

**Syllabus for the Trade
of**

ELECTRONICS MECHANIC

(SEMESTER PATTERN)

UNDER

CRAFTSMAN TRAINING SCHEME

Designed in 2013

By

Government of India
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
Directorate General of Employment & Training
Ministry of Labour & Employment (DGET)
EN – 81, SECTOR – V, SALT LAKE CITY,
Kolkata – 700 091.

List of members of Trade Committee Meeting for the trade of Electronics Mechanic held at ATI – EPI, Ramanthapur, Hyderabad-500 013.

Sl. No.	Name & Designation Shri/Smt.	Representing Organisation	Remarks
1.	A.K. Mishra, Director	ATI-EPI, Ramanthapur, Hyderabad	Chairman
2.	J. Sudharani, Asst. Professor	G.V.P. College of Engineering for Women, Visakhapatnam, Andhra Pradesh.	Member
3.	S. Sambaiah, Director	M/s Medisonics, Hyderabad-28.	Member
4.	Sandhya Salwan, Jt. Director (Director I/C)	ATI-EPI, Dehradun.	Member
5.	D.K. Ojha, Dy. Director	ATI-EPI, Dehradun.	Member
6.	C. Chandrasekhar, JDT	ATI-EPI, Ramanthapur, Hyderabad	Member
7.	M.S. Ekambaram, DDT	ATI-EPI, Ramanthapur, Hyderabad	Member
8.	C.S. Murthy, DDT	ATI-EPI, Ramanthapur, Hyderabad	Member
9.	T. Ragulan, DDT	ATI-EPI, Ramanthapur, Hyderabad	Member
10.	V. Subrahmanyam, ADT	ATI-EPI, Ramanthapur, Hyderabad	Member

List of members attended the Workshop to finalize the syllabi of existing CTS into Semester Pattern held from 6th to 10th May'2013 at CSTARI, Kolkata.

Sl. No.	Name & Designation	Organisation	Remarks
1.	R.N. Bandyopadhyaya, Director	CSTARI, Kolkata-91	Chairman
2.	K. L. Kuli, Joint Director of Training	CSTARI, Kolkata-91	Member
3.	K. Srinivasa Rao, Joint Director of Training	CSTARI, Kolkata-91	Member
4.	L.K. Mukherjee, Deputy Director of Training	CSTARI, Kolkata-91	Member
5.	Ashoke Rarhi, Deputy Director of Training	ATI-EPI, Dehradun	Member
6.	N. Nath, Assistant Director of Training	CSTARI, Kolkata-91	Member
7.	S. Srinivasu, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
8.	Sharanappa, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
9.	Ramakrishne Gowda, Assistant Director of Training	FTI, Bangalore	Member
10.	Goutam Das Modak, Assistant Director of Trg./Principal	RVTI, Kolkata-91	Member
11.	Venketesh. Ch. , Principal	Govt. ITI, Dollygunj, Andaman & Nicobar Island	Member
12.	A.K. Ghate, Training Officer	ATI, Mumbai	Member
13.	V.B. Zumbre, Training Officer	ATI, Mumbai	Member
14.	P.M. Radhakrishna pillai, Training Officer	CTI, Chennai-32	Member
15.	A.Jayaraman, Training officer	CTI Chennai-32,	Member
16.	S. Bandyopadhyay, Training Officer	ATI, Kanpur	Member
17.	Suriya Kumari .K , Training Officer	RVTI, Kolkata-91	Member
18.	R.K. Bhattacharyya, Training Officer	RVTI, Trivandrum	Member
19.	Vijay Kumar, Training Officer	ATI, Ludhiana	Member
20.	Anil Kumar, Training Officer	ATI, Ludhiana	Member
21.	Sunil M.K. Training Officer	ATI, Kolkata	Member
22.	Devender, Training Officer	ATI, Kolkata	Member
23.	R. N. Manna, Training Officer	CSTARI, Kolkata-91	Member
24.	Mrs. S. Das, Training Officer	CSTARI, Kolkata-91	Member
25.	Jyoti Balwani, Training Officer	RVTI, Kolkata-91	Member
26.	Pragna H. Ravat, Training Officer	RVTI, Kolkata-91	Member
27.	Sarbojit Neogi, Vocational Instructor	RVTI, Kolkata-91	Member
28.	Nilotpal Saha, Vocational Instructor	I.T.I., Berhampore, Murshidabad, (W.B.)	Member
29.	Vijay Kumar, Data Entry Operator	RVTI, Kolkata-91	Member

GENERAL INFORMATION

- 1. Name of the Trade: –** **ELECTRONICS MECHANIC**
- 2. NCO Code No.** :
- 3. Duration** : 02 years (Four semesters having duration of six months each)
- 4. Power Norms :** 3.04 kW
- 5. Space Norm :** 56 Sq mtrs
- 6. Entry Qualification :** Passed 10th class examination
- 7. Unit Size (No. of Students) :** 16 Trainees
- 8. Instructor's/Trainer's Qualification :**
- a) B.E./B.Tech in Electronics/Electronics & Telecommunication with one yrs. experience in the relevant field
- OR
- Diploma in Electronics/Electronics & telecommunication/from recognized board of technical education with two years experience in the relevant field.
- OR
- NTC/NAC in the trade with five years or four years experience respectively in the relevant field
- 9. Desirable qualification** : (b) Preference will be given to a candidate with Craft Instructors Certificate (CIC).

Note: At least one Instructor must have Degree / Diploma in the relevant field.

Syllabus for the Trade of “*Electronic Mechanic*”
Duration : Six Month

First Semester

Semester Code: ELM: SEM I

Week No	Trade practical	Trade Theory	Engg Drawing	Workshop cal & science
1	<p>Practice fixing of screws of different sizes on wooden board.</p> <p>Practice of Cutting on wooden blocks using Tenon saw/6 inch hand saw</p> <p>Drill holes on wooden boards using Electric/Hand Drill Machine.</p> <p>Smoothen the blunt surfaces using suitable files</p> <p>Repeat the above tasks on Metal and Plastic sheets.</p> <p>Practice the electrical safety norms</p> <p>Practice the Mock treatment of electrical shock</p>	<p>Introduction to NCVT and its certification mechanism.</p> <p>Semester system and its flexibility for the Trainee and to the Institute.</p> <p>EM Trade and its applicability in industries.</p> <p>Expectations of the Industry from trainees after the completion of the Trade.</p> <p>The skills to be acquired to become part of industry.</p> <p>Intro to Safety and measures to be taken to maintain the standards of safety of personnel working and the equipment. Different First aid mechanisms to rescue the effected by electric shocks or any physical injuries.</p>	<p>What is Engineering drawing, Importance, free hand sketching of straight lines, rectangles, square, circles, polygons, etc.</p>	<p>Quadratic equation, Simultaneous linear equation in two variables.</p>
2.	<p>Identify the Live, Neutral and Earth on power socket.</p> <p>Construct a test lamp and light a lamp</p> <p>Use a Tester to monitor AC power.</p> <p>Measure the unwanted voltage between the neutral and Ground and take measures to reduce it.</p>	<p>Basic terms such as electric charges, Potential difference, Voltage, Current, Resistance. Basics of AC & DC. Terms such as +ve cycle, -ve cycle, Frequency, Time period, RMS, Peak, P-P, instantaneous value. Single phase and Three phase power , terms like Line and Phase voltage/ currents.</p>	-do-	-do-

	<p>Connect two lamps in parallel to the AC Source and observe illumination.</p> <p>Connect two lamps in series to the AC Source and observe illumination</p> <p>Identify different wires and cables.</p> <p>Practice removal of insulation without destroying the strands on wires and cables of different ratings</p> <p>Measure the gauge using SWG</p> <p>Make cable joints using soldering gun</p> <p>Desolder to separate the soldered joints</p> <p>Read and interpret the settings, sockets on an Analog and Digital Multimeters.</p>	<p>Insulators, conductors and semiconductor properties</p> <p>Different type of electrical cables and their specifications. Different types of Cables used in the electronic industries.</p> <p>Ohm's law and its variables.</p>		
3.	<p>Measure and Test the voltage of the given primary/secondary cell(s).</p> <p>Charge and discharge the cell while measuring the respective Voltage and currents.</p> <p>Measure the voltage and current at different terminals of a resistive circuit</p> <p>Identify an electromagnet and a permanent magnet.</p> <p>Prepare a solenoid valve</p> <p>Prepare an electromagnet for a bell</p> <p>Dismantle and identify different parts of a relay</p> <p>identify coil voltage and contact current capacity.</p> <p>Assemble and test the relay (any four different relays).</p> <p>Repeat the above three tasks for an electrical contactor.</p> <p>Operate a Three phase Induction Motor with three pole EM Contactor having 1 NO + 1</p>	<p>Battery /Cells: construction, types of primary and secondary cells, materials used, specification of cells and batteries. Charging process, efficiency, shelf life, Selection of cells / Batteries etc. Use of Hydrometer.</p> <p>Types of electrolytes used in cells and batteries.</p> <p>Types and Properties of magnets and their materials, preparation of artificial magnets, significance of Electromagnetism, types of cores.</p> <p>Electromagnetic Relays, types, construction, specifications.</p>	<p>Free hand sketching of tools, reading of simple drawings and concepts of dimensions and dotted lines, chain lines etc.</p> <p>Magnifying glass.</p>	<p>Electricity: Negative & positive polarities, structure of Atoms, Electrons & protons, coulomb, unit of charge, volt, unit of potential difference, and charge in motion is current.</p>

