its role.

		charge a rechargeable 12 V DC battery and find out the charging time (15 hrs) 281. Install a Solar Inverter. (5 hrs)	Safety precautions while working with solar systems. (27 hrs.)
Professional Skill 50 Hrs; Professional Knowledge 18 Hrs	Dismantle, identify the various parts and interface of a cell phone to a PC. Estimate and troubleshoot.	**Cell phones** 282. Dismantle, identify the parts and assemble different types of smart phones (6 hrs) 283. Dismantle the cell phone/smart phone remove the key pad and clean it, test for the continuity of the matrix/tracks (10 hrs) 284. Interface the cell phone/smart phone to the PC and transfer the data card (6 hrs) 285. Flash the various brands of cell phone/smart phone (at least 3) (5 hrs) 286. Format the cell phone/smart phone for virus (approach the mobile repair shop/service centre) (5 hrs) 287. Unlock the handsets through codes and software (3 hrs) 288. Perform the interfacing of cell phone/smart phone to the PC and dismantle the cell phone and identify the power section and test its healthiness (6 hrs) 289. Find out the fault of basic	Introduction to mobile communication. Concept cell site, hand off, frequency reuse, block diagram and working of cell phones, cell phone features. GSM and CDMA technology. Use IEMI number to trace lost/misplaced mobile phone. (18 hrs.)

		cell phone system. Rectify the fault in ringer section and check the performance (6 hrs) 290. Replace various faulty parts like mic, speaker, data/ charging/ audio jack etc. (5 hrs)	
Professional Skill 25 Hrs; Professional Knowledge 09 Hrs	Check the various parts of a LED lights & stacks and troubleshoot.	**LED Lights** 291. Dismantle the LED light, identify the connections of LEDs stacks, protection circuits, regulator (12 hrs) 292. Identify the rectifier, controller part of LED lights (8 hrs) 293. Make series string connection of six LED's and connect four Series strings in parallel. (8 hrs) 294. Connect to such parallel sets in Series to create a matrix of LED's. (14 hrs.) 295. Apply suitable voltage and check Voltage across series strings. (8 hrs)	Types of LED panels used in various lighting applications. Stacking of LEDs. Driving of LED stacks. (09 hrs.)
Professional Skill 50 Hrs; Professional Knowledge 18 Hrs	Identify, operate various controls, troubleshoot and replace modules of the LCD/LED TV & its remote.	**LCD and LED TV** 296. Identify and operate different Controls on LCD, LED TV (05hrs) 297. Identify components and different sectors of LCD and LED TV. (10hrs) 298. Dismantle; Identify the parts of the remote control (05hrs) 299. Dismantle the given LCD/LED TV to find faults with input stages through connectors. (10hrs)	Difference between a conventional CTV with LCD & LED TVs. Principle of LCD and LED TV and function of its different section. Basic principle and working of 3D TV. IPS panels and their features. Different types of interfaces like HDMI, USB, RGB etc. TV Remote Control –Types, parts and functions, IR Code

		300. Detect the defect in a LED/LCD TV receiver given to you. Rectify the fault. (15hrs) 301. Troubleshoot the faults in the given LED/LCD TV receiver. Locate and rectify the faults. (15hrs) 302. Test LED/LCD TV after troubleshooting the defects (10 hrs) 303. Identify various connectors and connect the cable operators external decoder (set top box) to the TV. (5 hrs.)	transmitter and IR Code Receiver. Working principle, operation of remote control. Different adjustments, general faults in Remote Control. (36 hrs.)
Project work / Industrial visit **Broad areas:** a) Remote control for home appliances b) Solar power inverter c) Musical light chaser d) 7 segment LED display decoder drive circuit			