

7. TRADE SYLLABUS

SYLLABUS FOR INSTRUMENT MECHANIC TRADE			
FIRST YEAR			
Duration	Reference Learning Outcome	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
Professional Skill 90 Hrs. Professional Knowledge 16 Hrs.	Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check dimensional accuracy using precision instruments following safety precaution. <i>[Basic fitting operation – marking, Hacksawing, Chiseling, Filing, Drilling, Taping and Grinding etc. Accuracy: ± 0.5mm]</i> CSC/N0304	<ol style="list-style-type: none"> 1. Importance of trade training, List of tools & Machinery used in the trade. (01 Hr.) 2. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE). (05 Hrs.) 3. First Aid Method and basic training. (03 Hrs.) 4. Safe disposal of waste materials like cotton waste, metal chips/burrs etc. (03 Hrs.) 5. Safety signs for Danger, Warning, caution & personal safety message. (03 Hrs.) 6. Preventive measures for electrical accidents & steps to be taken in such accidents. (04 Hrs.) 7. Use of Fire extinguishers. (03 Hrs.) 8. Practice and understand precautions to be followed 	Organization of the Institute, Departments various trades & functions. Types of work, responsibility to be undertaken, incentives and future planning of profession. Safely precautions to be observed in the trade both during 'theoretical Periods' and 'Practical hours/workshop hours' Elementary First Aid. Safety and hazards. Sign boards and types. Hazardous and non-hazardous. Environmental pollution related to the trade-caused, consequences, mitigation and control. (06 Hrs.)

		<p>while working in fitting jobs. (05 Hrs.)</p> <p>9. Safe use of tools and equipments used in the trade. (05 Hrs.)</p>	
		<p>10. Demonstration and uses of hand tools- screwdrivers, pliers, spanners, tweezers, tester, wire stripper, electrician knife, steel rule, scribe, punches, hammer. (06 Hrs.)</p> <p>11. Visual inspection of raw material for rusting, scaling, corrosion etc. (05 Hrs.)</p> <p>12. Filing- flat & square (Rough finish). (05 Hrs.)</p> <p>13. Filing practice, surface filing, side and checking 90° by try square. (05 Hrs.)</p> <p>14. Marking out lines, filling and saving use of vice to given dimensions. (05 Hrs.)</p> <p>15. Filing- Flat, square and Parallel to an accuracy of 0.5mm. (05 Hrs.)</p> <p>16. Measurement of Length, Height & Diameter by Vernier callipers and Micrometers. (05 Hrs.)</p>	<p>Basic hand tools, types, classification use & metal cutting fundamentals.</p> <p>Filing- Flat, square and Parallel to an accuracy of 0.5mm.</p> <p>Measurement & measuring instruments, Marking tools, Fasteners & Fastening devices. (05 Hrs.)</p>
		<p>26. Select drill bits, reamers and tapes. (02 Hrs.)</p> <p>27. Drill through holes and blind holes. (10 Hrs.)</p> <p>28. Form external thread with dies to standard size. (10 Hrs.)</p>	<p>Precision Measuring Instruments, gauge blocks, sine bar, dial indicators, vernier calipers, micrometers, bevel protractor, thickness gauges.</p> <p>Element & types of screw threads used in instruments, Calculation of drill size for tapping. (05 Hrs.)</p>

<p>Professional Skill 25 Hrs.</p> <p>Professional Knowledge 04 Hrs.</p>	<p>Apply a range of skills to execute tube joints, dismantle and assemble tubes and fittings of PI arc & ferrule and test for leakage. [range of skills- cutting, threading, flaring, bending and joining]</p> <p>ELE/N9410</p>	<p>29. Flaring of tube and tube joints. (06 Hrs.)</p> <p>30. Cutting and threading of tube length. (06 Hrs.)</p> <p>31. Fitting of tube and per sketch observing conditions used for tube work. (06 Hrs.)</p> <p>32. Fit and assemble tubes, PI arc and ferrule fittings. (07 Hrs.)</p>	<p>Types of tubes used for instrumentation. Tube cutter, Flaring tools, swedging tools, equipment's & fixture required for pipe bending, straightening, thread cutting, method of installation.</p> <p>(04 Hrs.)</p>
<p>Professional Skill 20 Hrs.</p> <p>Professional Knowledge 05 Hrs.</p>	<p>Identify, test the cable and measure the electrical parameters.</p> <p>ELE/N9411</p>	<p>33. Construct a test lamp and use it to check mains healthiness. (02 Hrs.)</p> <p>34. Measure the voltage between phase and ground and rectify earthing. (03 Hrs.)</p> <p>35. Prepare terminations, skin the electrical wires /cables using wire stripper and cutter. (03 Hrs.)</p> <p>36. Measure the gauge of the wire using SWG and outside micrometre. (03 Hrs.)</p> <p>37. Refer table and find current carrying capacity of wires. (03 Hrs.)</p> <p>38. Measure AC and DC voltages using multi meter. (03 Hrs.)</p> <p>39. Use the multi meter to measure the various functions (AC V, DC V, DC I, AC I, R). (03 Hrs.)</p>	<p>Electrical components- conductor, semiconductor & insulators. Standard wire gauge (SWG). Introduction of electricity- static electricity. Current, voltage, P.D, E.M.F, resistance. Electrical circuit - D.C & A.C circuit differences. Importance of grounding.</p> <p>(05 Hrs.)</p>
<p>Professional Skill 20 Hrs.</p> <p>Professional Knowledge 05 Hrs.</p>	<p>Test various electrical passive and active components using proper measuring instruments and</p>	<p>40. Measure the resistor value by colour code and verify the same by measuring with multi-meter. (02 Hrs.)</p> <p>41. Practice soldering on IC bases and PCBs. (03 Hrs.)</p>	<p>Uses of multimeter. Resistor, Resistivity and colour code, Types of resistors used in instrumentation. Definition and purpose of soldering and desoldering. Soft soldering.</p>

	<p>compare the data using standard parameter. ELE/N9412</p>	<p>42. Practice de-soldering using pump and wick. (02 Hrs.) 43. Join the broken PCB track and test. (02 Hrs.) 44. Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources. (03 Hrs.) 45. Measurement of current and voltage in electrical circuits to verify Kirchhoff's Law. (02 Hrs.) 46. Verify laws of series and parallel circuits with voltage source in different combinations. (02 Hrs.) 47. Measure the resistance, Voltage, Current through series and parallel connected networks using multi meter. (02 Hrs.) 48. Measure and test the voltages of the given cells/battery using analog/digital multi-meter. (02 Hrs.)</p>	<p>Types of soldering irons. Solder & flux. Care & precaution of soldering. De-soldering tools and method of use. Ohm's law & Kirchhoff's laws. Series & parallel circuits. Primary & secondary cells and batteries. {Liquid & dry). Maintenance free batteries construction-charging, efficiency-use, advantage. (05 Hrs.)</p>
<p>Professional Skill 20 Hrs. Professional Knowledge 04 Hrs.</p>	<p>Identify, test and use of various types of switches, E.M. relays, Circuit breaker and construct electrical circuits. ELE/N9413</p>	<p>49. Dismantle and identify the different parts of a relay. (04 Hrs.) 50. Connect a timer relay in a circuit and test for its working. (04 Hrs.) 51. Connect a contactor in a circuit and test for its working. (04 Hrs.) 52. Construct and test series and parallel resonance circuit. (04</p>	<p>Switches and types. Magnet and magnetism, magnetic properties. Magnetic campus and its uses. Explanation of Electro-magnetism, Advantages, disadvantages-application-types E.M. relays. (04 Hrs.)</p>

		Hrs.) 53. Make a panel board using different types of switches for a given application. (04 Hrs.)	
Professional Skill 20 Hrs. Professional Knowledge 04 Hrs.	Estimate, Assemble, install and test wiring system. PSS/N6001	54. Practice cutting, threading of different sizes & laying Installations. (05 Hrs.) 55. Draw layouts and practice in PVC Casing-capping, Conduit wiring with minimum to a greater number of points of minimum 15 mtrs. (05 Hrs.) length. (05 Hrs.) 56. Wire up PVC conduit wiring to control one lamp from two different places. (05 Hrs.) 57. Draw layouts and practice Wiring for instrument panel. (05 Hrs.)	Principles of alternating current, A.C & DC electricity, types of wave forms, time period and frequency, peak to peak values, RMS values, Average values. (04 Hrs.)
Professional Skill 20 Hrs. Professional Knowledge 04 Hrs.	Test various electrical passive and active components using proper measuring instruments and compare the data using standard parameter. ELE/N9412	58. Measure the inductor value by written/colour code and verify the same by measuring with LCR meter. (10 Hrs.) 59. Measure charge, energy store of capacitor in series and parallel circuits with voltage source in different combination. (10 Hrs.)	Inductor and Inductance, types of inductors, Factors affecting the value of inductance, self-inductance (L), Capacitance, types of capacitor, unit of capacitance, factors affecting the value of capacitors, charge, energy stored in capacitors. Capacitors in series and parallel. Capacitors in DC circuit. (04 Hrs.)
Professional Skill 20 Hrs. Professional Knowledge 05 Hrs.	Verify characteristics of resonance circuits. ELE/N9413	60. Measure capacitive and inductive reactance with increase/decrease the input frequency of the circuit. (05 Hrs.) 61. Measure current & voltage and determine the characteristics of RL, RC and	A.C.-impedance, Inductive reactance, capacitive reactance. AC current through - R, L, C circuits. Resonance in RLC circuit. Importance - of series and parallel resonance. (05 Hrs.)

