

**Syllabus for the Trade
of
MECHANIC CONSUMER ELECTRONIC APPLIANCES
(SEMESTER PATTERN)**

**UNDER
CRAFTSMAN TRAINING SCHEME**

Re-designed in 2014

By

Government of India

**Directorate General of Employment & Training
Ministry of Labour & Employment (DGET)**

GENERAL INFORMATION

1. **Name of the Trade** : MECHANIC CONSUMER ELECTRONIC APPLIANCES
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 under 10+2 system of education

7. **Unit Size (No. of Students)** : 20 Trainees

8. **Instructor's/Trainer's Qualification** :
 - a) B.E./B.Tech in Electronics/Electronics & Telecommunication /Electronics & Communication with one year experience in the relevant field
OR
 - b) Diploma in Electronics/Electronics & telecommunication/ Electronics & Communication from recognized board of technical education with two years experience in the relevant field.

OR
 - c) NTC/NAC in the trade with three years' experience respectively in the relevant field

9. **Desirable qualification** : Preference will be given to an Instructors Certificate (CIC).

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

COURSE INFORMATION

Trade: - MECHANIC CONSUMER ELECTRONIC APPLIANCES

1. Introduction :-

This course is meant for the candidates who aspire to become a Technician to repair different Domestic and Consumer **Appliances**

2. Deliverables:- After successful completion of this course the trainee shall be able to perform the following skills with proper sequence.

1. Identify various active and passive components and their applications.
2. Handle different types of Electronic measuring Instruments
3. Identify different types of faults in electronics equipments.
4. Repair & maintenance computer hardware & networking
5. Repair and maintenance of SMPS, UPS, Inverter, solar power system and various analog and digital circuits.
6. Repair and maintenance of electronics communication equipments and fiber optics.
7. Installation of various transducer, sensor.
8. Repair maintenance of microcontroller based systems.
9. Repair maintenance& installation of LED/ LCD TV, Cell phone (Mobile).
10. Repair maintenance& installation of Consumer electronics equipments like Washing Machine, Dish Washer, Mixer Grinder, water purifiers, Vacuum cleaner, Microwave oven, Immersion heater, Induction cook top etc.
11. Repair, maintenance & Installation of various types of printers.
12. Repair, maintenance & Installation of Home theater systems
13. Repair, maintenance& Installation of CCTV

Employment Opportunities:- On successful completion of this course, the candidates shall be gain fully employed in the following industries:

1. Various Consumer/Domestic Electronics appliance Manufacturing Industry.
2. Service industries like BSNL, MTNL, Home appliances manufacturing company, Railways, ISRO, Naval dockyard, RCF, BPCL etc.
3. Manufacturers of Audio and Video Equipment
4. In public sector industries like BHEL, BEML, NTPC, AIR INDIA etc and private industries in India & abroad.
5. Various Consumer electronics company like Videocon, Samsung, LG, Onida, Akai, Panasonic, Sony, IFB, Godrej, Whirlpool etc
6. Self employment

Further learning pathways:

- On successful completion of the course trainees can opt for addition NCVT certificates in the following courses by doing the Third and Forth semester since the first and second semester is common for all three Electronics courses.
 - A. Electronic Mechanic
 - B. Technician Power Electronics Systems
- Also on successful completion of the course they can pursue Apprenticeship training in the reputed Industries / Organizations.
- They can have lateral entry to Diploma course

Syllabus for the Trade of “MECHANIC CONSUMER ELECTRONIC APPLIANCES”
Duration: 6 Months

First Semester

Semester Code: MCE: SEM I

Fundamentals of Electrical and Electronic components

OBJECTIVES:

- Familiarize with basics of electricity
- Identify and Use different hand tools
- Testing of electrical parameters, cables and measurements
- Identify and test cells/batteries
- Identify and test passive electronic components
- Use electronic components in different circuits
- Practice soldering and de-soldering of various types of electrical and electronic components
- Identify and test semiconductor devices
- identify , disassemble, and assemble a computer system
- replace various functional parts HDD, CDD, SMPS, Memory etc
- Practice of OS, Clean the system using Antivirus software and maintain the computer system
- Work with MS office packages
- Familiarize with internet browsing, creation of mail IDs, download desired data from internet using search engines

SYLLABUS FOR TRADE PRACTICAL AND TRADE THEORY SEMESTER-I

Week No	Trade practical	Trade theory
1	<p><u>Trade and Orientation</u> Visit to the institute and workshops. Introduction with the principal and other staffs. Care and safe working habits, safety precautions to be demonstrated to the trainees. Elementary first aid practice. Identify different types of fire extinguishers. Do's and Don'ts and standard practices to be followed in the institute</p>	<p>Introduction to NCVT and certification mechanism. Semester system and its flexibility for the trainee and to the institute. EM trade and its applicability in industries. Expectations of the industry from trainees after the completion of the trade. The skills to be acquired to become part of industry. Introduction to safety, safety signs, and measures to be taken to maintain the standards of safety of personal working and the equipments. Different first aid mechanisms to rescue the affected by electric shocks or any physical injuries.</p>
2 – 3	<p><u>Hand Tools and their uses</u></p> <ul style="list-style-type: none"> • Demonstration and uses of hand tools- screw drivers, pliers, tweezers, tester, wire stripper, electrician knife, steel rule, scribe, punches, hack saw, hammer, files, bench vice and drilling machine. • Simple mechanical fixtures • Identification of types of screws, bolts, nuts, washers, rivets, clamps, connectors • Fix screws of different sizes on wooden boards • Cutting of wooden blocks using hand/hack saw • Simple fitting practice and drilling practice • Simple sheet metal works 	<p>Identification, specifications, uses and maintenance of commonly used hand tools. Riveting of tags and lugs, cutting and bending of sheet metals, chassis and cabinets.</p>
4 – 5	<p><u>Basics of AC and Electrical Cables</u></p> <ul style="list-style-type: none"> • Identify the Phase, Neutral and Earth on power Socket. • Construct a test lamp and use it to check mains healthiness. • Use a Tester to monitor AC power. • Measure the voltage between phase and ground and rectify earthing. • Identify and test different AC mains cables. • Skin the electrical wires /cables using the 	<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 supply. Terms like Line and Phase voltage/ currents. Insulators, conductors and semiconductor properties. Different type of electrical cables and their Specifications.</p>