	NC auxiliary contacts			
4.	<p>Identify different transformers</p> <p>Measure the primary and secondary winding resistances for transformers of different capacities (upto 500 VA)</p> <p>Identify different sizes, shapes of cores used in low capacity transformers.</p> <p>Measure the primary and secondary voltage of different transformers.</p> <p>Identify primary and secondary terminals of the centre tapped transformer and test it.</p> <p>Measure input and output voltages of a given isolation transformer</p> <p>Identify different terminals on the given single phase and three phase fractional HP AC Induction Motor.</p> <p>Connect the power and test run</p> <p>Identify unmarked terminals of a three phase induction motor, connect to the DOL starter and run.</p> <p>Connect a DOL starter to the given single phase motor and control it</p> <p>Connect a DOL starter to the given three phase motor and operate it</p>	<p>Working principle of a Transformer, Transformer construction , Types of cores used Specifications of a transformer. Step-up , Step down and isolation transformers with applications. Different type of losses in Transformers.</p> <p>Phase angle, phase relations, active and reactive power, power factor and its importance in the industry.</p> <p>Three phase Transformers and their applications.</p> <p>Electrical motors: AC Motor (single phase induction motor) construction, sub assemblies, type of winding used, interpretation of name plate specifications, conventional speed control methods. Types of AC motors and their applications.</p> <p>Starting of split phase motor and three phase AC motors.</p>	-do-	-do-
5.	<p>Identify and Test Permanent Magnet DC motor</p> <p>Identify and Test Brushless DC motor</p> <p>Identify and Test stepper motor</p> <p>Identify and familiarize with various types of fuses with their bases.</p> <p>Trip a MCB by simulating fault conditions and Reset the MCB.</p> <p>Measure the current drawn by the motor and speed using a TACHO.</p>	<p>DC Motor construction, sub assemblies, commutators, carbon brushes, interpretation of name plate specifications, conventional speed control methods and applications.</p> <p>Types of DC motors and their applications.</p> <p>Overload Relay, Fuse ratings, types of Fuses, Fuse bases, single/three phase MCBs, single phase ELCBs.</p> <p>Types of Contactors, contactor coils and</p>	Atomic Structure, Different components.	Fundamentals and derived units, Supplementary units, of electrical parameters. Standards-definition, types-primary and secondary standards, working standards, Standards of length,

	<p>Connect a DOL starter and run the given AC motor</p> <p>Identify the terminal connections of the ceiling Fan(permanent capacitor motor).</p> <p>Connect, set proper direction of rotation and Run.</p> <p>Remove the ceiling Fan motor and test it</p> <p>Remove the Fan capacitor and test it</p>	<p>working voltages, contactor contact currents, protection to contactors and high current applications.</p>		<p>mass, time, current, voltage.</p>
6.	<p>Identify Resistors of different types(include NTC,PTC,W/W,Log, Linear, preset, VDR,LDR) values and power ratings.</p> <p>Use colour code to identify the Resistors and values.</p> <p>Measure with multimeter the Resistance, current and voltage through series and parallel connected resistor networks</p> <p>Identify different inductors, test and measure the values. Apply AC and DC to RL circuit and observe the response.</p> <p>Identify, Test and measure capacitance of various capacitors.</p> <p>Monitor RC ckt behavior by applying different voltages and frequencies</p> <p>Measure Time constant for different values of R and C.</p> <p>Measure the V, I of a RLC series and parallel ckts at resonant frequencies.</p> <p>Find the resonant frequency of the given RLC ckt.</p> <p>Measurement of inductance, capacitance and resistance with L.C.R. Bridge</p>	<p>KVL & KCL with applications. : Resistor - definition, types of resistors, their construction & specific use, color-coding, power rating,. Equivalent Resistance of series parallel ckts. Distribution of V & I in series parallel ckts.</p> <p>Principles of induction, inductive reactance, Types of inductors , construction, specifications and applications(energy storage concept). Self and Mutual induction. Behaviour of inductor at low and high frequencies.</p> <p>series and parallel combination, Q factor, Electromagnets ,Solenoids & relays construction & its application</p> <p>Capacitance and Capacitive Reactance, Impedance. Types of capacitors, construction, specifications and applications. Dielectric constant. Significance of Series parallel connection of capacitors. Capacitor behavior with AC and DC. Concept of Time constant of a RC ckt.</p> <p>Concept of Resonance and its application in RC,RL & RLC series and parallel ckts.</p>	-do-	-do-

7.	<p>Identify Si and Ge diodes Record any ten Diode component numbers (both Si & Ge) from Data book with their specifications. (I_f, PIV and forward voltage drop) Identify any five different packaging styles of Diodes with respective heat sinks Response of a Diode for different AC and DC voltages Test the PIV and Forward current of the given diode Construct and test Diode as a half wave, fullwave and Bridge rectifier. Connect a capacitor to the rectifier ckt and filter the output Observe on CRO the ripple from rectifiers by varying load and filter capacitance Identify and Test Zener diode, Varactor diode, tunnel diode. Construct and test zener based voltage regulator circuit and test.</p>	<p>Semiconductor component number coding for different electronic components such as Diodes, Zeners, Transistors, FETs, MOSFETs, IGBTs. PN Junction, Forward and Reverse biasing of diodes, Interpretation of diode specifications Forward current and Reverse voltage, packing styles of diodes. Diode Bridge Modules. Rectifier configurations, their efficiencies, Filter components and their role in reducing ripple. Working principles of Zener diode/specifications/applications Varactor diode /Tunnel diode/ specifications with applications.</p>	<p>Reading of simple drawing, free hand sketching of simple solids with dimensions, free hand sketch of solids viewed perpendicularly to their surface and axes.</p>	<p>Ohms law: Current, voltage, resistance, and related problems, multiple and submultiples units, electric power, power dissipation in resistance, power formulas.</p>
8.	<p>Identify PNP and NPN Transistors Record any ten Transistors numbers (both NPN & PNP) from Data book with their specifications. (β, V_{BE}, V_{CB}, V_{CE}, I_C, I_B, Junction Temperature, junction capacitance, Frequency of operation, Power Rating) Identify any five different packaging styles of Transistors with respective heat sinks Measure E-B, C-B & C-E terminal resistances and infer. Wire a circuit using a switch to turn on a Relay via Transistor (use Relays of different coil voltages and Transistors of different β)</p>	<p>Construction, Working of a PNP and NPN Transistors. Purpose of E,B & C Terminals. Flow of currents into and out of terminals of PNP/ NPN Transistors and their relations. Significance of β of a Transistor. Need for Biasing of Transistor junctions Interpretation of main parameters of a Transistor. V_{BE}, V_{CB}, V_{CE}, I_C, I_B, Junction Temperature, junction capacitance, Frequency of operation, Discuss a Transistor application as a switch. Discuss a Transistor application as an amplifier. Define input impedance and output</p>	<p>-do-</p>	<p>-do-</p>

	Construct a Transistorized amplifier and amplify a small signal. Vary the gain by changing the circuit components Calculate input impedance and output impedance of the constructed amplifier.	impedances		
9.	Identify any five FET Transistors and record main parameters from the Data book Test the given FET (atleast 5 no's) and record the impedances. Construct and test a FET Amplifier Identify SCRs of different ratings by their number. Test different SCRs (atleast 5 no's) for healthiness using a Multimeter. Construct SCR test circuit with a small load and test. Identify different heat sinks used with various SCRs. Identify and test a DIAC (atleast 3 no's) by its number. Use an RC circuit to fire and change the firing angle of SCR. Construct a circuit using DIAC as trigger device to fire SCR Identify and Test a UJT by its number Construct UJT based free running oscillator and change its frequency. Identify and test a DIAC(atleast 3 no's) by its number Construct a circuit using DIAC as trigger device to fire TRIAC for phase control application. Identify and test a power MOSFET (atleast 3 no's) by its number	Construction of FET, differentiate it with BJT. Purpose of Gate, Drain and source terminals and voltage/current relations between them. Amplification factor of FET. Impedances between various terminals. Interpret the main parameters of the FET. Suitability of FET amplifiers in measuring device applications. Working of power electronic components such as SCR, TRIAC,DIAC,UJT ,MOSFET and IGBT.	Electronic Component symbols, Series circuit, Representation of IR voltage drops.	Series circuits: Total resistance, same current in series circuits, IR voltage drops, Sum of IR drops equal to the applied voltage, Polarity of IR voltage drops, Total power in series circuits, related exercise.