		<p>RLC in AC series circuits. (05 Hrs.)</p> <p>62. Measure the resonance frequency in AC series circuit and determine its effect on the circuit. (05 Hrs.)</p> <p>63. Measure current & voltage and determine the characteristics of RL, RC and RLC in AC parallel circuits. (05 Hrs.)</p>	
<p>Professional Skill 46 Hrs.</p> <p>Professional Knowledge 10 Hrs.</p>	<p>Plan, execute commissioning, testing and evaluate performance of AC & DC motors and generators. ELE/N9402</p>	<p>64. Start, run and reverse the direction of rotation of single-phase AC motors. (07 Hrs.)</p> <p>65. Practice on speed control of single-phase AC motors. (06 Hrs.)</p> <p>66. Install, connect and determine performance of single-phase DC motors. (07 Hrs.)</p> <p>67. Start, run and reverse the direction of rotation of single-phase DC motors. (06 Hrs.)</p> <p>68. Install an alternator, identify parts and terminals of alternator. (07 Hrs.)</p> <p>69. Perform speed control of DC motors - field and armature control method. (06 Hrs.)</p> <p>70. Connect, start and run three phase induction motors by using DOL, star-delta and auto-transformer starters. (07 Hrs.)</p>	<p>Introduction of AC and DC generators working principles, construction.</p> <p>Operation, field magnets, armature windings, commutator and brushes, EMF equation. Faraday's Law, Lenz's Law, Fleming's left Hand and right-hand rules. DC motors working principles, construction, operation, types. Different speed controlling techniques of DC motors. AC motors, induction motors, three phase motors, stepper motors. (10 Hrs.)</p>
<p>Professional Skill 20 Hrs.</p> <p>Professional</p>	<p>Execute testing, evaluate performance and maintenance of</p>	<p>71. Perform OC and SC test to determine and efficiency of single-phase transformer. (05 Hrs.)</p>	<p>Transformer, types, transformation ratio. Open circuit test and short circuit test, regulation Auto</p>

<p>Knowledge 05 Hrs.</p>	<p>transformer. PSS/N2406, PSS/N2407</p>	<p>72. Determine voltage regulation of single-phase transformer at different loads and power factors. (05 Hrs.) 73. Verify and measure voltage regulation of auto transformer at different loads. (05 Hrs.) 74. Perform series and parallel operation of two single phase transformers. (05 Hrs.)</p>	<p>transformer. Current measurement. Instrument transformer. Potential transformer and current transformer. (05 Hrs.)</p>
<p>Professional Skill 40 Hrs. Professional Knowledge 06 Hrs.</p>	<p><i>Plan, select, and carry out measurement, extension of range, overhauling, testing and calibration of 'D' Arsonval meter, PMMC meter.</i> ELE/N9414</p>	<p>75. Overhaul, check, fault find, repair, test of voltmeter and ammeter. (07 Hrs.) 76. Study the construction circuit operation and adjustment for correct functioning of zero errors on voltmeter and ammeter. (06 Hrs.) 77. Find the minimum and maximum measurable range of the meter. (07 Hrs.) 78. Test the shunt and series resistance of various range of ammeter. (07 Hrs.) 79. Practice multipliers for different range extension of voltmeter and ammeter. (07 Hrs.)</p>	<p>Basics of electrical measuring instruments- Types - absolute and secondary instruments. Types of secondary instruments, DC instruments - 'D¹ Arsonval meter, PMMC meter- working principle, method of working, moving coil operation. (FSD) full scale deflection reading, measurement value, meter sensitivity, accuracy. Meter resistance, maximum power, capability etc. Meter range extension- Converting galvanometer into ammeter, voltmeter. Range extension of voltmeter, ammeter. Shunt resistance and series resistance value calculation. Meter resistance, meter FSD identification techniques. (06 Hrs.)</p>
<p>Professional Skill 60 Hrs.</p>	<p>Select, perform electrical/electronic</p>	<p>80. Prepare plate earthing and measure earth resistance</p>	<p>Ohm meters- measuring electrical resistance. Basic</p>

<p>Professional Knowledge 10 Hrs.</p>	<p>measurement, earthing installation service and calibrate MI instruments, electro dynamometer instruments, Induction type and Special instruments- voltage tester, continuity tester, rotation tester, phase sequence indicator, synchronising, synchronoscope, frequency meter, thermocouple type ammeter. ELE/N9415</p>	<p>by earth tester / megger. (05 Hrs.)</p> <p>81. Test earth leakage by ELCB and relay. (05 Hrs.)</p> <p>82. Measure the power using wattmeter. (05 Hrs.)</p> <p>83. Test and calibrate wattmeter. (05 Hrs.)</p> <p>84. Familiar with the construction of energy meter and ampere hour meter. (03 Hrs.)</p> <p>85. Overhaul, check and fault find of ampere hour meter. (05 Hrs.)</p> <p>86. Test and calibrate ampere hour meter. (05 Hrs.)</p> <p>87. Measure power in single and three phase circuit using voltmeter & ammeter. (05 Hrs.)</p> <p>88. Overhaul and maintenance of KWH meter and energy meter. (05 Hrs.)</p> <p>89. Test and calibrate KWH meter and energy meter. (05 Hrs.)</p> <p>90. Measure power factor in three phase circuit by using power factor meter and verify the same with voltmeter, ammeter and wattmeter readings. (05 Hrs.)</p> <p>91. Practice of use voltage tester to Test electrical power in circuit, to test for proper grounding, to determine whether</p>	<p>construction of Ohm meter, working method of ohmmeter. Types of Ohm meter - series and shunt type of ohm meters. Megger/insulation tester, earth tester - construction working advantages and disadvantages of various types of ohm meter. AC instruments - types of AC measuring instruments -MI, electro dynamometer type, Working principle, construction, advantages and disadvantages of MI instruments and electro dynamometer instruments. Various applications.</p> <p>Induction type meters - working principle construction and operation of induction type instruments. Construction and Applications - single phase and three phase energy meter, watt meter. Walt hour meter, Ampere Hour meter, power factor meter etc.</p> <p>Special instruments: voltage tester, continuity tester, rotation test, phase sequence indicator, synchronizing, the synchroscope, _ frequency meter. Thermocouple type ammeters. (10 hrs.)</p>
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<p>Professional Skill 80 Hrs.</p> <p>Professional Knowledge 16 Hrs.</p>	<p>Identify, Test various analog and power electronics components, Construct, test and analyze the circuit functioning. ELE/N9404</p>	<p>93. Test the power diode, Zener diode, tunnel diode, photo diode using multi meter and determine forward to reverse resistance ratio. (05 Hrs.)</p> <p>94. Determine V-I characteristics of semiconductor diode. (05 Hrs.)</p> <p>95. Measure the voltage and current through a diode in a circuit and verify its forward characteristic. (05 Hrs.)</p> <p>96. Measure the voltage and current through a Zener diode in a circuit and verify its forward and reverse characteristic. (05 Hrs.)</p> <p>97. Construct and test fixed-bias, emitter-bias and voltage divider-bias transistor amplifier. (05 Hrs.)</p> <p>98. Construct and Test a common emitter amplifier with and without bypass capacitors</p> <p>99. Construct a single stage amplifier and measure current gain, voltage gain & power gain. (05 Hrs.)</p>	<p>Semiconductor, Covalent bond, Doping, Intrinsic and extrinsic semiconductor. PN junction diode, Forward and Reverse characteristics. Specification of diodes (data sheets). Applications of diode. Special semiconductor diode-Zener diode, tunnel diode, Photo diode.</p> <p>Transistors. Defining transistors, NPN& PNP transistor, Symbol, operation, Biasing of Transistor & mode of Application. Transistor CB, CC, CE Amplification, current gain, voltage gain, and power gain. Introduction to FET, MOSFET.</p> <p>Rectifiers: half wave rectifier, full wave (bridge & center tapped) rectifier. Voltage multipliers. Filters: Introduction, purpose and use of ripple filter. Types of filters. Capacitance filter, inductance filters, RC filters, LC filters, voltage dividers and bypass filters.</p> <p>Voltage regulators. Introduction & purpose Zener regulators, shunt regulators,</p>

		<p>100. Construct and test a FET Amplifier. (04 Hrs.)</p> <p>101. Construct and test a half wave, full wave and Bridge rectifier circuit. (05 Hrs.)</p> <p>102. Construct and test different filter circuit used in rectifier and measure output voltage with load. (05 Hrs.)</p> <p>103. Construct and test Zener based voltage regulator circuit. (03 Hrs.)</p> <p>104. Construct and test Zener and transistor-based series regulator. (03 Hrs.)</p> <p>105. Construct and test a +12V fixed voltage regulator. (05 Hrs.)</p> <p>106. Construct and test a fixed +15ve and –15ve voltage regulator using ICs. (05 Hrs.)</p> <p>107. Construct and test a 1. (05 Hrs.)2V – 30V variable output regulated power supply using IC LM317T and its characteristics. (05 Hrs.)</p>	<p>series regulators, IC regulators, variable regulators. (16 hrs.)</p>
<p>Professional Skill 20 Hrs.</p> <p>Professional Knowledge 04 Hrs.</p>	<p>Detect the faults and troubleshoot SMPS, UPS, inverter, converter and Thyristor family. ELE/N7202</p>	<p>179. List the defect and symptom in the faulty SMPS. (02 Hrs.)</p> <p>180. Measure / Monitor major test points of computer SMPS. (02 Hrs.)</p> <p>181. 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. (05 Hrs.)</p>	<p>Power Supply units. Introduction, purpose & use. UPS and SMPS, inverters and converters and their applications. (04 Hrs.)</p>