	<p>wire stripper and cutter.</p> <ul style="list-style-type: none"> • Measure the gauge of the wire using SWG. • Prepare the mains cable for termination. • Crimp the lugs to wire end and Solder the lugs to wire end • Solder/crimp/terminate different types of electrical connectors • Measure AC and DC voltages using multi meter. 	<p>Types of wires & cables, standard wire gauge(SWG). Classification of cables according to gauge(core size), number of conductors, material, insulation strength, flexibility etc.</p>
6	<p><u>Cells & Batteries</u></p> <ul style="list-style-type: none"> • Identify the primary and secondary cells • Measure and test the voltages of the given cells/battery using analog / digital multimeter. • Charging and discharging the battery. • Maintain the secondary battery. • Use a hydro meter to measure the specific gravity of the secondary battery. 	<p>Battery /Cells: construction, types of primary and secondary cells, materials used, Specification of cells and batteries. Charging process, efficiency, life of cell/battery. Selection of cells / Batteries etc. Use of Hydrometer. Types of electrolytes used in cells and batteries. Series / parallel connection of batteries and purpose of such connections.</p>
7-9	<p><u>Passive Components</u></p> <ul style="list-style-type: none"> • Identify the different types of resistors • Measure the resistor values using colour code and verify the reading by measuring in multi meter • Identify the power rating using size • Verify ohms law • Measure the resistance, Voltage, Current through series and parallel connected networks using multi meter • Identify different inductors and measure the values using LCR meter • Identify the different capacitors and measure capacitance of various capacitors using LCR meter • Make an electro magnet. • Install a solenoid valve in a flow line. • Identify and test the circuit breaker and other protecting devices. • Dismantle and identify the different parts of a relay. • Connect a relay in a circuit and test for its working • Dismantle and identify the different parts of the electrical contactor • Connect a contactor in a circuit and test for its working • Construct and test RC time constant circuit • Construct a RC differentiator circuit and convert triangular wave into square wave • Construct and test series and parallel resonance circuit 	<p>Ohm's law and its variables. Resistor-definition, types of resistors, their construction & specific use, color-coding, power rating. Equivalent Resistance of series parallel circuits. Distribution of V & I in series parallel ckts. KVL& KCL with applications. Principles of induction, inductive reactance, Types of inductors, construction, specifications and applications (energy storage concept). Self and Mutual induction. Behavior of inductor at low and high frequencies. series and parallel combination, Q factor. Capacitance and Capacitive Reactance, Impedance. Types of capacitors, construction, specifications and applications. Dielectric constant. Significance of Series parallel connection of capacitors. Capacitor behavior with AC and DC. Concept of Time constant of a RC circuit. Concept of Resonance and its application in RC, RL& RLC series and parallel Types and circuit Properties of magnets and their materials, preparation of artificial magnets, significance of electro magnetism, types of cores. Electromagnetic Relays, types, construction, specifications- coil voltage and contact current capacity.</p>

10	<p><u>Transformers</u></p> <ul style="list-style-type: none"> • Identify different types of mains transformers and test. • Identify the primary and secondary transformer windings and test the polarity. • Identify different sizes, shapes of cores used in low capacity transformers. • Measure the primary and secondary voltage of different transformers • Construct a low voltage night lamp • Identify and test the variac 	<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, Phase angle, phase relations, active and reactive power, power factor and its importance in the industry.</p>
11- 12	<p><u>AC & DC measurements</u></p> <ul style="list-style-type: none"> • Identify the meter for measuring AC & DC parameters • Use the multi meter to measure the various functions (AC V, DC V, DC I, AC I, R) • Replace the fuse, battery for the given multimeter • Identify the different controls on the CRO front panel and observe the function of each controls • Measure DC voltage, AC voltage ,time period using CRO • Identify the different controls on the function generator front panel and observe the function of each controls • Connect the function generator to CRO and observe the different wave forms 	<p>Introduction to electrical measuring instruments, Importance of meter, classification of meters, forces necessary to work a meter. MC and MI meter, range extension, need of calibration, characteristics of meters and errors in meters. Multi meter, use of meters in different circuits. Care and maintenance of meters. Use of CRO, Function generator, LCR meter</p>
13	<p><u>Soldering & De-soldering and switches</u></p> <ul style="list-style-type: none"> • Identify different types of soldering guns and practice soldering of different electronic active and passive components and IC bases on lug boards and PCBs • Join the broken PCB track and test • Practice de-soldering using pump and wick • Prepare component for soldering. • Demonstrate soldering and de-soldering using soldering and de-soldering stations • Identify and use SPST, SPDT, DPST, DPDT, tumbler, push button, toggle, piano switches used in electronic industries • Make a panel board using different types of switches for a given application 	<p>Different types of soldering guns, related to Temperature and wattages, types of tips. Solder materials and their grading. Use of flux and other materials. Selection of a soldering gun for specific requirement. Soldering and De-soldering stations and their specifications. Different switches and their specification, uses.</p>

