SYLLABUS FOR TECHNICIAN POWER ELECTRONICS SYSTEMS TRADE			

FIRST SEMESTER- 6 MONTHS			

Week No.	Reference Learning Outcome	Professional Skills (Trade Practical) with Indicative Hours	Professional Knowledge (Trade Theory)
1	• Apply safe working practices	**Trade and Orientation** 1. Visit to various sections of the institute and identify location of various installations. (05 hrs) 2. Identify safety signs for danger, warning, caution & personal safety message. (03 hrs) 3. Use of personal protective equipment (PPE). (05 hrs) 4. Practice elementary first aid.(05 hrs) 5. Preventive measures for electrical accidents & steps to be taken in such accidents.(02 hrs) 6. Use of Fire extinguishers.(05 hrs)	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.
2-3	• Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc. observing suitable care & safety.	**Hand tools and their uses** 7. Identify the different hand tools. (05 hrs) 8. Selection of proper tools for operation and precautions in operation. (07 hrs) 9. Care & maintenance of trade tools. (08 hrs) 10. Practice safety precautions while working in fitting jobs. (10 hrs) 11. Workshop practice on filing and hacksawing. (05 hrs) 12. Practice simple sheet metal works, fitting and drilling.(05	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.

		hrs) 13. Make an open box from metal sheet. (10 hrs)	
4-5	• 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. (06 hrs) 15. Construct a test lamp and use it to check mains healthiness. (07 hrs) 16. Measure the voltage between phase and ground and rectify earthing. (05 hrs) 17. Identify and test different AC mains cables. (07 hrs) 18. Prepare terminations, skin the electrical wires/cables using wire stripper and cutter.(07 hrs) 19. Measure the gauge of the wire using SWG and outside micrometer. (05 hrs) 20. Refer table and find current carrying capacity of wires. (03 hrs) 21. Crimp the lugs to wire end. (05 hrs) 22. Measure AC and DC voltages using multimeter. (05 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.
6	• Select and perform electrical/ electronic measurement of single range meters and calibrate the instrument.	**Single range meters** 23. Identify the type of meters by dial and scale marking/ symbols. (03 hrs) 24. Demonstrate various analog measuring Instruments. (03 hrs) 25. Find the minimum and maximum measurable range of the meter. (03 hrs) 26. Carryout mechanical zero setting of a meter. (05 hrs) 27. Check the continuity of wires,	Introduction to electrical and electronic measuring instruments. Basic principle and parts of simple meters. Specifications, symbols used in dial and their meaning.

		meter probes and fuse etc. (05 hrs) 28. Measure voltage and current using clamp meter. (06 hrs)	
7	• 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. (02 hrs) 30. Identify the rated output voltage and Ah capacity of given battery. (01 hr) 31. Measure the voltages of the given cells/battery using analog/ digital multimeter. (03 hrs) 32. Charge and discharge the battery through load resistor. (05 hrs) 33. Maintain the secondary cells. (05 hrs) 34. Measure the specific gravity of the electrolyte using hydrometer. (03 hrs) 35. Test a battery and verify whether the battery is ready for use or needs recharging. (06 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.
8-9	• Test various electronic components using proper measuring instruments and compare the data using standard parameter.	**AC & DC measurements** 36. Use the multimeter to measure the various functions (AC V, DC V, DC I, AC I, R) (08 hrs) 37. Identify the different types of meter for measuring AC & DC parameters (08 hrs) 38. Identify the different controls on the CRO front panel and observe the function of each control (12 hrs) 39. Measure DC voltage, AC voltage, time period using CRO sine wave parameters (10 hrs)	Introduction to electrical measuring instruments. Importance and classification of meters. Forces necessary to work a meter. MC and MI meters. Range extension, need of calibration. Characteristics of meters and errors in meters. Multimeter, use of meters in different circuits. Care and maintenance of meters. Use of CRO, Function generator, LCR meter

		40. Identify the different controls on the function generator front panel and observe the function of each control. (12 hrs.)	
10	• 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. (05 hrs) 42. Practice soldering on IC bases and PCBs. (05 hrs) 43. Practice de-soldering using pump and wick (02 hrs) 44. Join the broken PCB track and test (03 hrs) 45. Identify and use SPST, SPDT, DPST, DPDT, tumbler, push button, toggle, piano switches used in electronic industries (05 hrs) 46. Make a panel board using different types of switches for a given application (05 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.
11-13	• 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. (03 hrs) 48. Measure the resistor value by colour code and verify the same by measuring with multimeter. (03 hrs) 49. Identify resistors by their appearance and check physical defects. (02 hrs) 50. Identify the power rating of carbon resistors by their size. (03 hrs) 51. Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage	Ohm's law and Kirchhoff's Law. Resistors; types of resistors, their construction & specific use, colour 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 andenergy storage concept. Self and Mutual induction. Behaviour of inductor at low and high frequencies. Series and parallel combination, Q factor. Capacitance and Capacitive

		sources. (09 hrs) 52. Measurement of current and voltage in electrical circuits to verify Kirchhoff's Law. (05 Hrs) 53. Verify laws of series and parallel circuits with voltage source in different combinations. (05 hrs) 54. Measure the resistance, Voltage, Current through series and parallel connected networks using multimeter. (08 hrs) 55. Identify different inductors and measure the values using LCR meter. (05 hrs) 56. Identify the different capacitors and measure capacitance of various capacitors using LCR meter. (05 hrs) 57. Identify and test the circuit breaker and other protecting devices. (05 hrs) 58. Dismantle and identify the different parts of a relay. (05 hrs) 59. Connect a timer relay in a circuit and test for its working. (03 hrs) 60. Connect a contactor in a circuit and test for its working. (02 hrs) 61. Construct and test RC time constant circuit. (04 hrs) 62. Construct a RC differentiator circuit and convert triangular wave into square wave. (05 hrs) 63. Construct and test series and parallel resonance circuit. (03 hrs)	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 electro magnetism, types of cores. Relays, types, construction and specifications etc.
14-15	• Assemble simple	**Power Supply Circuits**	Semiconductor materials,