		<p>182. Open top cover of a UPS; identify its isolator transformers, the UPS transformer and various circuit boards in UPS. (03 Hrs.)</p> <p>183. Perform load test to measure backup time. (03 Hrs.)</p> <p>184. Install and test an inverter. (02 Hrs.)</p> <p>185. Troubleshoot the fault in the given inverter unit. Rectify the defects and verify the output with load. (03 Hrs.)</p>	
<p>Professional Skill 20 Hrs.</p> <p>Professional Knowledge 04 Hrs.</p>	<p>Identify, place, solder and desolder and test different SMD, discrete components with due care and following safety norms using proper tools/setup. ELE/N5102</p>	<p>186. Measure and plot input and output characteristics of a CE amplifier. (05 Hrs.)</p> <p>187. Check for cold continuity of PCB. (03 Hrs.)</p> <p>188. Solder the SMD components from the given PCB. (04 Hrs.)</p> <p>189. De-solder the SMD components in the same PCB. (04 Hrs.)</p> <p>190. Repair solder mask and damage pad. (04 Hrs.)</p>	<p>General characteristics of an amplifier, Concept of amplification.</p> <p>PCB basic construction, applications. Lay outting circuit on PCB. (04 Hrs.)</p>
<p>Professional Skill 20 Hrs.</p> <p>Professional Knowledge 05 Hrs.</p>	<p>Identify, Test various analog and power electronics components, Construct, test and analyze the circuit functioning. ELE/N9407</p>	<p>Oscillators</p> <p>191. Demonstrate Colpitts oscillator, Hartley oscillator circuits and compare the output frequency of the oscillator by CRO. (08 Hrs.)</p> <p>192. Construct and test a RC phase shift oscillator circuits. (06 Hrs.)</p> <p>193. Construct and test a crystal-</p>	<p>Oscillator's oscillations, oscillation frequency, basic working principle and working of Talk circuit, Crystal controlled oscillators, Phase shift oscillators, RC phase shift oscillators, Colpitt, Clapp, Hartley. (05 Hrs.)</p>

		controlled oscillator circuit. (06 Hrs.)	
Professional Skill 44 Hrs. Professional Knowledge 10 Hrs.	Construct and test different circuits using operational amplifiers circuits and execute the result. ELE/N9407	<p>194. Use analog IC tester to test the various analog ICs. (07 Hrs.)</p> <p>195. Construct and test various Op-Amp circuits Inverting, Non-inverting and Summing Amplifiers. (05 Hrs.)</p> <p>196. Construct and test Differentiator and Integrator circuits. (05 Hrs.)</p> <p>197. Construct and test a voltage to current and current to voltage converter circuit using Op-amp. (05 Hrs.)</p> <p>198. Construct and test Instrumentation amplifier. (04 Hrs.)</p> <p>199. Construct and test Astable timer circuit using IC 555. (06 Hrs.)</p> <p>200. Construct and test mono stable timer circuit using IC 555. (06 Hrs.)</p> <p>201. Construct and test 555 timers as pulse width modulator. (06 Hrs.)</p>	<p>Operational Amplifier. Differential amplifier, ideal op-amp. Op-amp with feedback, advantages of feedback. Inverting and Non inverting and inverting amplifier, Op-amp as summer, differential amplifier. V to I converter and I to V converter, Instrumentation amplifier Basics of op- amp applications - integrator, differentiator, Introduction of timers (555) and its applications. (10 Hrs.)</p>
Professional Skill 125 Hrs. Professional Knowledge 20 Hrs.	Identify, test and Verify all digital ICs. Assemble, test and troubleshoot various digital circuits and digital instruments. ELE/N9405	<p>202. Verify the truth tables of all Logic Gate ICs by connecting switches and LEDs. (05 Hrs.)</p> <p>203. Construct and verify the truth table of all the gates using NAND and NOR gates. (05 Hrs.)</p> <p>204. Use digital IC tester to test the various digital ICs (TTL and CMOS). (05 Hrs.)</p>	<p>Number systems; binary, octal, decimal and hexadecimal number system. Conversion of number systems. Boolean algebra, binary addition, subtraction, multiplication and division. 1's and 2's compliment, BCD code, ASCII code, gray code. Logic Circuits. Basic gates-AND, OR and NOT gates. De-Morgan \s Theorem.</p>

		<p>205. Construct and verify the truth table of all the gates using DTL circuit. (05 Hrs.)</p> <p>206. Construct Half Adder circuit using ICs and verify the truth table. (05 Hrs.)</p> <p>207. Construct Full adder with two Half adder circuit using ICs and verify the truth table. (05 Hrs.)</p> <p>208. Construct Half subtractor and full subtractor circuit using ICs and verify the truth table. (05 Hrs.)</p> <p>209. Construct the adder cum subtractor circuit and verify the result. (05 Hrs.)</p> <p>210. Construct and test R-S flip-flop using IC7400 with clock and without clock pulse. (06 Hrs.)</p> <p>211. Verify the truth tables of JK Flip-Flop using ICs by connecting switches and LEDs. (06 Hrs.)</p> <p>212. Construct and test 7493 as a modulus-12 counter. (06 Hrs.)</p> <p>213. Construct and test seven segment LED display decoder with IC 7447. (06 Hrs.)</p> <p>214. Measure current flowing through a resistor and display it on LED Module. (06 Hrs.)</p>	<p>Universal gates - NAND and NOR gates.</p> <p>Special gates - Ex-OR, Ex -NOR gates and Buffer and its applications. Basic digital ICs, function, digital application, logic symbols.</p> <p>Adders - Half adder, full adder</p> <p>Subtractor - Half subtractor, full subtractor.</p> <p>Flip flops - RS flip flop, clocked RS flip flop, JK flip flop,</p> <p>Basics of Counters and registers. Multiplexer and de--multiplexer.</p> <p>Digital meters: displays: LED, 7 segment display, LCD, CRT, electro- luminescent displays, electro-phoretic image display, liquid vapor display, dot matrix display.</p> <p>(10 Hrs.)</p>
		<p>215. Construct and test Digital to Analog (D/A) Binary Weighted resistor converter</p>	<p>A/D and D/A converters, Introduction, weighted register D / A converter, binary(R-2R)</p>

		<p>by using op-amps. (06 Hrs.)</p> <p>216. Construct and test Digital to Analog (D/A) converter using R-2R ladder network circuit. (06 Hrs.)</p> <p>217. Perform the interfacing of IEEE 488.2 standard with a single controller can control up to 15 different instrument connected star topology. (06 Hrs.)</p> <p>218. Perform the interfacing of RS232 to the PC. (06 Hrs.)</p> <p>219. Convert RS-485 signals to RS-232 signals using RS-485 to RS-232 converter. (06 Hrs.)</p>	<p>ladder D / A converter, specification for D / A converter, Ramp or counter type A/D converter, GPIB (general purpose interface bus) IEEE - 488, RS 232. (06 Hrs.)</p>
		<p>220. Display a word on a two-line LED. (05 Hrs.)</p> <p>221. Measure/current flowing through a sensor and display it on a LED module (DPM). (05 Hrs.)</p> <p>222. Practice on measuring instruments in single and three phase circuits e.g. (05 Hrs.) Phase sequence meter and Frequency meter etc. (05 Hrs.)</p> <p>223. Practice on time measuring instrument to measure the time in different electrical control circuit. (05 Hrs.)</p>	<p>Digital meters: frequency meter, phase measuring meter, and time measuring instruments. Digital capacitance meter. (04 Hrs.)</p>
<p>Professional Skill 20 Hrs.</p> <p>Professional Knowledge 05 Hrs.</p>	<p>Measure the various parameters by CRO and execute the result with standard one. ELE/N9416</p>	<p>224. Measure the Amplitude, Frequency and time period of typical electronic signals using CRO. (10 Hrs.)</p> <p>225. Take a print of a signal from DSO by connecting it</p>	<p>CRO: introduction and applications of CRO, functional block diagram of CRO, CRT power supply. Various types of probes. Applications of various types of CROs like dual beam</p>

		to a printer and tally with applied signal. (10 Hrs.)	CRO, Dual trace CRO, storage oscilloscope. (05 Hrs.)
Professional Skill 70 Hrs.	Install and setup operating system and related software in a computer & Practice with MS office and application software related to instruments. ELE/N9417	226. Practice on windows interface and navigating windows. (07 Hrs.)	Introduction to Computer, Block diagram of PC, software familiarization of Multimedia System consisting of CD ROMS, DVD ROMS, Sound Cards. (05 Hrs.)
Professional Knowledge 10 Hrs.		227. Customize the desktop settings and manage user accounts. (07 Hrs.) 228. View system properties and control panel details. (07 Hrs.) 229. Install necessary application software for windows i.e. office package and media player. (07 Hrs.) 230. Burn data, video and audio files on CD/DVD using application software. (07 Hrs.)	
		231. Dismantle and assemble the desktop computer system. (07 Hrs.) 232. Replace RAM and ROM from CPU. (07 Hrs.) 233. Identify different parts, its function and operation of modem. (07 Hrs.) 234. Install a modem to the computer to send and receive data over a telephone line or a cable or satellite connection. (07 Hrs.) 235. Construct and test DAC and ADC using computer network circuit. (07 Hrs.)	Computer Hardware, Computer systems, computer hardware, CPU, CPU operations, ROMs and RAMs, I/P and O/P and peripheral equipments, terminals, printers, MODEMS, Data interface, ADC and DAC. (05 Hrs.)
Professional Skill 40 Hrs.	Identify various functional blocks of a microprocessor	236. Measure the crystal frequency, connect it to the processor. (10 Hrs.)	Introduction to microprocessor microcomputers, Memories Intel 8085. Architecture