	<p>Identify different heat sinks used with various power MOSFET devices. Construct MOSFET test circuit with a small load and test Identify and test a IGBT (atleast 2 no's) by its number Construct IGBT test circuit with a small load and test</p>			
10.	<p>Dismantle an Analog multimeter and identify components /sections and trace path for measurement of V, I & R. Measure the indicator coil voltage corresponding to different measurements. Assemble and test the meter Dismantle Digital Multimeter and Identify components /ICs/sections and Trace circuit path for measurement of V, I (AC & DC) & R. Measure the Signal voltage to the display IC corresponding to different measurements. Assemble and test the DMM.</p>	<p>Working principle of PMMC type ammeter. Conversion of ammeter into voltmeter. Working principles and study of Block diagrams / Schematic diagrams of Analog multimeter, Digital Multimeter, Digital LCR meter.</p>	-do-	-do-
11.	<p>Identify different electrical cables of various gauges and of different insulation strength. Remove the insulation of different cables and prepare for joining Make Solder joints of different cables Make Lug joints of different Electrical cables Identify atleast 12 different type of cables (including FRC) used in electronic industries. Identify atleast 12 different type of cable connectors used in electronic industries Solder/crimp/terminate atleast 10 connectors to the respective cables and test for continuity</p>	<p>Classification of cables according to guage, core size, insulation strength, flexibility etc</p>	-do-	<p>Arithmetic and geometric progression, sum of n-terms, simple calculations.</p>

	as per the marking on the connectors.			
12.	Practice with cable ties, ferrools, routing of cables etc. Identify and familiarize with spst, spdt, dpdt, tumbler, toggle, piano type electrical switches Identify and familiarize with electronic pushbutton (NO, NC), with and without indicator lamps, with auxiliary contacts of different sizes	Different electrical cables and their specifications	Free hand sketches of nuts with dimensions from samples. Circuit s and wiring diagrams.	-do-
13.	Select a soldering gun and practice soldering of different electronic active and passive components/digital ICs on varieties of PCBs. Join the broken PCB track and test. Desolder the soldered component and clean the surface of the track.	Different type of soldering guns, relate temperature with wattages, types of tips. Solder materials and their grading. Use of wax and other materials. Selection of a soldering gun for specific requirement. Soldering and Desoldering stations and their specifications.	-do-	Parallel circuits: Applied voltage is the same across parallel branches, Each branch current, Total current equal to the sum of the branch currents.
14.	Measure logical high and low for TTL and CMOS ICs. Identify by the number and Monitor the clock frequency of different crystal ICs on CRO and measure it. Identify different Logic Gates (AND, OR,NAND,NOR, X-OR, X-NOR,NOT ICs) by the number printed on them and and draw I/O pin-out numbers. Verify the truth tables of all Logic Gate ICs by connecting switches and LEDs. Use NAND Gates to realize an OR Operation. Use NAND Gates to realize a NOR operation Use NOR Gates to realize an AND Operatoin Use NOR Gates to realize a NAND operation	Difference between analog and digital signals, Logic levels of TTL and CMOS Introduction to Digital Electronics, Number systems and codes Digital code: binary, octal , Excess 3 code, grey code, BCD code, ASCII code and code conversions Logic Gates and their truth tables, propagation delay, power dissipation and noise immunity Logic families like TTL/CMOS and sub families and their comparison. Availability of logic gates in multiple numbers in a package with examples. Combinational logic circuits such as AND-OR Logic, AND-OR invert Logics	-do-	-do-

		Universal property of NAND and NOR gates. Study different IC Packages		
15.	Wire and illuminate LEDs of different sizes and observe the current drawn. Expose LDR different lights and Record the variation in resistance. Expose Photovoltaic cell to different lights and Record the variation in Voltage produced. Wire a photo Diode based circuit and switch a lamp load. Wire a photo Transistor based circuit and switch a lamp load. Identify an IRED coupled to photo Transistor (Optocouler) and operate a Relay by connecting a switch to input.	IR LEDS, Photo diode for photo transistor, its characteristics and application, optical sensor, opto-couplers, circuits with opto isolation, characteristics of LASER diodes	Parallel circuits, Branch currents, representation	Resistance in parallel circuits, Total power in parallel circuits, effect of open branch, short circuit across parallel branches, related exercise.
16.	Construct and test voltage divider bias Amplifier Construct and Test a common emitter Amplifier Construct and Test common base amplifier Construct and Test common collector amplifier Construct and Test Darlington amplifier	Transistor biasing circuits and stabilization technics. Voltage amplifiers- voltage gain, loading effect. configuration of common emitter, common base, common collector transistor, their definition characteristics and application	-do-	-do-
17.	Construct and test Class A amplifier. Construct and test Class B amplifier Construct and test Class AB push pull amplifier Construct and test a single stage CE amplifier with and without emitter bypass capacitor.	Classification of amplifiers according to frequency, mode of operation, methods of coupling. CE ,CB,CC amplifier circuit and their characteristics Alpha ,beta, voltage gain, Concept of dB dBm.	-do-	Temperature, pressure. Newton's law of motion, applications, momentum. Simple problems
18.	Construct an emitter follower, RC coupled amplifier Construct and test push pull power amplifier Construct and test oscillator using a HF	Distinguish between voltage and power amplifier Types and effect of negative feedback in amplifiers	Explanation of simple orthographic projection 3 rd angle.	-do-

	transistor. Construct and test RC Phase shift oscillator	Working of emitter follower circuit and its advantages different packages styles of transistors, in-circuit testing of transistor introduction to positive feedback and requisites of an oscillator		
19.	Construct and test astable multivibrator circuit Identify and test Transistors of different packaging styles Identify and pick a suitable heat sink for Transistors of different packaging styles Test various analog electronic components using linear linear IC Tester.	Types of multivibrators and study of circuit diagrams Transistor power ratings & packaging styles, use of different heat sinks. Study of a Linear IC Tester	-do-	Series-Parallel circuits: Finding Total resistance for series-parallel resistances, Whetstones' bridge.
20.	Construct and Test Half Adder circuit and verify the truth table. Construct and Test Full adder and verify the truth table. Construct the Adder cum Subtractor and verify the result Construct and Test a 2 to 4 Decoder and test Construct and Test a 4 to 2 Encoder and test Construct and Test a 4 to 1 Multiplexer and test Construct and Test a 1 to 4 DeMultiplexer and test	Combinational logic circuits such as Half Adder, Full adder, Parallel Binary adders. IC 7482 as 2-bit and four bit full adders. Magnitude comparators. Half adder, full adder ICs and their applications for implementing arithmetic operations Basic Binary Decoder and four bit binary decoders. ICs 74LS138 and 74154 pin details and functionality. BCD to Decimal decoder. Decimal to BCD Encoder, IC 74147 details and functionality. Need for multiplexing of data and IC 74151 AS Data selector/Multiplexer. 1 to 4 line Demultiplexing. IC 74154 as a Demultiplexer.	Types of resistors, colour coding, tolerance representation,	-do-
21.	Construct and test four bit latch using 7475. Identify different Flip-Flop (ICs) by the number printed on them. Verify the truth tables of Flip-Flop ICs (D,T, RS, JK) by connecting switches and LEDs Identify & Wire a Master-Slave Flip-Flop and Test the truth table.	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 Clocked Flip Flop, Master-Slave flip flops and Timing diagrams Basic flip flop applications like data storage , data transfer and frequency division.	-do-	Resistor types, their colour codes and tolerance, series and parallel combination of resistors, power rating of resistors.