	electronic power supply circuit and test for functioning.	64. Identify different types of diodes, diode modules and their specifications. (05 hrs) 65. Test the given diode using multimeter and determine forward to reverse resistance ratio. (05 hrs) 66. Measure the voltage and current through a diode in a circuit and verify its forward characteristic. (08 hrs) 67. Identify different types of transformers and test. (03 hrs) 68. Identify the primary and secondary transformer windings and test the polarity (02 hrs) 69. Construct and test a half wave, full wave and Bridge rectifier circuit. (10 hrs) 70. Measure ripple voltage, ripple frequency and ripple factor of rectifiers for different load and filter capacitors. (05 hrs) 71. Identify and test Zener diode. (02 hrs) 72. Construct and test Zener based voltage regulator circuit. (05 hrs) 73. Calculate the percentage regulation of regulated power supply. (05 hrs)	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 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.
16-20	• 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. (05 hrs) 75. Demonstrate various parts of the system unit and motherboard components. (05 hrs) 76. Identify various computer peripherals and connect it to	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 windows: Starting windows and its operation, file management using explorer,

		the system. (05 hrs) 77. Disable certain functionality by disconnecting the concerned cables SATA/ PATA. (05 hrs) 78. Replace the CMOS battery and extend a memory module. (05 hrs) 79. Test and Replace the SMPS (05 hrs) 80. Replace the given DVD and HDD on the system (05 hrs) 81. Dismantle and assemble the desktop computer system. (10 hrs) 82. Boot the system from different options (05 hrs) 83. Install OS in a desktop computer. (05 hrs) 84. Install a Printer driver software and test for print outs. (05 hrs) 85. Install antivirus software, scan the system and explore the options in the antivirus software. (5 hrs) 86. Install MS office software. (05 hrs) 87. Create folder and files, draw pictures using paint. (05 hrs) 88. Explore different menu/ tool/ format/ status bars of MS word and practice the options. (08 hrs) 89. Explore different menu/ tool/ format/ status bars of MS excel and practice the options. (07 hrs) 90. Prepare power point presentation on any three known topics with various design, animation and visual effects. (05 hrs) 91. Convert the given PDF File	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: 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 worksheets, 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 media, 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.

		into Word file using suitable software. (05 hrs) 92. Browse search engines, create email accounts, practice sending and receiving of mails and configuration of email clients. (05 hrs) 93. Identify different types of cables and network components e.g. Hub, switch, router, modem etc. (05 hrs) 94. Prepare terminations, make UTP and STP cable connectors and test. (05 hrs) 95. Connect network connectivity hardware and check for its functioning. (05 hrs) 96. Configure a wireless Wi-Fi network. (05 hrs)	
21	• Assemble simple electronic power supply circuit and test for functioning.	**IC Regulators** 97. Construct and test a +12V fixed voltage regulator. (05 hrs) 98. Identify the different types of fixed +ve and –ve regulator ICs and the different current ratings (78/79 series). (05 hrs) 99. Identify different heat sinks for IC based regulators. (02 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. (08 hrs) 101. Construct and test a 1.2 V – 30V variable output regulated power supply using IC LM317T. (05 hrs)	Regulated Power supply using 78XX series, 79XX series. Op-amp regulator, 723 regulator (Transistorized & IC based). Voltage regulation, error correction and amplification etc.
22-23	• Plan and carry out the selection of a	Make simple project applications using ICs, zener diode,	Discussion on the identified projects with respect to data of

project, assemble the project and evaluate performance for domestic/commercial applications.	transformer and other discrete components.
	   a) Full wave bridge rectifier with indicator.
	   b) Modular Rectifiers.
	   c) Transformer less 12V dual power supply.
	   d) Half wave dual power supply with zener diode.
	   e) Versatile regulated power supply.
	   f) AC/DC voltage tester.
	(Instructor will pick up any five of the project for implementation)
		the concerned ICs, components used in the project.

24-25	Revision	
26	Examination	

SYLLABUS FOR TECHNICIAN POWER ELECTRONICS SYSTEMS TRADE

SECOND SEMESTER – 06 MONTHS

Week No.	Learning Outcome Reference	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
27	• 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. (05 hrs) 103. Test the condition of a given transistor using ohmmeter. (05 hrs) 104. Measure and plot input and output characteristics of a CE amplifier. (07 hrs) 105. Construct and test a transistor based switching circuit to control a relay (use Relays of different coil voltages and Transistors of different β). (08 hrs)	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.
28-29	• Construct, test and verify the input/ output characteristics of various analog circuits.	**Amplifier** 106. Construct and test fixed-bias, emitter-bias and voltage divider-bias transistor amplifier. (12 hrs) 107. Construct and test a common emitter amplifier with and without bypass capacitors. (05 hrs) 108. Construct and test common base amplifier. (05 hrs) 109. Construct and Test common collector/emitter follower amplifier. (05 hrs) 110. Construct and test Darlington amplifier. (05 hrs) 111. Construct and test a two stage RC Coupled amplifier.	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,