Professional Knowledge 10 Hrs.	system, identify various I/O Ports, write and executive simple program and Interface a model application with the microprocessor kit and run the application. ELE/N9418	237. Use 8085 microprocessor, connect 8 LED to the port, blink the LED with a switch. (10 Hrs.)	Instruction set of 8085, Microprocessor. 1. Data transfer group. 2. Arithmetic group. 3. Logic group. (05 Hrs.)
		238. Perform addition and subtraction of two 8-bit numbers using 8085 microprocessors. (10 Hrs.) 239. Demonstrate entering of simple programs, execute & monitor the results. (10 Hrs.)	Basic Programming of 8085 such as adding, subtraction of two 8-bit numbers, etc. Block diagram and pin' diagram 8255 and its operation. Microprocessor applications. (05 Hrs.)
Engineering Drawing: 40 hrs.			
Professional Knowledge ED-40 Hrs.	Read and apply engineering drawing for different application in the field of work. CSC/N9401	<p><u>ENGINEERING DRAWING:</u></p> <p>Introduction to Engineering Drawing and Drawing Instrument –</p> <ul style="list-style-type: none"> • Conventions • Sizes and layout of drawing sheets • Title Block, its position and content • Drawing Instrument <p>Free hand drawing of –</p> <ul style="list-style-type: none"> • Geometrical figures and blocks with dimension • Transferring measurement from the given object to the free hand sketches. • Free hand drawing of hand tools. <p>Drawing of Geometrical figures:</p> <ul style="list-style-type: none"> • Angle, Triangle, Circle, Rectangle, Square, Parallelogram. • Lettering & Numbering – Single Stroke <p>Symbolic representation –</p> <ul style="list-style-type: none"> • Different Electronic symbols used in the related trades <p>Reading of Electronic Circuit Diagram. Reading of Electronic Layout drawing.</p>	
Workshop Calculation & Science: 38 hrs.			
Professional Knowledge WCS-38 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations.	<p><u>WORKSHOP CALCULATION & SCIENCE:</u></p> <p>Unit, Fractions Classification of unit system Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion. Factors, HCF, LCM and problems. Fractions - Addition, subtraction,</p>	

	<p>Understand and explain basic science in the field of study. CSC/N9402</p>	<p>multiplication & division. Decimal fractions - Addition, subtraction, multiplication & division. Solving problems by using calculator.</p> <p>Square root, Ratio and Proportions, Percentage</p> <p>Square and square root. Simple problems using calculator. Applications of pythagoras theorem and related problems. Ratio and proportion.</p> <p>Ratio and proportion - Direct and indirect proportions Percentage Percentage - Changing percentage to decimal and fraction.</p> <p>Material Science</p> <p>Types metals, types of ferrous and non ferrous metals. Introduction of iron and cast iron.</p> <p>Mass, Weight, Volume and Density</p> <p>Mass, volume, density, weight and specific gravity Related problems for mass, volume, density, weight and specific gravity</p> <p>Speed and Velocity, Work, Power and Energy</p> <p>Speed and velocity - Rest, motion, speed, velocity, difference between speed and velocity, acceleration and retardation Speed and velocity - Related problems on speed & velocity Work, power, energy, HP, IHP, BHP and efficiency</p> <p>Heat & Temperature and Pressure</p> <p>Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals Scales of temperature, celsius, fahrenheit, kelvin and conversion between scales of temperature Heat & Temperature - Temperature measuring instruments, types of thermometer, pyrometer and transmission of heat - Conduction, convection and radiation Concept of pressure - Units of pressure, atmospheric pressure, absolute pressure, gauge pressure and gauges used for measuring pressure</p> <p>Basic Electricity</p> <p>Introduction and uses of electricity, molecule, atom, how electricity is produced, electric current AC,DC their comparison, voltage, resistance and their units Conductor, insulator, types of connections - series and parallel. Ohm's law, relation between V.I.R & related problems. Electrical power, energy and their units, calculation with assignments. Magnetic induction, self and mutual</p>
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<p>Project Work/Industrial Visit (optional)</p> <p>Broad Areas:</p> <ul style="list-style-type: none"> a) Regulated & Unregulated Power Supply b) Battery Monitor & Charger c) Emergency Light d) Electronic Fan Regulator e) SCR, Using UJT Trigger Circuit. f) Dimmer circuit using Triac and Diac. g) Dancing LEDs h) Digital Clock i) Event Counter j) A to D Convertor. 		

SYLLABUS FOR INSTRUMENT MECHANIC TRADE

SECOND YEAR

Duration	Reference Learning Outcome	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
Professional Skill 68 Hrs. Professional Knowledge 18 Hrs.	Identify the parameters of measurement systems. Identify, select, test, wire & Execute the operation of different process sensors by selecting appropriate signal conditioning for stress, strain, load displacement and Thickness. ELE/N9408	240. Finding the range, span and accuracy of instrument (example- ammeter, voltmeter etc. (04 Hrs.) 241. Test the voltmeter/ ammeter using std. voltage/ current source for total range. Check the dead zone, repeatability, reproducibility, drift, Dead band, backlash, hysteresis. (05 Hrs.) 242. Identify the strain gauge type, cantilever or load cell specification. (04 Hrs.) 243. Check the strain gauge using ohm meter / multimeter. (03 Hrs.) 244. Measure the load using strain gauge instrument. [using half (two), quarter(one), full (four) strain gauges on bridge]. (06 Hrs.) 245. Determine the sensitivity,	Scope and necessity of instrumentation. Fundamentals of measurement systems- functional block diagram of measurement system. Calibration and calibration standards– basic standards, secondary standards, working standards. Fundamental units - The metric system, Base& supplementary units, Derived Units, Multiplying factors and standards of length, mass, time & frequency. Temperature & electrical units. Instrument characteristics Static characteristics– accuracy, precision, sensitivity, resolution dead zone, repeatability, reproducibility, drift, Dead band, backlash, hysteresis. Dynamic characteristics– speed response, fidelity, lag. Error,

		<p>liner range of strain gauge measurement. (06 Hrs.)</p> <p>246. Make null balance and gain adjustment. Calibrate strain gauge instrument by adjusting zero and span. (05 Hrs.)</p> <p>247. Identifying the various parts of LVDT. Study the specification of LVDT like range, exciting frequency, voltage, sensitivity etc. (05 Hrs.)</p> <p>248. Identifying the coils in LVDT. Verifying the connection of secondary coils. Testing the LVDT coils using multimeter. (05 Hrs.)</p> <p>249. Verify the LVDT characteristics by changing the displacement. (05 Hrs.)</p> <p>250. Determine the liner range and sensitivity, resolution of LVDT. (05 Hrs.)</p> <p>251. Measure the phase difference of LVDT secondary coils on CRO. (05 Hrs.)</p> <p>252. Calibrate the LVDT by adjusting zero and span. (05 Hrs.)</p> <p>253. Test and calibrate displacement meter, accelerometer and thickness instruments. (05 Hrs.)</p>	<p>deviation, true value, data.</p> <p>Types of errors- systematic, random & illegitimate error. Certainty/uncertainty, validity Of result. Measuring system Response. Introduction, amplitude responses, Phase response, Delay, rise time & slew rate. Damping & its importance.</p> <p>Statistical analysis – arithmetic mean, deviation from the mean average deviation, standard deviation.</p> <p>Stress & Strain Measurement. Introduction to Strain gauges, types of strain gauges and differences. Applications of strain gauges, load cells. LVDT, RVDT, advantages and limitations.</p> <p>(18 hrs.)</p>
Professional Skill 36 Hrs.	Select, Installs, services and calibrate	<p>254. Measure the vibration of motor/ machine. (06 Hrs.)</p> <p>255. Servicing and maintenance</p>	<p>Measurement of motion, velocity / vibrometers and acceleration. Difference</p>

<p>Professional Knowledge 10 Hrs.</p>	<p>instruments for motion, speed, position, acceleration, vibration & record the data. ELE/N9419</p>	<p>vibrometers & accelerometer. (06 Hrs.) 256. Measure the speed of motor. (06 Hrs.) 257. Identify different parts, its function & Operation of eddy current, type AC and DC tachometer. (06 Hrs.) 258. Servicing and maintenance of mechanical and electrical tachometer. (06 Hrs.) 259. Identify different parts/section, its function & Operation and use Stroboscope and find motion of object. (06 Hrs.)</p>	<p>between tachometer and speedometers. Types of tachometers-Eddy current type, AC and DC tachometer. Stroboscope and its applications. seismic instrument. (10 Hrs.)</p>
<p>Professional Skill 120 Hrs. Professional Knowledge 35 Hrs.</p>	<p>Identify different unit of pressure, terms and operation of basic instruments. Perform maintenance, Servicing calibration and installation of field pressure gauges, switches, electronic pressure indicators and transmitters for absolute, atmospheric, gauge, vacuum and differential pressure measurement. ELE/N9420</p>	<p>260. Measure the atmospheric pressure using barometer. (03 Hrs.) 261. Identify specification and construction of each manometer and find their range, scale type, resolution, type of liquid using, tube material, isolation valve types, fitting types and sizes, zero adjustment and spirit bubbler etc. (05 Hrs.) 262. Measure the differential pressure, gauge pressure and vacuum pressure using U tube manometer. (05 Hrs.) 263. Dismantle and assemble the manometer. Cleaning the glass tube, aligning the gravity balances etc. (05 Hrs.)</p>	<p>Principle of Pressure in Liquids & Gases. Properties of matter Principles of liquid pressure, units of pressure Liquids pressure and volume, density and specific gravity. Factors affecting liquid pressure. Pressure relation with volume, temperature and flow. Units of pressure and unit conversions. Types of pressure: absolute, gauge, atmospheric and vacuum pressures and their relationships. Barometers, manometers types and applications. (07 Hrs.)</p>