	Familiarization with front panel controls and display system of Digital IC Tester Testing of : TTL , CMOS ,Memory Peripheral ICs	Specifications and block diagram , Operation of a Analog IC Tester and its Circuit description (in brief		
22.	Construct and test a four bit asynchronous binary counter using 7493. Connect 7493 as a modulus-12 counter. Construct and test a four bit Synchronous binary counter using 74163. Construct and test synchronous Decade counter. Construct and test an up/down synchronous decade counter using 74190 and monitor the output on LEDs. Display the count value on seven segment display using decoder/driver ICs.	Basics of Counters. Two bit and three bit Asynchronous binary counters and decade counters with the timing diagrams. 3- bit Synchronous counters and synchronous decade counters. BCD display, BCD to decimal decoder. BCD to 7 segment display circuits	Explanation of simple orthographic projection 3 rd angle.	-do-
23 & 24	Construct the shift register using RS/D/JK flip flop and verify the result Construct and test four bit SIPO register Construct and test four bit PIPO register Construct and test two digit Seven segment LED / Decoder-Driver circuits. Construct and test of Dotmatrix / LCD Displays. Construction and testing of Binary weighted and R-2R Ladder type Digital-to-Analog Converters. Familiarization with various types of Memory ICs Identification of Flash Memories of various capacities. Test various digital ICs using digital IC Tester.	Shift Register functions, Serial to parallel and vice versa, Parallel to parallel and serial to serial, Bidirectional shift registers, Timing diagram ,important applications.pin details and functionality of universal shift register IC 74194 Memory concepts, types of memories RAM/ROM/EPROM/FLASH PROM etc.and their applications. Study of a Digital IC Tester : Specifications & Block diagram , Operation and circuit description of of a Digital IC Tester	-do-	Static and dynamic friction. Gravitational forces. Force-definition, units, and fractional, forces. Problems on force and frictional forces.
25		(i)Project work		

		(ii) industrial visit (optional)		
26		Examination		

Syllabus for the Trade of “*Electronic Mechanic*”
Duration : Six Month

Second Semester

Semester Code: ELM: SEM II

Week No	Trade practical	Trade Theory	Engg Drawing	Workshop cal & science
1	Construct RC circuit and measure the Time constant by measuring voltages. Construct and test a simple high pass RC circuit and observe the integrated output for applied input. Construct RC differentiator circuit and convert Triangular wave into square wave. Construct simple diode based shunt clipping circuits to clip below and above reference voltages.	Time constants of RC & RL circuits. Diode shunt and series clipper circuits and clamping/limiting circuits and their applications. RC based Differentiator and Integrator circuits	Schematic diagram of Moving coil meter, Moving Iron meters, voltmeter, Ammeter, Ohm meter.	Voltage dividers, & current dividers: Series voltage dividers, current divider with two parallel resistances.
2.	Construction and testing of various Op-Amp circuits like Inverting, Non-inverting and Summing Amplifiers, Differentiator and Integrator	Introduction to Differential amplifier : construction & working block diagram of Op-Amp, importance, characteristics, common-mode gain, advantages and applications. schematic diagram of 741, symbol, Non-inverting voltage amplifier, inverting voltage amplifier, , linear and non-linear applications	-do-	-do-

		of 741, Comparator using op-amp ,other popular op-amps		
3.	Instrumentation Amplifier. Construct the comparator using OP-AMP Construct and test monostable timer circuit using IC 555 Construct and test Astable timer circuit using IC 555 Construct and test VCO (V to F Converter) using IC 555 Construct and test 555 timer as pulse width modulator.	Block diagram of 555, functional description wrt different configurations of 555 such as monostable, astable and VCO operations for various application	Explanation of simple orthographic projection 3 rd angle.	Direct-current meters: Moving coil meter, design of voltmeter, ammeter, loading effect of voltmeters, related problems.
4& 5	Measure using CRO – DC Voltage, AC voltage, Period & Frequency & and observe different wave forms Troubleshooting CRO Vertical Preamplifier & all other sections (a) to (c). Troubleshooting CRO Vertical Preamplifier & all other sections (d) to (f). Familiarize and doing measurement using Digital storage oscilloscope Interfacing DSO with a PC (IEEE)	Study of CRO : Specifications and block diagram , Familiarization with front panel and controls of a CRO. Study of CRO circuits (a) Vertical preamp (b) Vertical Intermediate amplifier (c) Vertical Final amplifier (d) Time base circuits, (e) Horizontal Final amplifier (f) Low voltage & EHT power supply circuits. Study of H V circuits Digital storage and IEEE interface of a oscilloscope. Trouble shooting procedure of a CRO.	-Do-	-do-
6.	Identify and test DIODE/SCR Power bridge Identify and test MOSFET Power bridge Identify and test IGBT Power bridge Connect the heat sinks to the above power bridges	Power MOSFET, IGBT - their types, characteristics, switching speed, power ratings and protection	Different types of series parallel circuits, representation of nodes, etc.	Complex numbers. Simple problems Work, power and energy- definition, units, and simple problems and on shop floor practices. Conservation of momentum and energy

7.	<p>Construct and test a lamp dimmer /fan regulator circuit</p> <p>Construct a flashing lamp circuit using a thyristor</p> <p>Construct a UJT based Time delay circuit to turn on a lamp load with delay of 5 seconds</p> <p>Control the speed of a universal motor using a TRIAC based circuit.</p>	<p>Identify and test DIODE/SCR Power bridge</p> <p>Identify and test MOSFET Power bridge</p> <p>Identify and test IGBT Power bridge</p> <p>Connect the heat sinks to the above power bridges</p>	-do-	-do-
8.	<p>Identify different fixed +ve and –ve voltage regulator ICs of different current ratings (78/79 series) alongwith i/o, reference pins.</p> <p>Wire a fixed voltage regulator as a variable one by floating the reference.</p> <p>Identify proper heatsinks for different IC based voltage regulators.</p> <p>Vary the input voltage and observe the fixed output for the above mentioned series</p> <p>Construct a dual power supply using above regulator ICs with current limiting and short circuit features.</p>	<p>Regulated Power supply using 78XX series, 79XX series, Op-amp regulator, 723 regulator , (Transistorized & IC based) voltage regulation, error correction and amplification etc.</p>	-do-	<p>Kirchoff's laws: Kirchoff's voltage & current law, Branch currents, node voltages, Mesh currents, related problems.</p>
9.	<p>Identify different front panel controls and connectors of the given power supply.</p> <p>Test the given power supply and limit the output for a specific voltage and current.</p> <p>Open the power supply and identify major sections and power components with heatsinks.</p> <p>Test the semiconductor power switches of a power supply.</p>	<p>Specifications & block diagram of Linear power supplies.</p> <p>Front panel controls and features of various power supplies.</p> <p>Different types of power switches and heat sinks used in power supplies.</p>	Familiarization and sketching the details of components	-do-

	Operate a programmable power supply and test its features			
10.	<p>Dismantle the given stabilizer and find major sections/ ICs/ components. Measure voltages at vital points. Identify various input and output sockets/connectors of the given SMPS.</p> <p>Apply input and measure outputs using a multimeter.</p> <p>Test capacity of the given SMPS.</p> <p>Identify major sections/ ICs/ components of SMPS.</p> <p>Measure / Monitor major test points of SMPS.</p> <p>Identify and replace the faulty components.</p> <p><i>Use SMPS used in TVs and PCs for practice</i></p>	<p>Manual & automatic and servo voltage stabilizers-concept and block diagram, o/p voltage adjustment, voltage cutoff systems, study of different types of relays used in stabilizers, study of electronic circuit commonly used, buck and boost concept</p> <p>Block Diagram of Switch mode power supplies and their working principles.</p> <p>Principles of Inversion and Inverter circuits using different techniques.</p> <p>Pulse width modulation and their applications.</p>	-do-	Trigonometry – identity & solve
11.	<p>Construct and test step up type chopper circuit</p> <p>Construct and test step down type chopper circuit</p> <p>Construct and test inverter type chopper circuit</p> <p>Construct and test IC Based DC-DC converter for different voltages</p>	<p>Various types of chopper circuits step-up, step down, inverting types.</p> <p>Introduction to DC-DC Converters</p> <p>ICs used for converting DC- DC , block diagrams and their pin outs. Applications of DC-DC converters</p>	-do-	-do-
12.	<p>Identify various input and output sockets/connectors /indicators on the given UPS.</p> <p>Make individual connections between batteries of battery stack and test for healthiness of batteries on stack.</p> <p>Connect battery stack to the UPS.</p>	<p>Electrical wiring for Single phase and Three phase systems, Earthing and earth resistance measurement, calculation of load power and power factor of a power source.</p> <p>Review on Batteries – various types, their selection, grouping of cells and batteries, charging of batteries, Various Battery charging</p>	Draw different rectifier circuit	-do-

	Make load test to measure backup time	circuits used in Inverters and UPS , Maintenance of Batteries 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		
13.	Identify isolator transformer, inverting transformer and control transformers. Adjust charging current according to number of batteries Identify various circuit boards and monitor voltages at vital test points. Identify the charging section and set the charging current according to backup. Identify the semiconductor power modules and measure voltages. Perform a load test to UPS	Types of UPS. Block diagram and working principle of different types UPS. Specifications of a typical UPS. Most frequently occurring faults and their remedies. Concept of UPS, OFF LINE and ONLINE . Difference between Inverters and UPS. Selection of UPS – calculation of load power, Line interactive UPS ON- Line UPS, their circuit description and working- controlling circuits, Micro controller circuits, power circuits, charging circuits, alarm circuits, Indicator circuits	-do-	Network theorems: Thevenin's, Norton's theorems, conversion of voltage and current sources.
14.	Identify and draw different active, passive components using symbols Draw schematic diagrams for basic analog circuits Draw schematic diagrams for basic Digital circuits Draw schematic diagrams for Microprocessor and Microcontroller based circuits	Identify different active, passive components using symbols Draw schematic diagrams for basic analog circuits Draw schematic diagrams for basic Digital circuits Draw schematic diagrams for Microprocessor and Microcontroller based circuits	Draw different amplifier circuit	-do-
15.	Identify foot prints for different analog /digital electronic (lead and SMD) components Prepare layouts for simple analog/digital circuits	Identify foot prints for different analog /digital electronic (lead and SMD) components Prepare layouts for simple analog/digital circuits	-do-	-do-