		(05 hrs)	Distinguish between voltage
		112. Construct and test a Class B complementary push pull amplifier. (08hrs)	and power amplifier, Push pull amplifier and class C tuned amplifier.
		113. Construct and test class C Tuned amplifier. (05hrs)	Alpha, beta, voltage gain, Concept of dB dBm.
			Feedback and its types.
30	• Construct, test and verify the input/ output characteristics of various analog circuits.	**Oscillators**	Introduction to positive feedback and requisites of an oscillator.
		114. Demonstrate Colpitts oscillator, Hartley oscillator circuits and compare the output frequency of the oscillator by CRO. (07 hrs)	Study of Colpitts, Hartley, Crystal and RC oscillators.
		115. Construct and test a RC phase shift oscillator circuits. (05 hrs)	Types of multivibrators and study of circuit diagrams.
		116. Construct and test a crystal oscillator circuits. (05 hrs)	
		117. Demonstrate Astable, monostable, bistable circuits using transistors. (08 hrs)	
31	• Construct, test and verify the input/ output characteristics of various analog circuits.	**Wave shaping circuits**	Diode shunt clipper circuits, Clamping/limiting circuits and Zener diode as peak clipper, uses their applications.
		118. Construct and test shunt clipper. (06 hrs)	
		119. Construct and test series and dual clipper circuit using diodes. (07 hrs)	
		120. Construct and test clamper circuit using diodes. (05 hrs)	
		121. Construct and test Zener diode as a peak clipper. (07 hrs)	
32-33	• Plan and construct different power electronic circuits and analyze the circuit functioning.	**Power Electronic Components**	Construction of FET & JFET, difference with BJT.
		122. Identify different power electronic components, their specification and terminals. (06 hrs)	Purpose of Gate, Drain and source terminals and voltage/ current relations between them and Impedances between various terminals.
		123. Construct and test a FET Amplifier. (06 hrs)	Heat Sink- Uses &purpose.
		124. Construct a test circuit of SCR using UJT triggering. (07hrs)	Suitability of FET amplifiers in measuring device applications.
		125. Identify different heat sinks used in SCRs. (03 hrs)	Working of different power
		126. Construct a snubber circuit	electronic components such as

		for protecting SCR use freewheeling diode to reduce back emf. (07 hrs) 127. Construct a jig circuit to test DIAC. (07 hrs) 128. Construct a simple dimmer circuit using TRIAC. (07 hrs) 129. Construct UJT based free running oscillator and change its frequency. (07 hrs)	SCR, TRIAC, DIAC and UJT.
34	• Plan and construct different power electronic circuits and analyze the circuit functioning.	**MOSFET & IGBT** 130. Identify various Power MOSFET by its number and test by using a multimeter. (05 hrs) 131. Identify different heat sinks used with various power MOSFET devices. (05 hrs) 132. Construct MOSFET test circuit with a small load.(05hrs) 133. Identify IGBTs by their numbers and test by using a multimeter. (05 hrs) 134. Construct an IGBT test circuit with a small load. (05 hrs)	MOSFET, Power MOSFET and IGBT, their types, characteristics, switching speed, power ratings and protection. Differentiate FET with MOSFET. Differentiate Transistor with IGBT.
35	• Select the appropriate opto-electronics components and verify the characteristics in different circuit.	**Opto-Electronics** 135. Test LEDs with DC supply and measure voltage drop and current using multimeter. (05 hrs) 136. Construct a circuit to test photovoltaic cell. (05 hrs) 137. Construct a circuit to switch a lamp load using photo diode. (05 hrs) 138. Construct a circuit to switch a lamp load using photo transistor. (05 hrs) 139. Identify optocoupler input and output terminals and measure the quantum of isolation between input/output terminals and	Working and application of LED, IR LEDs, Photodiode, photo transistor, their characteristics and applications. Optical sensor, Opto-couplers, circuits with Opto-Isolators. Characteristics of LASER diodes.

36	• Assemble, test and troubleshoot various digital circuits.	**Basic Gates** 140. Identify different Logic Gates (AND, OR, NAND, NOR, EX-OR, EX-NOR, NOT ICs) with the number printed on them. (06 hrs) 141. Verify the truth tables of all Logic Gate ICs by connecting switches and LEDs. (08 hrs) 142. Construct and verify the truth table of all the gates using NAND and NOR gates. (06 hrs) 143. Use a digital IC tester to test the various digital ICs (TTL and CMOS). (05 hrs)	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.
37	• Assemble, test and troubleshoot various digital circuits.	**Combinational Circuits** 144. Construct Half Adder circuit using ICs and verify the truth table. (03 hrs) 145. Construct Full adder with two Half adder circuit using ICs and verify the truth table. (05 hrs) 146. Construct the adder cum subtractor circuit and verify the result. (05 hrs) 147. Construct and test a 2 to 4 Decoder. (03 hrs) 148. Construct and test a 4 to 2 Encoder. (03 hrs) 149. Construct and test a 4 to 1 Multiplexer. (03 hrs) 150. Construct and test a 1 to 4 DeMultiplexer. (03 hrs)	Combinational logic circuits such as Half Adder, Full adder, Parallel Binary adders, 2-bit 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.
38	• Assemble, test and troubleshoot various digital circuits.	**Flip Flops** 151. Identify different Flip-Flop (ICs) by the number printed on them. (05 hrs) 152. Construct and test four bit latch using 7475. (05 hrs)	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.