		<p>264. Dismantle and assemble the pressure gauge (bourdon tube, diaphragm type), Identify the various parts like sensing element, link, liver, pinion gear, hair spring, pointer size shape material, sensor material etc. (06 Hrs.)</p> <p>265. Measurement of gauge pressure and vacuum pressure using bourdon tube / diaphragm gauge. (04 Hrs.)</p> <p>266. Measurement of differential pressure using diaphragm/capsule gauge. (04 Hrs.)</p> <p>267. Identify specifications of pressure switch – range, differential pressure span, contact types, contacts current rating, number of contacts etc. (05 Hrs.)</p> <p>268. Dismantle and assemble the pressure switch – identify the various parts- sensing elements, control spring, pressure and differential pressure adjustment screws, shaft arrangement pivoting, contacts relay operation and change of contacts. Type of material using for various parts etc. (05 Hrs.)</p> <p>269. Connect and operate the pressure switch with load at various pressure and differential pressure</p>	<p>Types of pressure sensing elements-bourdon tube, diaphragms, capsules, and bellows. Eachontypes, shapes, material used for various applications, ranges advantages and limitations. Pressure switches types and applications. (07 Hrs.)</p>
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		settings. Make adjust the errors screws. (05 Hrs.)	
		<p>270. Identify the basic specifications of pressure indicator/ transmitter (electronic) like range, resolution, size of display, type of sensor (symbol), sealed type, number scales, connection type, tap threading size and type- (male, female NPT/SAE), body material, mounting type (back or bottom) etc. (05 Hrs.)</p> <p>271. Test and operating the pressure transmitter with supply, milli ammeter, pressure source (pneumatic/hydraulic). Finding the resolution, accuracy etc. (05 Hrs.)</p> <p>272. Familiar with pressure calibrator controls and settings. (03 Hrs.)</p> <p>273. Calibrating the pressure gauge using standard meter/ pressure calibrator. (05 Hrs.)</p> <p>274. Measuring gauge, vacuum and differential pressure using DP transmitter. (05 Hrs.)</p> <p>275. Calibrating the DP transmitter using standard meter / pressure calibrator. (05 Hrs.)</p>	<p>Electrical pressure transducers. Method of conversion, primary and secondary pressure transducers. Potentiometric pr. Transducers, Capacitive pr. transducers, reluctance-servo pressure transducers, strain gauge pressure transducers, piezo electric pressure transducer. Differentials pressure transducers. (07 Hrs.)</p>
		276. Measuring low pressure/ vacuum using McLeod	Low Pressure Measurement. Vacuum, gauges, thermal

		<p>gauge. (05 Hrs.)</p> <p>277. Test & calibrate of Pressure gauges, indicators, transmitters with Dead weight Tester. (05 Hrs.)</p> <p>278. Test & calibrate of Pressure gauges, indicators, transmitters with comparator Tester. (05 Hrs.)</p>	<p>conductivity gauges, pirani gauges, thermocouple gauges, slack diaphragm. Ionization gauge, McLeod gauge, capacitance manometers. Method of pressure instrument calibration. Dead weight tester and comparators/manifolds. (07 Hrs.)</p>
		<p>279. Installation of pressure gauge in pipeline with safety valve and pig tail /siphon etc. measuring pressure in flow line. (05 Hrs.)</p> <p>280. Installation and testing of pressure switch and pressure relief valve with compressor. (05 Hrs.)</p> <p>281. Installation and testing of pressure switch with solenoid and alarm in process line. (05 Hrs.)</p> <p>282. Fault finding in pressure gauge. (05 Hrs.)</p> <p>283. Simple fault finding in pressure transmitter. (05 Hrs.)</p> <p>284. Fault finding in pressure process line. (05 Hrs.)</p>	<p>Pressure Instrument Installation and Servicing. Elements of pressure transmitters, Installation components, pressure taps, Isolation valve, instrument piping, connections and fittings blow down valve, instrument valve, pulsation damper, diaphragm seal, pressure transmitter, Installation, procedure, locating and mounting, piping, electrical wiring placing into service, guidelines for periodic maintenance, troubles shooting and repair, instrument shop safety. (07 Hrs.)</p>
<p>Professional Skill 88 Hrs.</p> <p>Professional Knowledge 27 Hrs.</p>	<p>Recognize the fundamental of fluid flow, terms, different unit of flow, read specification of flow meters. And fluid pump. Perform the</p>	<p>285. Measurement of pressure in flow line with different flow rates. (04 Hrs.)</p> <p>286. Measurement of flow rate using fixed volume tank. (04 Hrs.)</p> <p>287. Operating fluid pump and observing the pressure at</p>	<p>Properties of Fluid Flow. Basic properties of fluids, fluids in motion, getting fluids to flow, units of flow rate and quantity flow, factors affecting flow rate, Reynolds number, relation between flow rate and pressure, area, quantity.</p>

	<p>maintenance, Servicing and calibration and installation of variable DP flow meters / head flow meters, variable area flow meters, positive displacement meters, Electronic type flow meters and mass flow meters for fluids flow measurement. ELE/N9421</p>	<p>input and output. verifying flow variation by adjusting bypass line. (04 Hrs.)</p> <p>288. Measurement of DP of venturi and orifice using manometer. (04 Hrs.)</p> <p>289. Measurement of DP using DP gauge. (04 Hrs.)</p> <p>290. Adjusting the valves of manifold and observing the changes in DP gauge. (04 Hrs.)</p> <p>291. Calibrating the pneumatic DP transmitter for flow rate measurement. (04 Hrs.)</p> <p>292. Calibration electronic DP transmitter for flow rate. Verifying the square root relation and linear relation of DP. (04 Hrs.)</p> <p>293. Installing a head type flow meter with venturi or orifice, manifold and DP, milli ammeter or indicator, supply. Measuring flow rate in line. (04 Hrs.)</p> <p>294. Calibrating head type flow meter with standard volumetric tank. (04 Hrs.)</p> <p>295. Dismantling, checking, overhauling and calibration of D. (04 Hrs.)P. cell/transmitter. (Pneumatic & electronic). (04 Hrs.)</p> <p>296. Identify and carry out preventive maintenance. (04 Hrs.)</p> <p>297. Study of construction of weirs, notches and flumes</p>	<p>Types of flow meters –head type, variable area type, quantitative flow meters. Mass flow meters. Head type of flow meters: working principle, types-venturi tube, orifice plates and its shapes. Pitot tube, flow nozzles, constructions, tapings, advantages, limitations, applications, materials used for various flows. Types of secondary devices used to measure for flow rates. Open channel flow meters-principle of open channel flow, weirs, notches and flumes. Various shapes and their applications, maintenance, Variable area type flow meter-Rota meter, constructions, working principle, applications. Various shapes of float, type of materials used for body and float. Factors affecting rotameter performance, measuring gas and liquid flow. Positive Displacement. Meters. Advantages and disadvantages of positive displacement meters, piston meter, oscillating piston meter, rotating vane meter, notating disk meter, lobed impeller and oval flow meter, calibrating positive displacement meters. Target flow meters, turbine flow meter, magnetic flow</p>
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		<p>their shape and connections and use. (04 Hrs.)</p> <p>298. Install and testing of Rota meters in flow line. Vertical alignment. (04 Hrs.)</p> <p>299. Measurement of flow rate and calibrating rotameter. (04 Hrs.)</p> <p>300. Dismantle, identify different parts, its function, AND operation of various types of positive displacement meters. (04 Hrs.)</p> <p>301. Installation, testing and calibrating quantitative flow meter. (04 Hrs.)</p> <p>302. Dismantle and assemble quantitative flow meters like Oscillating piston type, Rotating vane meter, Lobed impeller and oval flow meter. (04 Hrs.)</p> <p>303. Identify and carry out preventive maintenance of positive displacement flow meters. (04 Hrs.)</p> <p>304. Installation, testing and calibration of turbine flow meter. (04 Hrs.)</p> <p>305. Installation, testing and calibration of vortex flow meter. (04 Hrs.)</p> <p>306. Installation, testing and calibration of ultrasonic flow meter. (04 Hrs.)</p>	<p>meters, vertex flow meter. Construction, working principle, advantages and disadvantage, applications. Carioles mass flow meter, thermal flow meters and summary basics of ultrasonic flow meters. The Doppler hit method. The beam deflection method, frequency difference method. (27 hrs.)</p>
Professional Skill 29 Hrs.	Identify, operate, maintain, troubleshoot and calibrate the devices	<p>307. Installation, testing and calibration of mass flow meter. (05 Hrs.)</p> <p>308. Measuring semi solid liquid</p>	<p>Metering the flow of solid particles. Measuring volumetric and mass flow rate of solids, volumetric solids flow</p>