	Generation of output prints for fabrication (topside / bottom side / solder mask)	Generation of output prints for fabrication (topside / bottom side / solder mask)		
16.	<p>Identification of 2/3/4 terminal SMD components</p> <p>Soldering / desoldering of above components</p> <p>Identification of PGA packages</p> <p>Soldering / Desoldering of above PGA components</p> <p>Cold/Continuity check of PCBs</p> <p>Identification of loose /dry solders, broken tracks on printed wiring assemblies.</p>	<p>Identification of 2/3/4 terminal SMD components</p> <p>Soldering / desoldering of above components</p> <p>Identification of PGA packages</p> <p>Soldering / Desoldering of above PGA components</p> <p>Cold/Continuity check of PCBs</p> <p>Identification of loose /dry solders, broken tracks on printed wiring assemblies</p>	-do-	Calculation of RMS and average value of rectifier half wave and full wave, ripple factor.
17.	<p>Familiarize with the Microprocessor kit, identify different ICs on the kit.</p> <p>Observe the voltage/waveforms on different ICs and IC pins of the processor</p> <p>Monitor the clock frequency.</p> <p>Write down the address range of different memory ICs and peripheral ICs on the kit</p> <p>Enter data to different memory locations in RAM</p> <p>Enter simple programs and execute using assembly language</p>	<p>Intro to 8085 Microprocessor, Architecture, pin details and Bus System of the processor</p> <p>Function of different ICs such as decoders, buffers, latches etc used with 8085 processor</p>	Multiplexer and demultiplexer	Moment of inertia of simple shapes like disc, cylinder & sphere.
18.	<p>Use assembler to assemble the programs and load them for execution by the processor</p> <p>Program to Blink an LED using port pins of 8255.</p> <p>Program to Control a relay using the port pins of 8255.</p>	<p>Interfacing to memory ICs RAM, PROM/EEPROM</p> <p>Interfacing different peripheral ICs such as 8255.</p> <p>Instruction set covering data transfer, logical, Arithmetic , serial communication etc.</p>	741 & 555 timer pin configuration and different connection and output wave form	-do-

	Program to read the data from memory to sequentially ON the LEDs			
19.	Write the RAM and ROM address ranges (internal and external) of the given Microcontroller kit. Enter data into specific RAM locations and observe the volatility. Practice different commands to enter/edit and execute Assembly programs Identify different ICs used in the given Microcontroller kit and test vital signals on the ICs.	Differentiate Microprocessor and Microcontroller, Architecture of 8051 family of Microcontrollers, pin diagram and various on chip resources . Types of memory with 8051 such as Onchip, external code memory, External RAM .	-do-	-do-
20.	Enter simple programs, execute and monitor the results Configure the port pins as input and output and apply inputs to activate/deactivate LEDs Initialize a Timer, Load a timer , and turn on a LED with delay.	Register Banks and their use Memory mapping of the microcontrollers, bit addressable registers (bit memories). Instruction set and various types of instructions	OCR Block Diagram, Block diagram of signal generator	Transistor amplifiers, Voltage Gain, Current gain, power gain, decibel. Oscillators, Frequency calculations, Relaxation oscillator problems, related exercises,
21.	use the timer as an event counter to count external pulses. Execute a program to flash a set of 4 LEDs connected to port pins on the kit Write a program to use on board ADC and convert the analog voltage signal into digital value and store it memory	Special function registers (SFRs) and their configuration for various applications. Input / output ports and their configuration. Implementation of various Timer and counting functions, aspects of serial communication, Utilization of onchip resources such as ADC etc. Assembly software and compilers for 8051 Microcontrollers. 8052 and its difference with 8051		-do-
22.	Cutting, cleaning and preparing of fibre cable for splicing Splicing of OFC using splicing	Intro to optical fibre as a transmission media, its advantages over other media. Working principle of transmitter and receiver	Architectural drawing of microprocessor	-do-

	machine	in fibre optic communication. Applications and advantages of fibre optic communication.	8085 and data busbar	
23 & 24	Testing of OFC using OTDR Measure propagation , return and bending losses etc. Measure optical signal power using optical power meter Test the optical fiber cable using Visual Fault locator Make optical fibre setup to transmit and receive analog and digital data	Properties of optic fibre, testing, losses , types of fibre optic cables and specifications Encoding of light Fibre optic joints, splicing, testing and the related equipments/measuring tools, precautions to be taken laying of cables, safety aspects while handling optical cables	Different Computer Net working topology	Transistors: Biasing of transistors, CB, CE, CC, DC & AC Load line , operating/ 'Q' point, problems.
25		(i)Project work (ii)industrial visit (optional)		
26		Examination		

Syllabus for the Trade of “*Electronic Mechanic*”
Duration : Six Month

Third Semester
Semester Code: ELM: SEM III

Week No	Trade practical	Trade Theory	Engg Drawing	Workshop cal & science
1.	Modulate and Demodulate various signals using AM and FM on the trainer kit and observe the waveforms. Construct and Test IC based AM Receiver Construct and Test IC based FM receiver Construct and Test IC based FM transmitter. Construct and Test HF Transistor based AM circuit.	Need for Modulation ,types of modulation. Demodulation techniques, Introduction to AM, FM & PM SSBSC & DSBSC FM Generation & Detection Radio Receivers: Types, Super heterodyne receiver Blocks, Principle, characteristics, advantages and disadvantages, Block diagram of FM Receives, Pre-emphasis and De-emphasis, AFC in FM Receivers RF, IF & AF Amplifier Sections	Use of drawing instruments, ‘T’ square, drawing board, construction of simple figures & solids with dimensions, use of different types of scales in inch & millimeters, lettering numbers & alphabets.	Batteries: Cells & Batteries, Series and parallel cells, related exercise,
2.	Assemble a dipole antenna and receive sky free satellite signal.	AM/FM RF Alignment, Radio Wave Propagation – Principle, Fading,	-do-	-do-

	<p>Measure and establish relation of different elements of antenna with the frequency selection.</p> <p><i>Visit to any local cable TV Installation and study the dish antenna elements</i></p>	<p>Fundamentals of Antennas, principles of radiation, antenna parameters, antenna gain, bandwidth, polarization. different elements and types of antennas dipole, yagi, parabolic reflector and their testing.</p>		
3.	<p>Modulate and Demodulate light source using AM/FM/PAM /PPM/ PWM techniques</p> <p>Multiplex/Demultiplex transmit/receive and reconstruct a signal using fibre optic media</p>	<p>Digital modulation and demodulation techniques, sampling and quantization</p> <p>Concept of multiplexing and demultiplexing of AM/FM/PAM/ PPM /PWM signals</p>	<p>Symbols, Cells, batteries, series, parallel, representation, Magnets, Electromagnets, symbols,</p>	<p>Logarithm definition, properties, simple problems.</p>
4.	<p>Identify sensors used in process industries such as RTDs, Temperature ICs, Thermocouples, proximity switches (inductive, capacitive and photo electric) , load cells, strain gauge. LVDT by their appearance</p> <p>Measure temperature of a lit fire using a Thermocouple and record the readings referring to data chart.</p> <p>Measure temperature of a lit fire using RTD and record the readings referring to data chart</p>	<p>Basics of passive and active transducers – Role, selection and characteristics.</p> <p>Working principles of RTD, Thermocouple, pt-100. Sensor voltage and current formats</p>	-do-	-do-
5.	<p>Detect a metal using Inductive proximity switch and indicate on LED. Observe the effect of distance.</p> <p>Detect a water level in a transparent glass using capacitive proximity switch and indicate on LED.</p> <p>Detect a transparent plastic glass using photo electric proximity sensor.</p> <p>Measure the weight on a strain gauge and record the output reading</p> <p>Detect direction of a movement of a motor by connecting it to a rotary encoder</p>	<p>Inductive, capacity sensors, photo – emission, voltaic and conductive cells and their applications Strain gauge, load cell and LDR – construction and working principles. Earthing and shielding-Safety measures</p>	<p>Drawing of various electrical circuits with B.I.S. symbols of circuits, series& parallel circuits, power transformer instrument transformer etc.</p>	<p>Magnetism & Magnetic units: The magnetic field, flux, flux density, Ampere-turns,</p>