14-15	<p><u>Rectifiers</u></p> <ul style="list-style-type: none"> • Identify diodes, diode bridges • Record the specifications of different diodes using data book/ web site • Identify different packaging styles of diodes and heat sinks types • Test the given diode using multi meter • Construct and test Diode as a half wave, full wave and Bridge rectifier. • Construct a rectifier with capacitor filter circuit and measure the output voltage • Use CRO to observe the ripple from rectifiers for different load and filter capacitors • Identify and Test Zener diode. • Construct and test Zener based voltage regulator circuit. 	<p>Semiconductor component number coding for different electronic components such as Diodes, Zeners. 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>
16	<p><u>IC Regulators</u></p> <ul style="list-style-type: none"> • Identify the different types of fixed +ve and –ve regulator ICs and the different current ratings (78/79 series) • Identify the pins • Construct a fixed voltage regulator as a variable one by floating the reference • Identify the different heat sinks for IC based regulators • Observe the output voltage of different IC regulators by varying the input voltage • Construct a dual power supply by using the fixed IC regulators with current limiting and short circuit protection features 	<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>
17-21	<p><u>Computer Hardware, OS, MS office Networking</u></p> <ul style="list-style-type: none"> • Identification of various indicators, Connectors, ports on the computer cabinet • Identify drives and their capacity. • Identify various connectors and cables inside the cabinet & Identify connections to rear side and front panel of the cabinet • Identify various parts of the system unit and motherboard • Disable certain functionality by disconnecting the concerned cables (like USB, SERIAL, Flat) • Replace the CMOS battery • Replace/Extend a memory module • Test and Replace the SMPS • Replace the given HDD on the system • Replace the given DVD on the system • Configuring and troubleshooting display problems 	<p>Basic blocks of a computer, Hardware and software, I/O devices, keyboard, types of mouse and their working, Different types of printers, their function and inter-connection and their advantages HDD, CDD, DVD. Various ports in the computer. POST Booting concept. Windows O.S. MS widows: Starting windows and its operation, file management using explorer, Display & sound properties, screen savers, font management, installation of program, setting and using of control panel., application of accessories, various IT tools and applications, Components of desk top Concept of word processing,: MS word – Menu bar, standard tool bar, saving, copying, deleting & retrieving files,</p>

	<ul style="list-style-type: none"> • Boot the system from different options • Practice various features of OS • Perform maintenance of the computer using standard tools provided in the OS • Install a Printer driver software and test for print outs • Install antivirus software and scan the system and Explore the configuration options in the antivirus software • Install MS office software • Use start menu, check available programs in computer, use search, settings, run and options. Creation of short cuts • Changing screen savers • Create folder and files, Drawing pictures using paint, using menus of paint • Explore different Menu/Tool/Format/status bars of MS word and practice the options: Editing the text, saving the text, changing the font and size of text. • Creation of brochures and taking the printouts • Practice the Mail merge and Hyperlink options • Prepare a power point presentation on any three known topics with various design features • Prepare a power point presentation with different animation and visual effects. • Invoke excel sheet from MS WORD and vice versa • Convert the given PDF File into WORD File using suitable software. (<i>use free downloadable software</i>) • Use of search engines, Creation of email accounts, sending and receiving the mails configuration of email clients. • Identify the cables and network components. • Making UTP cross cables and testing, Making straight cables and testing, Making cable layout drawing 	<p>page setting, editing, formatting, advance features i.e. highlighting, cut & paste, subscript & superscript drawing features, mail merging, Hyperlink, tables and borders, printing of document etc.</p> <p>Excel – Worksheet basics, data entry and formulae. Moving data in worksheet using tool bars and menu bars, Formatting and calculations, printing worksheet, creating multiple work sheets, creating charts, changing chart types, Adding titles, legends and gridlines, colouring charts, printing charts, placing charts in a word file.</p> <p>Introduction to power point Basics of preparing slides, different design aspects of slides, animation with slides etc</p> <p>Concept of Internet, Browsers, Websites, search engines, email, chatting and messenger service. Downloading the Data and program files etc.</p> <p><u>Computer Networking:-</u></p> <p>Network features-Network topologies, protocols- TCP/IP, UDP, FTP, models, types, network components, network medias, Specification and standards, types of cables, UTP, STP, Coaxial cables. Network components like hub, Ethernet switch, router, NIC Cards, connectors, media and firewall. Difference between PC & Server.</p> <p>Operating system -OS, NOS-features, types etc.</p> <p>Identify physical topology of a network and members of the network, Internet search engines and applications.</p>
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SYLLABUS FOR WORKSHOP SCIENCE AND CALCULATION SEMESTER-I