		153. Construct and test R-S flip-flop using IC7400 with clock and without clock pulse. (05 hrs) 154. Verify the truth tables of Flip-Flop ICs (RS, D, T, JK, MSJK) by connecting switches and LEDs. (10 hrs)	Master-Slave flip flops and Timing diagrams. Basic flip flop applications like data storage, data transfer and frequency division.
39-40	• Simulate and analyze the analog and digital circuits using the 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 electronic and domestic electronic circuit using simulation software. (14 hrs)	Study the library components available in the circuit simulation software. Various resources of the software.
41-43	• Assemble, test and troubleshoot various digital circuits.	**Counter & shift registers** 159. Construct and test a four bit asynchronous binary counter using 7493. (10 hrs) 160. Construct and test 7493 as a modulus-12 counter. (10hrs) 161. Construct and test a four bit Synchronous binary counter using 74163. (10 hrs) 162. Construct and test synchronous Decade counter. (05 hrs) 163. Construct and test an up/down synchronous decade counter using 74190 and monitor the output on LEDs. (10 hrs) 164. Identify and test common anode and common cathode seven segment LED display using a multimeter. (05 hrs) 165. Display the two digit count value on seven segment	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.

		display using decoder/driver ICs. (05 hrs) 166. Construct a shift register using RS/D/JK flip flop and verify the result. (05 hrs) 167. Construct and test four bit SIPO register. (05 hrs) 168. Construct and test four bit PIPO register. (05 hrs) 169. Construct and test bidirectional shift registers. (05 hrs)	
44-47	• Construct and test different circuits using ICs 741operational amplifiers & ICs 555 linear integrated circuits and execute the result.	**Op – Amp & Timer 555 Applications** 170. Use analog IC tester to test the various analog ICs. (05 hrs) 171. Construct and test various Op-Amp circuits Inverting, Non-inverting and Summing Amplifiers. (15 hrs) 172. Construct and test Differentiator and Integrator (10 hrs) 173. Construct and test a zero crossing detector. (05 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. (15 hrs) 176. Construct and test Astable timer circuit using IC 555. (10 hrs) 177. Construct and test mono stable timer circuit using IC 555. (10 hrs) 178. Construct and test VCO (V to F Converter) using IC 555. (10 hrs) 179. Construct and test 555 timers as pulse width modulator (10	Block diagram and Working of Op-Amp, importance, Ideal 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 amplifiers, 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.

		hrs)	
48-50	• Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications.	Make simple project applications using ICs, transformer and other discrete components. a) Pencil charger indicator. b) Delayed automatic power on the circuit. c) Neon flasher circuit using IC741. d) UJT act as a relaxation oscillator. e) Up/down synchronous decade counter. f) Test a 4 to 1 multiplexer circuit. g) Dimmer circuit of Light & Fan using DIAC & TRIAC. h) Timer Circuit using IC-555. (The instructor will pick up any five of the project for implementation)	Discussion on the identified projects with respect to data of the concerned ICs, components used in the project.
51	Revision		
52	Examination		

SYLLABUS FOR TECHNICIAN POWER ELECTRONICS SYSTEMS TRADE			
THIRD SEMESTER - 06 Months			
Week No.	Learning Outcome Reference	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
53.	• 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.(05 hrs) 181. Measure the Amplitude, Frequency and time period of typical electronic signals using DSO &Store a portion of signal waveform using DSO. (07 hrs) 182. Take a print of a signal from the DSO by connecting it to a printer & tally with applied signal. (06 hrs) 183. Construct and test function generator using IC 8038. (07 hrs)	Block diagram of CRO and applications of CRO, application of digital CRO, block diagram of function generator. Differentiate a CRO with DSO. Advantages of DSO.
54	• Identify, place, solder, desolder and test different SMD discrete components and IC's 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 terminals SMD components. (05 hrs) 185. De-solder the SMD components from the given PCB. (05 hrs) 186. Solder the SMD components on the same PCB. (05 hrs) 187. Check for cold continuity of PCB. (03 hrs) 188. Identification of loose/dry solder, broken tracks on printed wired assemblies. (07 hrs)	Introduction to SMD technology Identification of 2, 3, 4 terminals SMD components. Advantages of SMD components over conventional lead components. Soldering of SM assemblies - Reflow soldering. Tips for selection of hardware, Inspection of SM.

| 55-56 | • Identify, place, solder and de-solder and test different SMD discrete components and IC's Package with due care and following safety norms using proper tools/setup. | **SMD Soldering and De-soldering:**
189. Identify various connections and the setup required for the SMD soldering station. (05 hrs)
190. Identification of crimping tools for various IC packages.(03 hrs)
191. Make the necessary settings on SMD soldering station to de-solder various ICs of different packages (at least four) by choosing proper clamping 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 clamping tools.(14 hrs)
193. Make the necessary setting rework of a defective surface mount component used soldering/de-soldering method. (14 hrs) | Soldering/ de-soldering of the above components.
Identification of PGA packages.
Soldering/ de-soldering of above PGA components.
Cold/Continuity check of PCBs.
Identification of lose/dry solders, broken tracks on printed wiring assemblies. |
| 57-58 | • Rework on PCB after identifying defects from SMD soldering and de-soldering. | **PCB Rework:**
194. Check 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. (08 hrs)
196. Remove the conformal coatings by different methods. (08 hrs)
197. Perform replacement of coating. (08 hrs) | ESD Control in Electronics
Introduction to Static charges, Prevention of Static charges, Handling of static sensitive devices, Various standards for ESD
Introduction to non-soldering interconnections
Introduction to crimping, wire wrapping, Conductive adhesives, Chip on Board, Tape Automated bonding.
Introduction to components, Printed Circuit Boards
Introduction to components, |