<p>Knowledge 09 Hrs.</p>	<p>for solid flow measuring system & verify the result within standard. ELE/N9422</p>	<p>flow rate using flow meter. (06 Hrs.) 309. Calibrating and adjustment of flow meter for solid flow. (06 Hrs.) 310. Identify and carry out maintenance & preventive maintenance of solid flow measuring system. (06 Hrs.) 311. Service and calibrate solid flow meter. (06 Hrs.)</p>	<p>meter, mass flow meter for solids, belt type solid meters belt type solid meters belt speed sensing and signal processing, slurries, constant weight feeders. (09 Hrs.)</p>
<p>Professional Skill 68 Hrs. Professional Knowledge 20 Hrs.</p>	<p>Identify, select, wire & Execute the operation of different types of level instruments use for liquid level and solid level. Carry out maintenance, Servicing, calibration and Installation. ELE/N9423</p>	<p>312. Measurement of liquid level using stick gauge and converting liquid level into volume and mass (using specific gravity). (04 Hrs.) 313. Study the construction and operation of various types of sight glasses. (04 Hrs.) 314. Installation, testing and calibration of liquid level indicator. (04 Hrs.) 315. Cleaning the glass tube and operating the isolation valves, calibrating zero adjustments. (04 Hrs.) 316. Calibrating and Measuring the liquid level using float type, displacer type level systems. (04 Hrs.) 317. Measuring the liquid level of open and close tank using pressure / DP gauge. Converting liquid height into pressure using liquid density. (04 Hrs.) 318. Calibrating DP transmitter for liquid level measurement. Adjusting</p>	<p>Principles of level measurement. Types of level measurements-solid and liquid, volume and mass, mechanical and electrical type. Surface sensing gauges, storage tank gauges, sight glasses, magnetic gauges, buoyancy, displacement gauges. Factors need to consider for open and closed channel level measurements level switches, mercury level switches in high pressure tank, level detectors, magnetic reed switches. Pressure head instruments. Hydrostatic pressure, specific gravity, pressurized fluids, pressure head instrumentation, air bellows, U- tube manometers, air purge systems, liquid purge systems, force balance diaphragm system. Electrical method conductivity and capacitance method for measuring the liquid level,</p>

		<p>square root to linear scale display. (04 Hrs.)</p> <p>319. Installation, testing measurement of liquid level using air purge level measurement. (04 Hrs.)</p> <p>320. Service and calibrate different types level indicators and transmitters. (04 Hrs.)</p> <p>321. Identify and carry out maintenance & preventive maintenance of above level indicators and transmitters. (04 Hrs.)</p> <p>322. Construct and operate conductivity probe Level indicator. (04 Hrs.)</p> <p>323. Construction and operation of capacitance probes indicating transmitters and sonic level detector. (04 Hrs.)</p> <p>324. Install and test capacitance probes indicating transmitters and sonic level detector. (04 Hrs.)</p> <p>325. Service and calibrate capacitance probes indicating transmitters and sonic level detector. (04 Hrs.)</p> <p>326. Study the construction, operation and use of load cell technique to determine solid level in vessel. (04 Hrs.)</p> <p>327. Study the construction, operation and use of</p>	<p>capacitance probes, zero and span adjustments, sonic level detectors, point level detection.</p> <p>Solid level measurement Using weight to determine level, sonic solid level measurement with microwaves, using capacitance probes to measure solid level, diaphragm switches, nuclear gauges, microwave solid level detectors. (20 hrs.)</p>
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		<p>different types of solid level switches. (02 Hrs.)</p> <p>328. Study the construction, and operation of capacitance probes transmitters, microwave level detector / gauges. (02 Hrs.)</p> <p>329. Install and test various types of solid level indicating transmitters and sonic level detector. (04 Hrs.)</p> <p>330. Service and calibrate various types of solid level indicating transmitters and sonic level detector. (04 Hrs.)</p>	
<p>Professional Skill 29 Hrs.</p> <p>Professional Knowledge 09 Hrs.</p>	<p>List out different unit of temperature, terms and read specification of temperature instruments.</p> <p>Perform measurement, maintenance, Servicing and calibration of Bimetallic and filled system thermometers & thermo switches.</p> <p>ELE/N9424</p>	<p>331. Study the construction, operation and use of temperature-controlled oil bath/furnace for low and high temperature. (03 Hrs.)</p> <p>332. Dismantling identify different parts, its function, adjustment, assemble and operation of Bimetallic and fluid filled (liquid, gas and vapour) system thermometers & thermo switches. (10 Hrs.)</p> <p>333. Install and test various types of thermometers and switches. (08 Hrs.)</p> <p>334. Service and calibrate various types of thermometers and switches. (08 Hrs.)</p>	<p>Temperature measurement. Temperature, heat, specific heat, changing physical state Fahrenheit and Celsius temperature scales Rankin and Kelvin scales, calibration of temperature scales primary and secondary standards. Industrial application of temperature measuring instruments with compensating link & precautions to be taken. Bimetallic and fluid filled temperature instruments. Bimetallic thermometers, liquid-in-glass thermometers, filled system thermometers, thermometer bulbs, capillary & bourdon tube, temperature transmitters for filled system, advantages & disadvantages of</p>

			filled systems. (09 Hrs.)
Professional Skill 29 Hrs.	Identify, select, evaluate performance, install, service and calibrate temperature Indicators, Transmitters (RTD'S, Thermistors and Thermocouples types) various type of pyrometers and instruments for humidity. ELE/N9425	335. Verify the characteristics of different types of RTD's, and Thermistors. (02 Hrs.)	Electrical temperature instrument.
Professional Knowledge 09 Hrs.		336. Study circuit operation of signal conditioner for RTD's, and Thermistors. (02 Hrs.)	Resistance thermometer, how it works, RTD bridge circuits, lead wire error, RTD elements. (03 Hrs.)
		337. Install and test various types of two and three wire RTD transmitters. (03 Hrs.)	
		338. Service and calibrate various types of RTD transmitters using temperature calibrator or resistors. (03 Hrs.)	
		339. Verify the characteristics of different types of Thermocouples. (02 Hrs.)	protecting wells for RTD, advantages and disadvantages of RTDs, thermistors, thermocouples, Ex-tension wires, compensating for changes in reference junction temperature, construction of thermocouple junction, types of thermocouple, advantages and disadvantages of thermocouples. (03 Hrs.)
		340. Study circuit operation of signal conditioner for Thermocouples based indicator and transmitters. (02 Hrs.)	
		341. Install and test various types of Thermocouples based indicator and transmitters. (03 Hrs.)	
		342. Service and calibrate various types of Thermocouples based indicator and transmitters using temperature calibrator or milli volt source. (03 Hrs.)	
		343. Measure high temperature using Optical and Radiation pyrometer. (03 Hrs.)	Pyrometry. Molecular activity and electromagnetic radiation, defining pyrometry, effects of emittance, effects of
		344. Measure the relative	

		<p>humidity using humidity sensors. (03 Hrs.)</p> <p>345. Measure the various points like motor, drilling point, hill person temperature etc. using thermal imager. (03 Hrs.)</p>	<p>temperature, wavelength and radiated energy, pyrometers and wavelengths, using of optical and radiation pyrometer, Measurement of humidity. Thermal imagers. (03 Hrs.)</p>
<p>Professional Skill 29 Hrs.</p> <p>Professional Knowledge 09 Hrs.</p>	<p>Identify, select, Operate, maintain, Service and calibrate different types of recorders. ELE/N9426</p>	<p>346. Practice recording of variable signal. (05 Hrs.)</p> <p>347. Study the construction, operation and use of circular chart recorder for temperature or pressure or mV or mA. (03 Hrs.)</p> <p>348. Study the construction, operation and use strip chart recorder- pneumatic and electronic recorders. (03 Hrs.)</p> <p>349. Calibrating electronic recorder. (04 Hrs.)</p> <p>350. Calibrating pneumatic recorder. (04 Hrs.)</p> <p>351. Overhaul, check, fault find, repair, test of pneumatic, electronic recorders. (single point & multipoint). (06 Hrs)</p> <p>352. Study of paperless LCD/LED recorder. (04 Hrs.)</p>	<p>Recorders. Introduction to recorders, Construction, working principle, various parts installation and use of pneumatic and electronic recorders. Strip-chart, circular chart. (09 Hrs.)</p>
<p>Professional Skill 29 Hrs.</p> <p>Professional Knowledge 09 Hrs.</p>	<p>Identify different types of Final control elements and role. Identify different valve body, constructional feature, Dismantle, inspect parts, replace parts, recondition, check,</p>	<p>353. Installation and testing valve actuator (pneumatic) with control valve. (02 Hrs.)</p> <p>354. Calibrating valve positioner with control valve. (01 Hr.)</p> <p>355. Calibrating current to pressure converter. (01 Hr.)</p> <p>356. Calibrating voltage to current converter. (01 Hr.)</p> <p>357. Installation and testing</p>	<p>Final control elements in process loops. Final control elements, actuators, load set Point compensation, feedback loops, control variables, effects of disturbances on performance, parts of final control sub-system, control signal, electric control signals, fluidic control signals,</p>

	and resetting of control valves with actuators, convertors & positioners. Install and test the performance. ELE/N9427	<p>electro pneumatic positioner with control valve. (02 Hrs.)</p> <p>358. Calibrating electro pneumatic positioners with control valve. (01 Hr.)</p> <p>359. Dismantle, fault finding, repair, clean, reassemble and test of actuators and positioners. (02 Hrs.)</p>	<p>Pneumatic and Hydraulic Actuators. Pneumatic principles, effects of changing pressure, pressure /volume/ temperature relationship, effects of changing temp. Pneumatic actuators, diaphragm actuator, spring and springless actuators, direct and reverse acting actuator, piston actuator, positioner, Electrical actuators and their advantages. (03 Hrs.)</p>
		<p>360. Record specification of linear, equal, percentage quick opening control valves. (01 Hr.)</p> <p>361. Record the characteristic of control valves. (01 Hr.)</p> <p>362. Remove and install control valves with service line. (01 Hr.)</p> <p>363. Dismantling, reconditioning, checking, replacing parts and resetting of control valves. (02 Hrs.)</p> <p>364. Carry out maintenance of control valves. (01 Hr.)</p> <p>365. Identifying the proximity switch and study the specifications, constructions, No. of contacts etc. (01 Hr.)</p> <p>366. Installation and testing micro and limit switches with the load. Verifying its function. (01 Hr.)</p> <p>367. Installation and testing capacitance or inductive</p>	<p>Control valves. Control valves functions and components, types' of control valves, based on valve flow characteristics- liner, equal percentage, quick opening valves, globe valves, cage valves, butterfly valves, ball valves, sliding gate valves, diaphragm valves, split body valves, capacitive, inductive type valve, proximity switch, IR switch, micro switch, limit switch, other control valves, control valve mechanical considerations, selecting control valves, valve positioner. (03 Hrs.)</p>