Week No	Workshop calculation & Sc.
1	FPS,CGS,SI Units dimensions and conversions
2 – 3	Fundamentals and derived units, Supplementary units
4 – 5	Basic algebra - algebraic formula. Simultaneous equation– quadratic equations.
6	Simultaneous linear equation in two variables. Factorization.
7-9	Ohms law: Current, voltage, resistance and related problems, multiple and submultiples units, electric power, power dissipation in resistance, power formulas. Calculation of Equivalent resistance of series and parallel circuits Calculation of voltage and current in series and parallel resistive circuits
10	Calculations related to transformers, turns ratio, voltage ratio, current ration & efficiency,
11-12	Calculations related extension of Direct-current meters: Moving coil meter Loading effect of voltmeters related problems
13	Heat and temperature, its units and specific heat of solids, liquids and gases
14-15	Half wave, full wave and bridge rectifier dc output, ripple factor, efficiency calculations
16	Calculation on zener regulator circuits.
17-21	Time constant calculation of RC circuit. Voltage, current, phase angle and Impedance calculation of RC, RL Circuits Voltage, current, phase angle and Impedance calculation of RLC Circuits Calculation of resonant frequency of series and parallel circuits

SYLLABUS FOR ENGINEERING DRAWING SEMESTER-I

Week No	Engineering Drawing
1	Engineering drawing and its importance
2 – 3	Free hand sketches of straight line, square, rectangle, circle, polygon etc.
4 – 5	Free hand sketches of hand tools
6	Types of lines
7-8	Dimensions and its types. Use of drawing instruments, T square, set square etc. Lettering practice
9	Types and Scaling of drawings. Electrical symbols
10- 11	Symbols of electronic components
12	Schematic diagram of Moving coil meter, Moving Iron meters,
13	Schematic diagram voltmeter, Ammeter, Ohm meter.
14-15	Draw Half wave, full wave and bridge rectifier circuits with and without filters
16	Regulated power supplies with capacitors
17-21	Orthographic 1 st angle projection

Syllabus for the Trade of “MECHANIC CONSUMER ELECTRONIC APPLIANCES”
Duration: 6 Months

Second Semester

Semester Code: MCE: SEM II

Analog and Digital Electronic Circuits

OBJECTIVES

- Construct and test simple amplifier circuits
- Construct and test wave shaping circuits
- Identify and test power electronic components
- Identify and test opto electronic devices
- Practice SMD Soldering and De-soldering of Simple SMD components
- Identify and verify truth tables of various digital ICs using Data book
- Practice circuit simulation software to simulate and test the circuits
- Stimulate and test various circuits using the software
- Identify and test various types of LEDs and LED displays
- Construct and test various OP-AMP IC based circuits
- Construct and test 555 IC based application circuits