		198. Perform baking and preheating. (08 hrs) 199. Repair solder mask and damage pad. (06 hrs)	Construction of Printed Circuit Boards (single, Double, multi-layer), Important tests for PCBs 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. Introduction to rework and repair concepts. Repair of damaged track. Repair of damaged pad and plated through hole. Repair of solder mask.
59	• 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. (06 hrs) 201. Wire an MCB to a motor and run it. (04 hrs) 202. Test and rectify defects associated with MCBs.(07 hrs) 203. Connect an ELCB and test the leakage of an electrical motor control circuit. (08 hrs)	Fuse ratings, types of Fuses, Fuse bases, single/three phase MCBs, single phase ELCBs. Types of Contactors, contactor coils and working voltages, contactor contact currents, protection to contactors and high current applications.
60	• Construct different electrical control circuits and test for their proper functioning with due care and safety.	**Electrical control circuits:** 204. Measure the coil winding resistance of the given motor. (06 hrs) 205. Prepare the setup and Control an induction motor using a DOL Starter. (07 hrs) 206. Construct a direction	Fundamentals of single phase Induction motors, synchronous speed, slip, rotor frequency, torque–speed characteristics, Starters used for Induction motors.

		control circuit to change the direction of an induction motor. (06 hrs) 207. Connect a overload relay and test for its proper function.(06 hrs)	
61-63	• Test, service and troubleshoot the various components of different domestic/ industrial programmable systems.	**Microcontroller** 208. Identify various ICs & their functions on the given Microcontroller 8051 Kit. (05 hrs) 209. Identify the address range of RAM & ROM. (05 hrs) 210. Write data into RAM & observe its volatility. (05 hrs) 211. Measure the crystal frequency, connect it to the controller. (05 hrs) 212. Identify the port pins of the controller & configure the ports for Input & Output operation. (10 hrs) 213. Connect an input switch & control a lamp using necessary program. (10 hrs) 214. Demonstrate the initialization, load & turn on an LED with delay using Timer. (10 hrs) 215. Demonstrate the use of a Timer as an even counter to count external events. (10 hrs) 216. Demonstrate entering of simple programs, execute & monitor the results. (15 hrs)	Introduction to 8051 Microcontroller, architecture, pin details & the bus system. The 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 configuration for different applications. Utilization of on chip resources such as ADC. Availability of assembly software & compiler for 8051. Application of microcontroller in domestic, consumer & industries.
64-65	• Plan and interface the LCD, LED DPM panels to various circuits and evaluate performance.	**Digital panel meter**: 217. Identify LED Display module and its decoder/driver ICs. (06 hrs)	Different types of seven segment displays, decoders and driver ICs for them. Concept of multiplexing and its advantages.

		218. Display a word on a two line LED. (08 hrs)	Block diagrams of 7106 and 7107 and their configuration for different measurements.
		219. Measure/current flowing through a resistor and display it on LED Module. (08 hrs)	Use of DPM (Digital Panel Meter) with seven segment displays to display different
		220. Measure/current flowing through a sensor and display it on an LED module (DPM). (10 hrs)	voltage & current signals. Principles of working of LCD. Different sizes of LCDs.
		221. Identify LCD Display module and its decoder/driver ICs. (08 hrs)	Decoder/Driver ICs used with LCDs and their pin-out diagrams.
		222. Display a word on a two line LCD. (04 hrs)	Scrolling displays and its design. Use of DPM (Digital Panel
		223. Measure/current flowing through a sensor and display it on an LCD module (DPM). (06 hrs)	Meter) to display different voltage & current signals.
66	• Assemble, test and troubleshoot single phase & 3-phase controlled and uncontrolled rectifier using SCR.	**3-Phase Rectifier (controlled &uncontrolled)** 224. Construct & test three phase uncontrolled rectifiers (half wave & bridge). (04 hrs)	High current rectifiers. Differentiate uncontrolled and controlled rectifiers. Discuss on 3-phase uncontrolled rectifier, control and power circuits
		225. Construct & test single phase Half controlled rectifier using SCR. (04 hrs)	and their applications. Discussion on 3-phase controlled rectifiers, control
		226. Construct & test single phase full controlled rectifier using SCR. (04 hrs)	and power circuits and their applications.
		227. Identify and replace the faulty components. (04 hrs).	
		228. Test, 3-phase controlled rectifiers under fault condition & rectify faults. (04 hrs)	
		229. Construct & test three phase controlled rectifiers (half wave & bridge) using	

		SCR. (05 hrs)	
67	• Construct, test & repair different chopper using MOSFET and IC based DC-DC converter and execute the result.	**Chopper** 230. Construct & test chopper circuit using MOSFET. (05 hrs) 231. Construct and test step up type chopper circuit. (05 hrs) 232. Construct and test step down type chopper circuit. (05 hrs) 233. Construct and test IC Based DC-DC converter for different voltages. (05 hrs) 234. Test chopper circuit under fault condition and rectify fault. (05 hrs)	Various types of chopper circuits step up, step down, inverting types. Introduction to DC-DC Converters. Applications of DC-DC converters. ICs used for converting DC-DC. Applications of DC-DC converters.
68-69	• Detect the faults and troubleshoot Power supplies, SMPS, UPS and inverter.	**Power Supplies & SMPS** 235. Identify different front panel controls and connectors of the given power supply. (04 hrs) 236. Test the given power supply and limit the output to a specific voltage and current. (04 hrs) 237. Open the power supply and identify major sections and power components with heat sinks. (04 hrs) 238. Test the semiconductor power switches of a power supply. (04 hrs) 239. Operate a programmable power supply and test its features. (04 hrs) 240. Identify various input and output sockets/ connectors of the given SMPS. (04 hrs)	Specifications & block diagram of Linear power supplies. Front panel controls and features of various power supplies. Different types of power switches and heat sinks used in power supplies. Block Diagram of Switch mode power supplies and their working principles. Various ICs used in different types of SMPS. Principles of Inversion and Inverter circuits using different techniques. Pulse width modulation and their applications.