6.	<p>Measure speed of a motor by connecting it to a rotary encoder and a frequency counter. Identify on/off solenoid valve and control the flow of water through it by turning it on off electrically.</p> <p>Transfer water from one tub to the other through two different pumps based on the Hi/Low level switches installed in both tubs. Monitor the position change of an object moving through LVDT and record the position.</p>	<p>Working principles of Rotary encoder, solenoid valves, float switches, LVDT, Basics of transmitters and signal conditioning circuits.</p>	-do-	-do-
7.	<p>PIC Family of microcontrollers: Write the RAM and ROM/EPROM address ranges (internal and external) of the given PIC Microcontroller kit. Enter data into specific RAM locations and observe the volatility. Practice different commands to enter/edit and execute Assembly programs Identify different ICs used in the given PIC Microcontroller kit and test vital signals on the ICs. Enter simple programs, execute and monitor the results Configure the port pins as input and output and apply inputs to activate/deactivate LEDs Prepare a program , compile and Dump the code on to the on-chip flash memory of the PIC development kit and test the function. <u>Use embedded C- programming for the following Tasks</u> Control an LED connected to port pin using</p>	<p>Study of 16F/18F series of PIC Family of Microcontrollers. Architecture of PIC Microcontrollers Special features of PIC like OSC Options, Power on Reset, Power up timer, Watch Dog timer, Brownout Reset, Low Voltage Programming. Memory organization of PIC (Data memory, Flash memory and Return Address stack) I/O Ports and their control Registers Parallel Slave Port mode and its importance Timers / Counters in different modes. Timers as “ Ticks”, Timers for measuring Pulse Widths and Frequencies, Timers as PWM outputs. Timer for Capture and Compare operations Watch Dog timer concept ON CHIP peripheral resources like Comparators, ADC. PIC s Instruction set</p>	<p>AC wave form, frequency, wavelength representation, Inductors, series parallel, transformers, types, cores, types, lamination types, representation,</p>	<p>Angular momentum & torque simple problems</p>

	<p>an input switch connected to another port pin Blink an LED connected to a port pin with a delay of 500 ms. Enable a siren using port pin to generate variable audio signals</p>	<p>I/O ports and their configuration PIC C-Programming Basics</p>		
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8&11	<p>Identification of various indicators, connectors on the System unit and I/O devices, identify drives and their capacity, identify various connectors and cables inside the cabinet. Identify connections to rear side and front panel of the cabinet.</p> <p>Disable certain functionality by disconnecting the concerned cables (like USB,SERIAL, FDD etc as may be required in some cases)</p> <p>Replace the CMOS battery</p> <p>identification and testing and troubleshooting of computer memory</p> <p>Replace/Extend a memory module</p> <p>configuring and troubleshooting display problems</p> <p>power supply testing and replacing, upgrading BIOS using flashing.</p> <p>Replace the given HDD on the system</p> <p>Replace the faulty SMPS</p> <p>Boot the system from different options</p> <p>Install a Printer driver software and take print outs</p> <p>Install antivirus software and scan the system</p> <p>Explore the configuration options in the antivirus software</p> <p>Create folder and files</p> <p>use of search engines, Creation of email accounts, sending and receiving the mails</p> <p>configuration of email clients.</p>	<p>Basic blocks of a computer, Hardware and software, I/O devices, HDD,FDD,CDD, DVD.</p> <p>Windows O.S., various types of files, folder concept, various ports in the computer, saving ,copying, deleting & retrieving files, POST Booting concept.</p> <p>Different types of printers and their advantages, function and inter-connection</p> <p>Concept of Internet, Browsers, Web sites, search engines, email, chatting and messenger service. Downloading the Data and program files etc.</p>	-do-	<p>Areas of rectangle, circles, regular polygons, calculation of areas, volumes & weight of simple solids, cubes, hexagonal prism. Shop problems</p>
12-14	<p>Use start menu, check available programs in computer, use search, settings, run and options. Creation of short cuts</p> <p>Changing screen savors.</p>	<p>MS widows: Starting windows and its operation, file management using explorer, Display & sound properties, screen savers, font management</p>	<p>Free hand sketching of plan & elevation of simple objects</p> <p>hexagonal bar, sq. bar,</p>	<p>Inductance: Inductance, mutual inductance, transformer, Inductances in series and parallel,</p>

	<p>Install MS office software</p> <p>Drawing pictures using paint, using menus of paint</p> <p>Explore different Menu/Tool/ Format/status bars of MS word and practice the options</p> <p>Editing the text, saving the text, changing the font and size of text. Creation of brochures and taking the printouts Practice the Mail merge options</p> <p>Prepare a power point presentation on any three known topics with various design features</p> <p>Invoke excel sheet from MS WORD and vice versa</p> <p>Prepare a power point presentation with different animation and visual effects.</p> <p>Convert the given PDF File into WORD File using a suitable software.</p>	<p>,installation of program, setting and using of control panel., application of accessories, various IT tools and applications, Components of desk top</p> <p>Concept of word processing,: MS word – Menu bar, standard tool bar, page setting, editing, formatting ,advance features i.e. highlighting ,cut & paste, subscript & super subscript drawing features, mail merging , tables and borders, printing of document etc.</p> <p>Introduction to power point</p> <p>Basics of preparing slides, different design aspects of slides, animation with slides etc</p>	<p>circular bar tapered bar hollow bar etc.</p> <p>Capacitor structure, symbol, types, colour code, Variable capacitors,</p>	<p>Impedance, related problems.</p>
15-17	<p>Identify different pneumatic and electro pneumatic components</p> <p>Construct and control a single acting cylinder</p> <p>Construct and control a double acting cylinder</p> <p>Construct and control single/double acting cylinder using series/ parallel circuits</p> <p>Construct and perform bidirectional control of a cylinder</p> <p>Construct and control automatic return of a double acting cylinder</p> <p>Construct and control oscillating motion of a double acting cylinder</p> <p>Construct and control a latching circuit using single or double acting cylinder</p> <p>Construct and control automatic return</p>	<p>Intro to pneumatic power source and measure of compressed air, storage and transmission of compressed air, applications of pneumatics in the industries</p> <p>Symbols of different pneumatic and electro pneumatic components</p> <p>Various supply elements such as compressors, reservoir, pressure regulating valve, service unit etc.</p> <p>Various input elements such as push button valves, roller lever valves, proximity switches, Air barriers etc</p> <p>Various pneumatic control elements, processing elements such as directional control valves, shuttle</p>	<p>Calculation of area of triangles, polygons with the aid of trigonometry.</p> <p>Series RLC, Parallel RLC circuits,</p>	<p>Concepts of elasticity & elastic limits, stress & strength, hooke's law, young modulus of elasticity, applications in plant</p>

	<p>initiated by a limit switch. Throttle a cylinder to adjust forward and return strokes. Adjust the pressure as per the requirements Construct and test different electro pneumatic control circuits for various industrial applications.</p>	<p>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 Study different electro pneumatic components used in the industries Various pneumatic power components such as single acting, double acting cylinders and Rotary actuators such as air motors and rotary motors etc.</p>		
18-20	<p>Identify different size of LEDs and measure voltage drop/ current drawn. Identify suitable LED holders and fix them. Identify common anode, cathode seven segments, Connect binary inputs through switches and display different numbers and characters. Identify display decoder/ driver IC by its number and connect to seven segment display. Connect a Thumb-wheel switch and display the set number on a Seven-segment display Construct and test a two digit Digitally Multiplexed display circuit using seven segment Display. Identify LCD display module and its decoder/ driver ICs. Display a word on to a two line LCD. Measure the voltage/ current flowing through</p>	<p>Different types of seven segment displays, decoders and driver IC s for them. Concept of multiplexing and its advantages. Use of DPM (Digital Panel Meter) with seven segment displays to display different voltage & current signals. Principles of working of LCD. Different sizes of LCDs. Decoder/Driver ICs used with LCDs and their pin-out diagrams. Scrolling displays and its design. Use of DPM (Digital Panel Meter) with LCD to display different voltage & current signals</p>	<p>Symbols as per different semi-conductor devices- LDR, VDR, Thermister & their use in circuits.</p>	<p>Capacitance: Charge stored in capacitors, Farad unit and conversions, Capacitor colour coding, Series and parallel capacitances, Capacitive reactance, Impedance,</p>