SYLLABUS FOR TRADE PRACTICAL AND TRADE THEORY SEMESTER-II

Week No	Trade practical	Trade theory
1	<p style="text-align: center;"><u>Transistor</u></p> <ul style="list-style-type: none"> • Identify PNP and NPN Transistors • Record the different specification of transistors using data book/web site • Identify different transistors with respect to different packaging styles, power, switching transistor, heat sinks • Measure E-B, C-B & C-E terminal resistances and infer. • Construct and test a transistor based switching circuit to control a relay (use Relays of different coil voltages and Transistors of different β) • Construct a Transistorized amplifier vary the gain by changing the circuit components 	<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 impedances Transistor power ratings & packaging styles, use of different heat sinks.</p>
2-3	<p style="text-align: center;"><u>Amplifier</u></p> <ul style="list-style-type: none"> • Construct and test voltage divider bias • Construct and Test a common emitter amplifier with and without bypass capacitors • Construct and Test common base amplifier • Construct and Test common collector/emitter follower amplifier • Construct and Test Darlington amplifier • Construct and test a two stage RC Coupled amplifier • Construct and test a Class B complementary push pull amplifier • Construct and test class C Tuned amplifier 	<p>Transistor (CB, CE & CC) configurations and their characteristics and applications Transistor biasing circuits and stabilization Techniques. Classification of amplifiers according to frequency, mode of operation, methods of coupling, Voltage amplifiers- voltage gain, loading effect. Configuration of common emitter, common base, common collector transistor, their definition characteristics and applications. Single stage CE amplifier, (CC amplifier) emitter follower circuit and its advantages RC coupled amplifier, Distinguish between voltage and power amplifier, Push pull amplifier and class C tuned amplifier Alpha, beta, voltage gain, Concept of dB dBm. Feedback and its types.</p>

4	<ul style="list-style-type: none"> • Demonstrate Colpitts oscillator, Hartley oscillator circuits • Construct and test a RC phase shift oscillator circuits • Construct and test a crystal oscillator circuits • Demonstrate Astable, monostable, bistable circuits using transistors. 	<p>Introduction to positive feedback and requisites of an oscillator, Study of Colpitts, Hartley, Crystal and RC oscillators.</p> <p>Types of multi vibrators and study of circuit diagrams</p>
5	<p><u>Wave shaping circuits</u></p> <ul style="list-style-type: none"> • Construct and test shunt clipper • Construct and test series and dual clipper circuit using diodes • Construct and test clamper circuit using diodes • Construct and test Schmitt trigger circuit using transistors 	<p>Diode shunt clipper circuits and Clamping /limiting circuits and their applications.</p> <p>Schmitt trigger circuits</p>
6-7	<p><u>Power Electronic Components</u></p> <ul style="list-style-type: none"> • Identify FET transistors and record main parameters from the Data book • Test the given FET using multi meter • Construct and test a FET Amplifier • Identify SCRs of different ratings and the packages • Test different SCRs using a Multi meter and component tester • Construct a test circuit to test SCRs • Construct a test circuit of SCR using UJT triggering • Identify different heat sinks used with SCRs. • Construct a snubber circuit for protecting SCR use freewheeling diode to reduce back emf. • Construct and test solid state relay. • Construct a jig circuit to test DIAC • Identify and test a TRIAC using multi meter • Construct a simple dimmer circuit using TRIAC • Identify and Test a UJT using multi meter • Construct UJT based free running oscillator and change its frequency. 	<p>Construction of FET, differentiate it with BJT. Purpose of Gate, Drain and source terminals and voltage / current relations between them, 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 and UJT.</p>
8	<p><u>MOSFET & IGBT:</u></p> <ul style="list-style-type: none"> • Identify MOSFET by its number • Identify different heat sinks used with various power MOSFET devices. • Construct MOSFET test circuit with a small load • Identify IGBT by its number • Construct IGBT test circuit with a small 	<p>Working of MOSFET, Power MOSFET and IGBT - their types, characteristics, switching speed, power ratings and protection. Differentiate FET with MOSFET, differentiate a Transistor with IGBT.</p>