		241. Apply input and measure outputs using a multimeter. (04 hrs) 242. Test capacity of the given SMPS. (04 hrs) 243. Identify major sections/ ICs/ components of SMPS. (08 hrs) 244. Measure/ monitor major test points of SMPS. (05 hrs) 245. Identify and replace the faulty components. (05 hrs) (Use SMPS used in TVs and PCs for practice)	
70-71	• Detect the faults and troubleshoot Power supplies, SMPS, UPS and inverter.	**Inverters** 246. Construct & test simple inverter circuit using transistors/ MOSFET. (04 hrs) 247. Prepare a load bank using resistive & Inductive load up to 2KW for testing of Inverter & UPS. (04 hrs) 248. Identify front panel control & indicators of Inverter. (04 hrs) 249. Identify & understand the use of back panel sockets & connections.(04 hrs) 250. Connect battery & load to Inverter & test on battery mode. (04 hrs) 251. Open Top cover of Inverter & identify isolator transformer &inverter transformer. (04 hrs) 252. Identify various circuit boards in Inverter and monitor voltages at various test points. (04 hrs) 253. Make load test to	Inverter – their principle & operation, power rating, change over period. Installation of Inverters, Protection circuits used in inverters– battery level, over load, over charging etc. Various faults and its rectification. Three phase inverter circuits– principle and working. Installation of single phase & three phase Inverter.

		measure backup time. (04 hrs)	
		254. Test Inverter under faulty condition & rectify fault. (08 hrs)	
		255. Perform all above experiments for three phase Inverter. (04 hrs)	
		256. Measure battery current when inverter is working on Battery Mode & measure load current. (06 hrs)	
72-73	• Detect the faults and troubleshoot Power supplies, SMPS, UPS and inverter.	**UPS** 257. Identify front panel control & indicators of UPS. (04 hrs) 258. Identify & understand the use of back panel sockets & connections. (06 hrs) 259. Connect Battery & load to UPS & test on battery mode. (06 hrs) 260. Measure whether battery current UPS is working on Battery Mode & measure load current. (04 hrs) 261. Open Top cover of UPS & identify isolator transformer & UPS transformer & additional circuit other than an inverter. (10 hrs) 262. Identify various circuit boards in UPS and monitor voltages at various test points. (05hrs) 263. Perform a load test to measure backup time. (05 hrs) 264. Test UPS under faulty condition & rectify fault. (05 hrs) 265. Perform all above	Concept of UPS, Difference between Inverters and UPS. Basic block diagram of UPS & operating principle, explanation of rectifier, battery, inverter, static transfer switch. Types of UPS: Offline UPS, Online UPS, Line interactive UPS & their comparison UPS specifications. Load power factor & types of indications & protections UPS circuit description and working- controlling circuits, Microcontroller circuits, power circuits, charging circuits, alarm circuits, Indicator circuits. Three phase UPS Circuits. Installation of single phase & three phase UPS

		experiments for three phase UPS. (05 hrs)	
74	• Prepare fiber-optic setup and execute transmission and reception.	**Fiber optic** 266. Demonstrate the use of the fiber-optic trainer kit. (03 hrs) 267. Make optical fiber setup to transmit and receive analog and digital data. (04 hrs) 268. Demonstrate FM modulation and demodulation using the OFC trainer kit using audio signal and voice link.(06 hrs) 269. Demonstrate PWM modulation and demodulation using the OFC trainer kit using audio signal and voice link. (06 hrs) 270. Demonstrate PPM modulation and demodulation using the OFC trainer kit using audio signal and voice link. (06 hrs)	Introduction to optical fiber as a transmission Media, its advantages over other media, properties of optic-fiber, testing, losses, types of fiber-optic cables and specifications. Encoding of light. Fiber optic joints, splicing, testing and the related equipments/measuring tools, precautions to be taken laying of cables, safety aspects while handling optical cables.
75-76	• Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications.	Make simple project applications using ICs, transformer and other discrete components. a) Speed control of Motor/Fan. b) Electronic code lock. c) Programmable musical bell. d) Three phase uncontrolled rectifier using SCR. e) Single phase controlled rectifier using SCR. f) LCD display module with decoder/driver ICs.	Discussion on the identified projects with respect to data of the concerned ICs, components used in the project.

		(The instructor will pick up any five of the project for implementation)	
77	Revision		
78	Examination		

	SYLLABUS FOR TECHNICIAN POWER ELECTRONICS SYSTEMS TRADE		
	FOURTH SEMESTER – 06 MONTHS		
Week No.	Learning Outcome Reference	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
79-81	• Install a solar panel, execute tests and evaluate performance by connecting the panel to the inverter.	**Solar Inverter** 271. Connect and test solar panel to the Inverter and run the load. (05 hrs) 272. Mount a solar panel to a roof. (1 0hrs) 273. Wire a solar panel to a solar controller.(10 hrs) 274. Wire a solar controller to a battery storage station. (10 hrs) 275. Connect storage batteries to a power inverter. (10 hrs) 276. Wire a power inverter to an electrical service panel. (05 hrs) 277. Test circuits for voltages. (05 hrs) 278. Installation of Solar Inverter. (05 hrs) 279. Take the trainees to the nearest solar power installation and demonstrate various aspects to cover skills as specified above. (15 hrs)	Need for renewable energy sources, Solar energy as a renewable resource. Materials used in solar cells. Principles of conversion of solar light into electricity. Basics of photovoltaic cell. Types of solar cells. Mono crystalline and poly crystalline PV cells. Define components like Solar 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. Define solar charge controller or regulator and its role. Safety precautions while working with solar systems.
82-83	• Execute the operation of the different process sensor, identify, wire & test various sensors of different industrial processes by selecting	**Sensor** 280. Identify & test different sensors such as RTDs, thermocouples, proximity sensors, inductive, capacitive& photoelectric), load cells, strain gauge & LVDT, Hall	Basics of passive and active transducers – Role, selection and characteristics. Working principles of RTD, Thermocouple, LVDT, Strain gauge, Proximity sensor, Hall Sensor, Tacho-generator,