	<p>a resistor and display it on a seven segment display module. (DPM)</p> <p>Measure the voltage/ current coming from a sensor and display it on a seven segment display module (DPM)</p>			
21-24	<p>Identify solar power panels of different capacities, Measure the voltage and maximum load that can be connected to the panels. Aware of the installation of solar panels. Identify the cables/connectors used to interconnect a solar panel to the indoor equipment</p> <p>Measure the connection losses</p> <p>Connect and test solar panel to the inverter and run the load.</p> <p>Measure the discharge current</p> <p>Mount a solar panel anchor system to an asphalt single roof</p> <p>Attach a solar panel rail system to roof anchors, Mount a solar panel to a roof anchor system</p> <p>Wire a solar panel to a solar controller. Wire a solar controller to a battery storage station and connect storage batteries in a series circuit, Connect storage batteries to a power inverter wire a power inverter to an electrical service panel. Test circuits for voltage and its calculation of voltage. Disassemble solar panels</p>	<p>Need for renewable energy sources, Global warming and its impact. Solar energy as a renewable resource. Solar energy applications.</p> <p>Solar radiation fundamentals.</p> <p>Solar radiation measurement using pyrometers</p> <p>Basics of photo-voltaic and Arrays.</p> <p>Materials used for solar cells. Principles of conversion of solar light into electricity. Types of solar cells. Mono-crystalline and poly crystalline PV cells.</p> <p>Define Components like Solar cell, Module, panel and Arrays.</p> <p>Factors that influence the output of a PV module.</p> <p>SPV systems and the key benefits</p> <p>Difference between SPV and conventional power.</p> <p>Define solar charge controller or regulator and its role.</p> <p>Safety precautions while working with solar systems.</p>	<p>Diodes, Forward & Reverse bias, Rectifiers, Input & output waveforms, Regulator circuits, Clipper circuits, wave forms,</p>	<p>Simple problems on stress in bars. Concept of share modulus, bulk modulus & poisson's ratio</p>
25		<p>(i)Project work</p> <p>(ii)industrial visit (optional)</p>		
26		Examination		

Syllabus for the Trade of “*Electronic Mechanic*”
Duration : Six Month

Fourth Semester
Semester Code: ELM: SEM IV

Week No	Trade practical	Trade Theory	Engg Drawing	Workshop cal & science
1.	Connect a cell phone to PC and transfer the photos using the data card. Connect internet on cell phone and browse popular web sites. Reinstall the cell phone software and test healthiness. Remove the key pad and clean it and test it.	Block diagram and working of cell phones, cell phone features	Drawing of A.F. amplifiers circuit with stage & with types of O/P, p-p.	Resonance: Series resonance, Parallel resonance circuits, Resonance frequency, related exercise,
2.	Dismantle the cell phone and identify power section and test its healthiness Enhance the memory of the cell phone	Study of most frequently occurring faults and remedies	-do-	-do-
3.	Test the healthiness of incoming signal from exchange line. Connect a telephone receiver to the line. Dismantle the telephone set and identify various functional stages, various ICs and components. Service the given faulty telephone set following the service flow charts and the circuit diagrams	Block diagram and working of Telephone receiver. different tones used in Telephone exchange with waveforms. Discuss the function of different stages of a telephone receiver wrt the specific ICs used in the receiver. Discussion on most frequently occurring faults with telephone receivers	Symbols of transistors, CB, CE, CC configurations, biasing circuits,	AC circuits: Power, VA, KVA, Watts, KW, related exercise, power factor,
4.	Make a set up of a small sized intercom system Identify various cards and the power supply components of the system	Working principle of Electronic Private Automatic Branch Exchange. Block diagram of Intercom system and function of each block.	-do-	-do-

	Follow the wiring diagram to identify line defects. Make modifications to the existing set up by introducing more connections. Change the number of a telephone receiver.	Specifications of a typical intercom system. Most frequently occurring faults with an intercom system and remedies.		
5.	Identify various microphones and pick ups and test them Make the cables with connectors for the microphones and test them. Make setup with wireless mic.	Sound wave characteristics, Room, Acoustics, Decibel, B.H. Curve, A.C./D.C. Bias, P.A. System , Amplifiers , Various microphones, speakers and their selection	Block diagram of an oscillator, symbols for different wave shapes, Sq., saw tooth, sine, triangular etc.	Concept of shear forces, bending moment, torsion in shaft, simple problems.
6.	Dismantle and identify various functional blocks of a PA system Measure and monitor vital signals at different test points Identify critical ICs and components and test their healthiness	Specifications of typical PA (Public Address) System. Block diagram and various stages of PA System	-do-	-do-
7& 8	Identify various controls, sockets and connectors of ACD/VCD/DVD players Dismantle the given player and identify various parts, mechanism and major functional parts. Test and monitor voltage/ waveforms at main points. Fault findings of given VCD player Fault finding on given ACD / VCD drive mechanism Study and fault findings of optical pickup units, and drive mechanism ,to wire up ACD to VCD conversion card Identify various cables.	Working principle of ACD/VCD/DVD players, CD mechanism & power supply , types of CD's and writing procedure on CDs , five in one system, MP3 formats / flash memory recording, Laser fundamentals, optical pickup units, laser beam , CD recording standards Difference between ACD and VCD players, & DVD , ,MP easy card, Single CD and 3 CD changer. Fault finding procedure in different stages including CD drive mechanism	Single stage amplifiers, Multistage amplifiers, Class 'A', Class 'B', Push pull, Complimentary symmetry circuits, Oscillators circuits, Multivibrators, UJT oscillator, FET, MOSFET symbols, DIAC,TRIC	Diodes: Rectifier, peak voltage, PIV, Rectifier efficiency, Voltage regulators, Voltage doublers, multipliers, Clipper circuits, related exercise.

9	<p>Construct and test IC based FM receiver.</p> <p>Construct and test IC based AM receiver.</p> <p>Dismantle the given FM Receiver set and identify different stages.</p> <p>Identify AM section, audio amplifier section etc.</p>	<p>AM/FM Band of frequencies, different stages in AM/FM Commercial receivers.</p> <p>General defects and trouble shooting aspects.</p>	-do-	<p>Properties of triangles, simple problem of height & distance</p>
10-11	<p>Trace and rectify the faults of a various remote controls</p> <p>Identify various connectors provided on a LCD TV and test the healthiness.</p> <p>Identify various connectors and Connect the cable operator's external decoder (set top box) to the TV. Identify the various controls and sections of Plasma , projection TV, Digital TV</p>	<p>Colour Picture tube – Parts and functions, Construction, function of degaussing coil, functions of pure and convergent magnets, difference between monochrome and colour picture tubes. TV Remote Control – Types, parts and functions, IR Code transmitter and IR Code Receiver, Working principle, operation of remote control. Different adjustments, general faults in Remote Control. Difference between a conventional CTV with LCD & LED TVs,.</p> <p>IPS panels and their features</p> <p>Different types of interfaces like HDMI, USB, RGB etc with latest TVs.</p>	<p>Drawing of AM&FM modulated wave at various modulation 100 pc., 50 pc etc.</p>	
12	<p>Dismantle and identification of various parts, sensors, wiring, tracing of various controls, Electronic circuits, fault finding in various types of washing M/C.</p>	<p>Washing M/c: different types of machines, Block diagram & basic working principle of manual, semi automatic and fully automatic machines, study the working of motors, different types of timers, power supply circuits, Different aspects of servicing of Washing M/C</p>	<p>Logic gates, Combinational gates, other circuits.</p>	<p>Power transmission by shaft, belts & ropes</p>

13	<p>Dismantle and identification of various parts, wiring, tracing of various controls, fault finding in Microwave oven</p> <p>Dismantle and identification of various parts, wiring, tracing of various controls, Electronic circuits, fault finding in various types of Vacuum cleaners.</p>	<p>Microwave oven: Different types of oven, study the various functions of Oven, Microwave generation system-circuit , description & working ,study ,working of Power supply, various precautions to be observed, Different aspects of servicing of Microwave Oven.</p> <p>Vacuum cleaner-Block diagram, working principle, study of different features of the machine, study & working of motor used , Electronic circuit, power supply, Different aspects of servicing of Vacuum cleaner.</p>	-do-	-do-
14	<p>Dismantle and identification of various parts, wiring, tracing of various controls, Electronic circuits, fault finding in various types of Mixers/grinders/steam Irons/skimmers etc.</p>	<p>Mixer/Grinder: Block diagram, working principle , study of different features of machine , Study & working of motor used ,different aspects of servicing of Vacuum cleaner.</p>	-do-	<p>Concepts of lifting machine, velocity ratio, mechanical advantage, relation between them</p>
15& 16	<p>Identify different cable TV components Test the healthiness of the cable TV Components Draw, Trace or follow the cable TV setup of any commercial installation. Observe the alignment of satellite DISH for various signals Measure the field strengths at different points. <i>Take the students to any nearby commercial cable TV installation to carry out the above tasks.</i></p>	<p>Working of various cable TV components Different type of satellite DISH used in cable TV. Mounting and Tracking procedures. Different type of cables used for consumer connections. Set top box and its role, Decoders role in selection of channels</p>	<p>Exercise on blue print reading/ circuit. Reading of house service connections & small power circuits, Connections of ammeter, voltmeter, KWh-meter with ISI symbols, circuit,</p>	-do-