		<p>proxy with the load (buzzer/indicator etc). testing its function. (01 Hr.)</p> <p>368. Installation and testing, adjusting the range of IR or ultrasonic proxy with load. (01 Hr.)</p> <p>369. Installation of proxy with relay and operating high current load (like motor or AC lamp etc. (01 Hr.)</p>	
		<p>370. Operate of, sequential. (01 Hr.) Control and block valves. (02 Hrs.)</p> <p>371. Operate of electromechanical and solid-state relay. (02 Hrs.)</p> <p>372. Service & test and use electromechanical and solid-state relay. (02 Hrs.)</p> <p>373. Design and test sequential. Logic operation using relay. (01 Hr.)</p>	<p>Control elements applications. Feed water control system works, sequential. valve control, control and block valves, applying relays in final control elements, relay logic in operation, automatic valve control, controllers and activators, turbine control System, throttle and governor valves and activators. Introduction of internal parts of different types of control valves. (03 Hrs.)</p>
<p>Professional Skill 29 Hrs.</p> <p>Professional Knowledge 09 Hrs.</p>	<p>Identify fundamental of automatic control system and various functional elements in control loop. Identify, select, Install, wire, configure, test the performance, maintain, and service various types of ON-OFF and PID controllers</p>	<p>374. Install, wire up and test the control operation. (03 Hrs.)</p> <p>375. Study construction & operation of ON-OFF Electronic and pneumatic Controllers. (02 Hrs.)</p> <p>376. Service and maintenance of ON-OFF Electronic and pneumatic Controllers. (03 Hrs.)</p> <p>377. Install, wire up, test and monitor the performance of control operation using ON-OFF Electronic and</p>	<p>Introduction to controllers. Basic block diagram of control systems. Advantages Process variable and set point, analog controllers, digital controllers, control angles and limits, control loop measuring Pv, amplifying signals final control elements, current proportioning. Hunting & its effect on the product. Types of controller and their operation. Types of controller, range limit of controllers.</p>

	(electronic and pneumatic). ELE/N9428	<p>pneumatic Controllers. (03 Hrs.)</p> <p>378. Practical on PID controller trainer on various process parameters. (03 Hrs.)</p> <p>379. Study construction & operation of PID Electronic / DIGITAL Controllers. (02 Hrs.)</p> <p>380. Service and maintenance of PID Electronic/ DIGITAL Controllers. (03 Hrs.)</p> <p>381. Install, wire up, Configure, test the control operation using PID Electronic / DIGITAL Controllers. (03 Hrs.)</p> <p>382. Verify the steady state and transient responses of PID Electronic / DIGITAL Controllers in P, PI, PD, PID. (02 Hrs.)</p> <p>383. Install, connect pneumatic signal, align and test the control operation using PID pneumatic Controllers. (03 Hrs.)</p> <p>384. Verify the steady state and transient responses of PID pneumatic Controllers in P, PI, PD, PID. (02 Hrs.)</p>	<p>(05 Hrs.)</p> <p>ON/OFF controllers, direct and reverse acting controllers, proportional controllers, automatic/manual split control, pneumatic control. Adaptive, limiting and batch control, ratio control system, feed forward, feedback control systems and cascade control system. Comparison between pneumatic and electronic control systems. Basic knowledge on communication protocol. (04 Hrs.)</p>
<p>Professional Skill 29 Hrs.</p> <p>Professional Knowledge 09 Hrs.</p>	<p>Tune controller mode and evaluate performance of control loops as per specification and system application ELE/N9428</p>	<p>385. Perform the control operation in manual and automatic mode. (15 Hrs.)</p> <p>386. Set “optimum setting for unit process in PID Controller (Electronic and pneumatic). (14 Hrs.)</p>	<p>Controller models and tuning. Controller tuning, setting, controller modes, proportional mode, off-set, integral mode, reset mode, derivative mode(rate),single, mode controller, two mode controller, three mode</p>

			controllers, tuning the control loop, step-change- response method. (09 Hrs.)
Professional Skill 58 Hrs. Professional Knowledge 14 Hrs.	Identify modules of PLC, its function, Wire and connect the digital I/OS field devices to the I/O Module of PLC, install Software, Hardware and configure plc for operation. Write and execute simple logic and real application programs. ELE/N9429	<p>387. Wire and connect the digital I/OS field devices to the I/O Module of PLC. (04 Hrs.)</p> <p>388. Install PLC Programming software and establish communication with PC and PLC. (04 Hrs.)</p> <p>389. Hardware configuration and Prepare the input and output addresses for each slot. (04 Hrs.)</p> <p>390. Prepare and download ladder programs for various switching Gates. (04 Hrs.)</p>	Introduction to programmable controllers. History of programmable controllers, general characteristics of programmable controllers, some limitation of PLCs, method of developing PLC programming. (04 Hrs.)
		<p>391. Write and execute program logic control operation. (04 Hrs.)</p> <p>392. Develop programs using arithmetic, / data copy operation and execute. (04 Hrs.)</p> <p>393. Write and execute program on sequence control using timers and counters. (04 Hrs.)</p> <p>394. Develop programs using shift bit operation. (04 Hrs.)</p> <p>395. Interface analog o/p module of plc with actuator, relay. (04 Hrs.)</p>	Input/output devices. Definition of input /output devices, I/O interface, input modules, output modules, input devices encoders, output devices, the opto-isolators, safety. (04 Hrs.)
		396. Prepare programs based on on-delay and off-delay timers making on and off of a single LED taking one input and one output. (04 Hrs.)	Processing and programming functions. The processor unit, the memory, memory organization, ladder diagrams, data logger, most used programming symbols, start,

		<p>397. Two LEDs on and off using pushbutton as an input. first LED on for 3 sec and off for 2 sec, and second Led on for 2 sec and off for 3 sec for continuous cycle till stop is pressed. (04 Hrs.)</p> <p>398. Sequencer task using three LEDs as output and two input pushbuttons one as input (NO) for start and other for stop (NO). (04 Hrs.)</p> <p>399. Configuring the project using analog input and output instructions and implement a on off closed loop control for the given process. (05 Hrs.)</p> <p>400. Development of ladder logic for various tasks related to timers and counter based industrial applications. (05 Hrs.)</p>	<p>stop, station example, other programming symbol timers and counters, data manipulation instructions, alternate PLC symbols. (06 Hrs.)</p>
<p>Professional Skill 58 Hrs.</p> <p>Professional Knowledge 14 Hrs.</p>	<p>Operate, maintain, service, configure, install, WIRE and test HART transmitters /devices (I/O). And Net-working system for instrumentation. ELE/N9430</p>	<p>401. Installing & Operating HART transmitters/devices (I/O). (10 Hrs.)</p> <p>402. Creating tag, measuring the parameter, configuring the parameter values in Hart transmitter using communicator. (10 Hrs.)</p> <p>403. Preparation network cables and connectors. Testing network cables. (07 Hrs.)</p>	<p>Digital control systems: need of smart devices, HART transmitters futures, advantages, applications. Working method of HART devices, HART protocol. HART communicators and PC based HART device configuration. Steps in calibration of HART devices. Communication. (04 Hrs.)</p> <p>Networking: types of networks used in digital instrument systems. LAN, WAN, Ethernet. Point to point</p>

		<p>404. Preparation of network cables - serial (RS232/485 standards or equivalent) and Ethernet. (07 Hrs.)</p> <p>405. Connect network connectivity hardware and check for its functioning. (07 Hrs.)</p> <p>406. Dismantle and assemble the desktop computer system. (07 Hrs.)</p> <p>407. Study the operation of Pulse Code Modulation and Demodulation. (03 Hrs.)</p> <p>408. Connect any one data output of the decade counter to the Data Inputs of the FSK Modulator and measure output waveform. (07 Hrs.)</p>	<p>and multi networking. Ring, delta, star connections. Redundant Net. TCP/IP addresses and descriptions. Types of Cable categories (CAT), and their descriptions. Various types of Cable connectors. Advantages and disadvantages of co-axial cable and fiber optic cables. Various tools used in networking- wire cutter, crimp tool, memory blade holder, memory blade cartridge, cable strip tool with blade cassettes. Terminators and extra connectors, taps, calibration tool etc. fundamentals: modulation and demodulation, signal to noise ratio, digital communication basics-PWM, PCM, FSK. (10 Hrs.)</p>
<p>Professional Skill 58 Hrs.</p> <p>Professional Knowledge 14 Hrs.</p>	<p>Identify the different modules of DCS, function, Wire and connect I/OS field devices to the I/O Modules, install Software, Hardware and configure DCS for operation with HMI. Write and execute DCS AND SCADA programs FOR real application. ELE/N9431</p>	<p>409. Wire and connect the I/O Module of DCS to field signals. (06 Hrs.)</p> <p>410. Install DCS Programming software and establish communication with PC and DCS. (06 Hrs.)</p> <p>411. Set the communication between DCS and SCADA System. (06 Hrs.)</p> <p>412. Concept of Tag/Points Generation. (06 Hrs.)</p> <p>413. Attaching points to the display Element. (06 Hrs.)</p> <p>414. Practice HMI, operator panel and touch panel operation and related</p>	<p>Fundamentals of SCADA and DCS. History of DCS development.</p> <p>Basic architecture, description advantages and disadvantages, applications.</p> <p>Terminology- RTU (remote transmitting unit, central monitoring station, types of communications, field instruments and types. (04 Hrs.)</p> <p>Field bus: futures, advantages, architecture, basic block diagram, working. Work</p>