appropriate test instruments. • Assemble, test & troubleshoot various digital controlled of field devices and execute the result.	sensor, Tacho-generator. (10 hrs) 281. Test the functionality of all the sensors mentioned above using the trainer kit. (05 hrs) 282. Refer the data chart & record various parameter ranges in respect of the sensors mentioned above. (10 hrs) **Digital control of field devices Input Devices to develop START (Logic 1) and STOP (Logic 0) pulses** 283. Develop AC – DC SIGNAL CONVERTER using push to ON switch, centre tapped transformer type full wave rectifier, filter and a pot to get Logic 1 (+5V); (START pulse) view pulse on an oscilloscope. (05 hrs) 284. Develop AC – DC SIGNAL CONVERTER using push to ON switch, bridge type full wave rectifier working on 24 V AC, filter, pot, 12V DC reed relay and separate stabilized + 5V supply to get Logic 1; (START pulse) view pulse on an oscilloscope. (05hrs) 285. Develop AC – DC SIGNAL CONVERTER using push to OFF switch, center tapped transformer type full wave rectifier, filter and a pot to get Logic 0 (0V); (STOP pulse) view pulse on an oscilloscope. (05hrs) 286. Develop AC – DC SIGNAL	optical sensors. Sensor voltage and current formats. Digital/ logical/on-off control of electrical machines and other actuators. Industrial control system: electro-magnetic control, static control; comparison; general block diagram; Information gathering section in the input section, Decision making section or logic section and Actuating device section or output section; advantages and disadvantages of static control over magnetic relay control; input devices for solid state logic contact bounce problem; Capacitive Switch Filters

		CONVERTER using push to OFF switch, bridge type full wave rectifier working on 24 V AC, filter, pot, 12V DC reed relay and separate stabilized + 5V supply to get Logic 0 (0V); (STOP pulse) view pulse on an oscilloscope. (05hrs) 287. Develop AC – DC SIGNAL CONVERTER – using Optocoupler method, push to ON switch, bridge type full wave rectifier working on 24 V AC, filter, pot, optocoupler or LDR & Lamp source and separate stabilized + 5V supply to develop START pulse. (05 hrs)	
84-86	• Perform speed control of DC machine and single phase and 3-phase AC machines.	**Electrical control of AC/DC machines** 288. Identify (unmarked) terminals of 3 phase induction motors. (04 hrs) 289. Construct a self hold contactor circuit and run a 3-Phase Induction Motor (4hrs) 290. Familiarize with different types of motor and identify the different parts. (04hrs) 291. Study & connect the motor and run (below 5hp) in star, note phase Voltage, line voltage and current. Study and connect and run the motor in Delta and note phase current line current. Phase voltage and line voltage.(07 hrs) 292. Connect and operate an	Fundamentals of AC 3 phase & single phase Induction motors, synchronous speed, slip, rotor frequency, torque – speed characteristics, Starters used for Induction motors, speed control of Induction motors Types of motors: Advantages &disadvantages among each other. DC Motors– types, working, torque speed characteristics, staring of DC Motors & change the DOR, 3 point and 4 point Starters, speed control of DC motor, Field flux control & armature current control. Brushless DC Motors.

		induction motor using DOL starter.(04 hrs)	
		293. Connect and run a 3-phase motor using manual and automatic star-delta starters.(04hrs)	
		294. Change the direction of rotation of Induction motor. (04 hrs)	
		295. Connect & run three phase induction motors in a sequence using contactor & relay. (04 hrs)	
		296. Construct, run, stop and jog in both directions of an induction motor. (04 hrs)	
		297. Understand all the information on a Motor template. (04 hrs)	
		298. Familiarize with different types of DC motors. (04 hrs)	
		299. Connect & run DC shunt motor using 3 point starter. (04 hrs)	
		300. Change the direction of rotation of DC motor. (04 hrs)	
		301. Control the speed of DC motor by armature control method. (04 hrs)	
		302. Control the speed of DC motor by the field control method. (04 hrs)	
		303. Construct the circuit for speed control of DC shunt motor (phase control method). (04 hrs)	
		304. Construct the PWM circuit for the speed control of DC shunt motors. (04 hrs)	
		305. Control the speed of DC shunt motor using SCR	