17 & 18	<p>Identify different CCTV components Draw, Trace or follow the CCTV setup of any commercial installation. Identify the strategic locations for the installation of cameras. Operate and learn the procedure for switching of cameras to have different views. connectors and sockets used on DVRs Test the healthiness cables and connectors. connect CCTV Cameras to DVR, Record and Replay.</p> <p>Dismantle DVR and identify major functional blocks and test for the healthiness. <i>Take the students to any nearby commercial CCTV installation to carry out the above tasks.</i></p>	<p>Types of cameras and their specifications used in CCTV systems CCTV Setup and its components Working of Digital Video Recorders and types of DVRs Block diagram of DVR</p>	-do-	<p>Digital Electronics: Binary numbers, Binary arithmetic, Basic logic gates, other logic gates,</p>
19 - 22	<p>Identify various pvc ducts used for resting the cables Cut and bend according to requirements place a group of wires and tie them mark on both sides using ferrools route the cable bunch according to requirements, use locking plug to prevent pulling of cables prepare the cable with the lugs install a terminal block and practice terminating the cables ends. Test the prepared set up using any simple digital control circuits Practice fitting of LEDs with holders on a hard board sheet.</p>	<p>Study various types of control panels and observe the routing, ducts, cable laying, tying, use of ferrools, types of terminations, connectors. <i>Use internet to view different types of electronic control panels and observe as detailed above</i></p>	<p>Reading & drawing of different stages of R/R/ free hand sketches of trade objects</p>	<p>Vector – definition of scalar, and vector, notations and representation of vectors</p>

	<p>Fix the sockets and switches on a hard board sheet.</p> <p>Fix a DIN Rail on a metal sheet</p> <p>Fix a PVC duct on a hard board sheet.</p> <p><i>Visit any industry to see control panel wiring, Modules placed on DIN rails etc.</i></p>			
23-24	<p>Identify various components and mechanism</p> <p>Interface the conveyor system to the given microcontroller kit</p> <p>Identify the resources required to control the conveyor.</p> <p>Program the microcontroller kit to control the conveyor</p>	<p>Control mechanism of conveyors using microprocessor and microcontrollers. Study the sensors, actuators used in the system. Type of motors and synchronization used.</p>	-do-	<p>Digital Electronics: Combined logic gates, other digital circuits.</p> <p>Addition and subtraction of vectors. Scalar and cross product. Simple problems</p>
25	Revision			
26	Examination			

TRADE: ELECTRONICS MECHANIC

LIST OF TOOLS & EQUIPMENT

A. TRAINEES TOOL KIT FOR 16 TRAINEES +1 INSTRUCTOR

Sl.No	Name of the items	Quantity
1	Connecting screwdriver 100 mm	17 nos
2	Neon tester 500 V.	17 nos
3	Screw driver set (set of 5)	17 nos
4	Insulated combination pliers 150 mm	17 nos
5	Insulated side cutting pliers 150 mm	17 nos
6	Long nose pliers 150 mm	17 nos
7	Soldering iron 25 W. 240 V.	17 nos
8	Electrician knife	17 nos
9	Tweezers 100mm	17 nos
10	Digital Multimeter	17 nos
11	Soldering Iron Change able bits 15 W	17 nos
12	De- soldering pump	17 nos

B. General Machinery Shop outfit

Sl.No	Name of the items	Quantity
1	Steel rule 300mm	4 nos
2	Steel measuring tape-3 m	4 nos
3	Tools makers vice 100mm (clamp)	1 no
4	Tools maker vice 50mm (clamp)	1 no
5	Crimping tool (pliers)	2 nos
6	Soldering Iron 25W	6 nos
7	Magneto spanner set	2 nos
8	File flat 200mm bastard	2 nos
9	File flat 200mm second cut	2 nos
10	File flat 200mm smooth	2nNos
11	100mm flat pliers	4 nos
12	100mm round nose pliers	4 nos
13	Scriber straight 150mm	2 nos
14	Soldering Iron 240W	1 no
15	Hammer ball pen 0.5Kg	1 no
16	Allen key set (set of 9)	2 nos
17	Tubular box spanner (set of 6nos)	1 no
18	Magnifying lenses 75mm	3 nos
19	Drill bit 5/16" (7.9mm)	2 nos
20	Continuity tester	6 nos
21	Hacksaw frame adjustable	2 nos
22	Cold chisel 20mm	1 no
23	Scissors 200mm	1 no
24	Handsaw 450mm	1 no
25	Hand Drill Machine	2 nos

26	First aid kit	1 no
27	Fire Extinguisher	2 nos
28	Bench Vice	3 nos
29	Bench Grinder	1 no
30	Dual DC regulated power supply 30-0-30 V, 2 Amps	2 nos
31	Dual Tracking DC regulated power supply 30-0-30 V, 2Amp	1 no
32	DC regulated power supply 0-300 V, 500 mA,	1 no
33	DC regulated power supply 0-24 V, 1Amp	2 nos
34	LCR meter (Digital)	1 no
35	CRO Dual Trace 30 MHz	1 no
36	Pulse Generator 0.1 Hz to 100Mhz.	2 nos
37	Signal Generator, 0-100 KHz	1 no
38	Battery Charger	1 no
39	Digital Multimeter and Analog multimeters	6 & 3 nos
40	Function generator 0.001 Hz to 100Mhz	2 nos
41	Dimmer stat, 8 Amps	6 nos
42	Analog Component Trainer	4 nos
43	Op Amp trainer	3 nos
44	Digital IC Trainer	3 nos
45	Personal Computer System with latest configuration with printer	1 no each
46	Digital IC Tester	1 no
47	Digital and Analog Bread Board Trainer	4 nos
48	Soldering & De soldering Station	1 no each
59	Assorted values of Resistors, capacitors and Inductors	As reqd.
50	Hot air soldering station –cum-De-soldering Station for SMD	1 no
51	Rheostats various values and ratings	6 nos
52	Soldering Gun with changeable bits 25 watts	3 nos
53	Resistance Bridge(Including P.O. Box)	2 nos
54	Capacitance test Bridge	2 nos
55	Inductance Bridge	2 nos
56	SMPS trainer	2 no
57	UPS trainer	2 nos
58	POWER ELECTRONICS TRAINER with at least 6 no's of onboard applications	1 no
59	LINEAR IC TRAINER with at least 6 no's of onboard applications	1 no
60	FIBRE OPTIC TRAINER	1 no
61	MICROPROCESSOR TRAINER KITS with 6 different application interfaces	1 no
62	MICROCONTROLLER TRAINER KITS with 6 different application interfaces	1 no
63	CRO Trainer	1 no
64	Different types of electronic and electrical cables, connectors, sockets, terminations.	As required
65	Different types of Analog electronic components, digital ICs, power electronic components	As required
66	Transducer Trainer	1 no
67	Seven segment DPM	2 nos
68	LCD based DPM	2 nos
69	5KVA online UPS	1 no
70	LAN Cards	4 nos

71	Motherboards (of different make)	3 nos
72	Hard Disk (500 GB or better)	4 nos
73	External Hard disk	2 nos
74	Computer Spares	As reqd.,
75	Different types of memory cards	3 nos
76	Blu-Ray drive and player	1 nos
77	Industrial Electropneumatic trainer	2 nos
78	Fibre optic communication trainer	2 nos
79	PCB DESIGN SOFTWARE and PCB making materials	4 LICENSES
80	Low wattage solar panel based inverter	1 no
81	Dipole antenna + Dish antenna	1 each
82	Mobile phone (different models) at least one 3 G mobile(android)	2 nos
83	DVD player with amplifier	2 nos
84	AM/FM Commercial radio receivers	4 nos
85	PA System with MICs and speakers	1 no
86	LCD TV (preferably in Trainer kit form)	1 no
87	LED TV (preferably in Trainer kit form)	1 no
88	Optical disk drives	2 nos
89	Cable TV set up with set top box	1 system
90	CCTV set up	1 system
91	Bending Machine (6-inch)	1 no
92	Sheet cutting machine (3 mm)	1 no
93	Wheel cutting machine (pipe cutting machine)	1 no
94	Grinding machine (4 inch)	1 no
95	Panel wiring components and materials as specified in practical's	As reqd.,
96	Mini EPABX system with 8 connections and telephones	1 no
97	Washing machine (auto and semi automatic)	1 each
98	Vaccum cleaner	1 no
99	Microwave oven 20 litres	1 no
100	Mixer cum grinder	1 no
101	Steam iron	2 nos
102	Milk skimmer	1 no
103	DTH set up	1 no
104	Signal strength meter	1 no

C.WORKSHOP FURNITURE:

Sl. No.	Name of the items	Quantity
1	Instructor's table	1 No
2	Instructor's chair	2 Nos
3	Metal Rack 100cm x 150cm x 45cm	4 Nos
4	Lockers with 16 drawers standard size	2 Nos
5	SteelAlmirah 2.5 m x 1.20 m x 0.5 m	2 Nos
6	Black board/white board	1 No