		<p>software. (10 Hrs.)</p> <p>415. Set up and configure HMI with PLC. (06 Hrs.)</p> <p>416. Animate objects on a HMI screen to monitor motor status. (06 Hrs.)</p> <p>417. Use security features to do tag logging and command execution. (06 Hrs.)</p>	<p>station, Human Machine Interface (HMI). Controller (with basic types), field bus interfacing modules, gateway, network manager, I/O modules, field bus devices (I/O), remote transmission panel (RTP), Ethernet. Electronic device description language (EDDL) and device description (DD). Field bus power supply and its function.</p> <p>Introduction of digital and multi drop communication protocol Vendors.</p> <p>Futures- library, call up, various visualized futures, Reports (alarms, events), history, trading etc. (10 Hrs.)</p>
<p>Professional Skill 29 Hrs.</p> <p>Professional Knowledge 09 Hrs.</p>	<p>Identify, check constructional Feature and function of hydraulic pump, and hydraulic power system, accumulator, hydraulic hoses and fitting, Hydraulic components. Build AND test hydraulic control circuit.</p> <p>ELE/N9432</p>	<p>418. Practice symbolic representation of Hydraulic components. (02 Hrs.)</p> <p>419. Familiar with hydraulic hoses and fitting. (02 Hrs.)</p> <p>420. Feature and function of hydraulic pump and hydraulic power system. (02 Hrs.)</p> <p>421. Feature and function of hydraulic accumulator. (02 Hrs.)</p> <p>422. Service and test different types of valves. (03 Hrs.)</p>	<p>Basic Hydraulics: Principles of Hydraulics. Fluid power and hydraulics, force, weight and mass, pressure, work, power, energy, incompressibility and non-diffusion, hydrostatic pressure, Pascal's law, transmission of fluid power, fluid flow in pipes, Bernoulli's principle, the effect of heat on liquids. A typical hydraulic power system.</p> <p>Hydraulic Fluids. Functions of Hydraulic fluids, physical properties, viscosity, viscosity index, viscosity and pressure, power point, fluid selection, component protections, chemical</p>

			properties, system contamination, water, dissolve air, foaming, corrosion and rusting, types of hydraulic fluids. (05 Hrs.)
		<p>423. Design hydraulic circuit for double acting cylinder actuation. (03 Hrs.)</p> <p>424. Design hydraulic circuit using Pilot operated check valve. (03 Hrs.)</p> <p>425. Design hydraulic circuit using Pressure reducing Valve. (03 Hrs.)</p> <p>426. Design hydraulic circuit Using Pressure relief & Pressure regulating valve. (03 Hrs.)</p> <p>427. Design hydraulic Pressure sequencing circuit. (03 Hrs.)</p> <p>428. Design hydraulic circuit using Pressure compensated flow control. (03 Hrs.)</p>	<p>Directional control valves. Directional control valve classification, review of two way valves, 'globe, gauge, plug, needle, ball, automatic two way valves, check valves, pilot operated check valves, spool valves, three ways pool valves, controlling hydraulic motors, NO and NC valves, holding valves, four and five way valves, rotary spool valves, schematic symbols, flow ratings, accessories. (04 Hrs.)</p>
<p>Professional Skill 29 Hrs.</p> <p>Professional Knowledge 09 Hrs.</p>	<p>Lay out construction feature, operate, maintain of air compressor, air Distribution system, pneumatic associate components, piping, tubing and fitting. Build and test pneumatic control circuit. ELE/N9433</p>	<p>429. Study construction operation and use of air compressor. (02 Hrs.)</p> <p>430. Operation and use of air filters, regulators and lubricator. (02 Hrs.)</p> <p>431. Practice and use of Pneumatic Piping, tubing and fitting. (Metallic and non-metallic). (02 Hrs.)</p>	<p>Pneumatic principles, mass, pressure, work and energy, compressibility, law of pneumatics, transmission of pneumatic fluid power, pneumatic leverage, air properties, airflow in pipelines, viscosity of air pressure, Bernoulli's law, components of pneumatic power system. Primary air treatment. Air treatment, preliminary filtering, relative. Humidity, effects of moisture, water removal, dew point, moisture</p>

			<p>separators, oil scrubbers, air dryers, (deliquescent and absorption type) air receivers. Secondary air treatment. Methods of treatment, Contaminate separation, contaminate filtration and filter classification and rating, types of media surface filters, depth filters, absorption filters, Lubricating their. (06 Hrs.)</p>
		<p>432. Set up a system to provide Pneumatic (air) supply of 20 psi output from the available compressor. (02 Hrs.)</p> <p>433. Build a pneumatic circuit of a single acting cylinder being controlled by 3 way 2 position directional control valves. (03 Hrs.)</p> <p>434. Build a pneumatic circuit of a double acting cylinder being controlled by 5 way 2 position directional control valves. (03 Hrs.)</p> <p>435. Build a pneumatic AND, OR circuit by 3 way 2 position directional control valves to operate double acting cylinder. (03 Hrs.)</p> <p>436. Build a pneumatic circuit of a pilot controlled double acting cylinder of being controlled by 3 way 2 position directional control valves and 5 way 2 positions valve. (02 Hrs.)</p> <p>437. Build a pneumatic circuit to</p>	<p>Piping houses and fittings. Requirement of piping, airflow, piping dimensions and safety factors, piping connections, compressed air piping applications, metallic tubing, tubing bending and tube fitting, tube installation, nonmetallic tube houses, hose fittings and coupling, hose installation. (03 Hrs.)</p>

		<p>test logical latch circuit by 5 way 2 position, 3 way 2 valve direction control valves. (02 Hrs.)</p> <p>438. Build a pneumatic circuit to control oscillation of piston by pilot operated 5 way 2 position, 3 way 2 direction control valves. (02 Hrs.)</p> <p>439. Cutting the metallic tube as per dimensions using tube cutter. (02 Hrs.)</p> <p>440. Bending the tube in to 90^o and 45^o using pipe bending tools. (02 Hrs.)</p> <p>441. Installation of simple piping diagram. (02 Hrs.)</p>	
<p>Professional Skill 25 Hrs.</p> <p>Professional Knowledge 09 Hrs.</p>	<p>Identify constructional feature, operate, maintain, service and calibrate of Analytical instruments. ELE/N9434</p>	<p>442. Operation of pH meter conductivity meter and dissolved oxygen Meter. (04 Hrs.)</p> <p>443. Wire up pH meter electrode to pH meter. (04 Hrs.)</p> <p>444. Calibrate pH meter using buffer solution. (04 Hrs.)</p> <p>445. Determination of pH (by pH meter). (04 Hrs.)</p> <p>446. Wire up conductivity meter to electrode and find the electrolytic conductivity of solution. (04 Hrs.)</p> <p>447. Service and maintenance of conductivity meter & Dissolved oxygen meter. (05 Hrs.)</p>	<p>Analytical instruments. Exposure to basic analytical instruments. Types of electrodes used for PH measurements. Relation of PH and mV. PH indicator and controllers. Conductivity meters. Dissolved oxygen meter. (09 Hrs.)</p>
Engineering Drawing: 40 hrs.			
<p>Professional Knowledge</p>	<p>Read and apply engineering drawing for different</p>	<p><u>ENGINEERING DRAWING</u></p> <ul style="list-style-type: none"> • Reading of Electronics Sign and Symbols. • Sketches of Electronics components. 	

ED-40 Hrs.	application in the field of work. CSC/N9401	<ul style="list-style-type: none"> • Reading of Electronics wiring diagram and Layout diagram. • Drawing of Electronics circuit diagram. Drawing of Block diagram of Instruments & equipment of trades.
Workshop Calculation & Science: 18 Hrs.		
Professional Knowledge WCS-18 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. CSC/N9402	<p><u>WORKSHOP CALCULATION & SCIENCE:</u></p> <p>Friction Friction - Advantages and disadvantages, Laws of friction, coefficient of friction, angle of friction, simple problems related to friction Friction – Lubrication Friction - Co- efficient of friction, application and effects of friction in workshop practice</p> <p>Algebra, Addition, Subtraction, Multiplication & Divisions. Algebra – Theory of indices, Algebraic formula, related problems.</p> <p>Estimation and Costing Simple estimation of the requirement of material etc., as applicable to the trade. Problems on estimation and costing.</p>
<p>Project Work/Industrial Visit</p> <p>Broad areas:</p> <ol style="list-style-type: none"> Automatic water level controller. On- Off temperature controller. Speed controller. Stepper motor control. Safety alarm system. Automatic door system. Event control. Humidity control. Built a pneumatic control for double acting cylinder. Regulated & Unregulated Power Supply Battery Monitor & Charger Emergency Light Electronic Fan Regulator SCR Using UJT Trigger Circuit. Dimmer circuit using Triac and Diac. Dancing LEDs Digital Clock Event Counter A to D Convertor. 		