		chopper by using a trainer. (05 hrs)	
87-89	• Install, configure and demonstrate the AC and DC drive to control the speed.	**AC Drives** 306. Study the AC Drive set up and its connections. (05 hrs) 307. Identify different cables and connectors used in the AC DRIVE setup. (05 hrs) 308. Identify various input and output terminals of the DRIVE unit, Operator panel and display unit.(05 hrs) 309. Familiarization with PMU & different terminals of Micro – Master AC Drive.(05 hrs) 310. Demonstration – Access parameter number & values. (05 hrs) 311. Familiarization with parameters. (05 hrs) 312. Parameter values for various operations. (05 hrs) 313. Commissioning parameter numbers and values. (05hrs) 314. Installation of AC Drive(similar to SIEMENS MM-420/440).(05hrs) 315. Familiarization with: Commissioning & Quick Commissioning(similar to SIEMENS MM-420/440). (05 hrs) 316. Reset to default values/ Factory setting values. (05 hrs) 317. MM Drive Programming/Parameteri zation for different	Block diagram of AC Drive – (Sources of supply – Converter/Rectifier – DC Link – Inverter –Motor Load) 1 phase & 3 phase rectifier circuits. Inverter – 1 phase Inverter 3 phase Inverter Switching circuit (Sequence and Switching timing control – PWM Technique & Switching Devices. Microprocessor/ Microcontroller) - VFD (Variable Frequency Drive) VVVF Control – (3 phase induction motor) Speed control. Introduction of PID controller. Installation of AC Drive/ Siemens Micro master Drive – MM-420/440 Commissioning/ Quick Commissioning of MM – 420/440 Micro – Master Drive – Programming (Parameterization)

		control operations. (10 hrs) 318. ON/OFF, Forward/ Reverse, Jog (R)/Jog (L), braking and speed control. (10 hrs)	
90-91	• Install, configure and demonstrate the AC and DC drive to control the speed.	**DC Drives** 319. Familiarization with different parts and terminals of DC Drive. (08 hrs) 320. Familiarization with parameters and operation for accessing parameter number and values. (08 hrs) 321. Start up procedure demonstration. (08 hrs) 322. Parameterization for variation of motor speed through POT with Armature voltage feedback (with internal setting). (08hrs) 323. Parameterization – Control drive through POT with encoder feedback (with internal setting). (10hrs) 324. Parameterization – Control the drive speed through external speed raise/ lower buttons. (08hrs)	Tacho-generator/Encoder technical data Related to DC drive. Block diagram of DC Drive. Converter bank – Gate Trigger set circuit. Hardware description of DC Drive. Description of 6RA70 Siemens (or similar) master drive. Start up procedure (Quick Commissioning) Terminal Diagram of 6RA70 DC Drive Function of 6RA70. BICO Technology. Parameterization of DC Drive – 6RA70 – BICO Parameterization
92-93	• Perform speed control of servo motors and test different industrial process circuit by selecting the suitable function.	**Servo Motor** 325. Construct a simple circuit to control servo motor using IC 555.(10 hrs) 326. Connect servo motor with drive & control its parameters. (10 hrs) 327. Connect the servo motor to computer for	Servo mechanism, Servo motor principal, Difference between motors & servo motor. Types of servo motor, AC & DC - brushless servo motor &permanent magnet servo motor construction & application.

		monitoring & controlling of various parameters. (10 hrs) 328. Parameter programming of servo motor. (10 hrs) 329. Various control method for controlling velocity & torque. (10 hrs)	Control method for servo motor. Study of servo drive.
94-95	• Install, test & control, the Electro Pneumatic actuators using various pneumatic valves.	**Electronic Pneumatics** 330. Identify different pneumatic and electro pneumatic components. (04hrs) 331. Construct and control a single acting cylinder. (04hrs) 332. Construct and control a double acting cylinder. (04hrs) 333. Construct and control single/double acting cylinder using series/ parallel circuits. (04hrs) 334. Construct and perform bidirectional control of a cylinder.(06hrs) 335. Construct and control, automatic return of a double acting cylinder. (06hrs) 336. Construct and control the oscillating motion of a double acting cylinder. (04 hrs) 337. Construct and control a latching circuit using single or double acting cylinder. (04 hrs) 338. Construct and control, automatic return initiated by a limit switch. (04 hrs) 339. Throttle a cylinder to adjust forward and	Introduction to pneumatic power source and measure of compressed air, storage and transmission of compressed air, applications of pneumatics in the industries. Symbols of different pneumatic and electro-pneumatic components. Various supply elements such as compressors, reservoir, pressure regulating valve, service unit etc. Various input elements such as push button valves, roller lever valves, proximity switches, Air barriers etc. Various pneumatic control elements, processing elements such as directional control valves, shuttle valves, non-return valves, pressure control valves, Timers and sequencers etc. Function and application of solenoid valves. Limit switches, memory valves, pressure dependent valves and time dependent valves.

		return strokes. (06 hrs)	
		340. Adjust the pressure as per the requirements. (04 hrs)	
96-99	• Execute the operation of different indication on PLC modules and wire different field devices of PLC and configure the system and perform the suitable function.	**PLC** 341. Identify various indicators on PLC Modules and interpret.(15hrs) 342. Wire in various digital input and output devices to the respective modules. (10 hrs) 343. Wire analog input and output devices to the respective modules. (10hrs) 344. Connect and configure PLC hardware and the software. (15 hrs) 345. Develop and run simple programs to read sensor status and to control various outputs. (15 hrs) 346. Force input and output devices using the software. (15 hrs) 347. Perform online editing of a rung/network. (10hrs) 348. Prepare data tables and monitor. (10hrs)	Evolution of control technology. Advantages of PLCs Modular architecture of PLCs, working principle of PLCs. Various modules and addressing Wiring of field devices to various modules, interpretation of indications on CPU and other modules Specification of PLC Modules Implementation of relays, timers and counters using PLCs
100-102	• Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications.	Make simple project applications using ICs, transformer and other discrete components. a) Smoke detector. b) Water level sensor. c) Run a three phase motor using manual and automatic star-delta starters. d) Solar power inverter. e) Control single/double acting cylinder using series/parallel circuit.	Discussion on the identified projects with respect to data of the concerned ICs, components used in the project.