	load	
9	<p><u>Opto Electronics:</u></p> <ul style="list-style-type: none"> • Identify different types of LEDs • Test LEDs using DC supply and measure voltage drop and current using multimeter • Identify and test LDR, Identify photo voltaic cell • Construct a circuit to test a photo voltaic cell • Construct a circuit to switch a lamp load using photo diode • Construct a circuit to switch a lamp load using photo transistor. • Identify Opto coupler input and output terminals and measure the quantum of isolation between i/o terminals (Opto Transistor, TRIAC and SCR) and operate a Relay by connecting a switch 	Working and application of LED, IR LEDs, Photo diode ,photo transistor, its characteristics and application, optical sensor, opto-couplers, circuits with opto isolators, characteristics of LASER diodes
10	<p><u>Basic SMD (2,3,4 terminal components):</u></p> <ul style="list-style-type: none"> • Identification of 2,3,4 terminal SMD components • De-solder the SMD components from the given PCB • Solder the SMD components in the same PCB • Check for cold continuity of PCB • Identification of loose /dry solder, broken tracks on printed wired assemblies 	<p>Introduction to SMD technology Identification of 2,3,4 terminal SMD components, advantages of SMD components over conventional lead components Introduction to solder paste and machine. Soldering of SM assemblies - Reflow soldering Tips for selection of hardware, Inspection of SM.</p>
11	<p><u>Basic Gates:</u></p> <ul style="list-style-type: none"> • Identify different Logic Gates (AND, OR, NAND, NOR, X-OR, X-NOR, NOT ICs) by the number printed on them and draw I/O pin-out numbers. • Verify the truth tables of all Logic Gate ICs by connecting switches and LEDs. • Construct and verify the truth table of all the gates using NAND and NOR gates • Use digital IC tester to test the various digital ICs (TTL and CMOS) 	<p>Introduction to Digital Electronics. Difference between analog and digital signals, Logic families and their comparison, Logic levels of TTL and CMOS. Number systems (Decimal, binary, octal, Hexadecimal) BCD code, ASCII code and code conversions. Logic Gates and their truth tables, propagation delay, power dissipation and noise immunity</p>
12	<p><u>Combinational Circuits:</u></p> <ul style="list-style-type: none"> • Construct Half Adder circuit and verify the truth table. • Construct Full adder and verify the truth table. • Construct the Adder cum Subtractor and verify the result • Construct and Test a 2 to 4 Decoder • Construct and Test a 4 to 2 Encoder 	<p>Combinational logic circuits such as Half Adder, Full adder, Parallel Binary adders, 2-bit and four bit full adders. Magnitude comparators. Half adder, full adder ICs and their applications for implementing arithmetic operations Basic Binary Decoder and four bit binary decoders.. Concept of encoder</p>

	<ul style="list-style-type: none"> • Construct and Test a 4 to 1 Multiplexer • Construct and Test a 1 to 4 De Multiplexer 	and decoder, Need for multiplexing of data. 1:4 line Multiplexer /Demultiplexer.
13	<p><u>Flip Flops:</u></p> <ul style="list-style-type: none"> • Identify different Flip-Flop (ICs) by the number printed on them • Construct and test four bit latch using 7475 . • Verify the truth tables of Flip-Flop ICs (RS, D, T, JK, MSJK) by connecting switches and LEDs 	Introduction to Flip-Flop. S-R Latch, Gated S-R Latch, D- Latch. Flip-Flop: Basic RS Flip Flop, edge triggered D Flip Flop, JK Flip Flop, T Flip Flop, Master-Slave flip flops and Timing diagrams, Basic flip flop applications like data storage , data transfer and frequency division.
14-15	<p><u>Electronic circuit simulation software</u></p> <ul style="list-style-type: none"> • Prepare simple digital and electronic circuits using the software • Simulate and test the prepared digital and analog circuits • Convert the prepared circuit into a layout diagram. • Explore various troubleshooting and fault finding resources provided in the simulation software. 	Study the library components available in the circuit simulation software. Various resources of the software.
16-17	<p><u>Counter & shift Registers:</u></p> <ul style="list-style-type: none"> • Construct and test a four bit asynchronous binary counter using 7493. • Construct and test 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. • Identify and test common anode and common cathode seven segment LED display using multi meter • Display the two digit count value on seven segment display using decoder/driver ICs. • Construct a 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 bidirectional shift registers 	Basics of Counters, types 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. Types of seven segment display, BCD display, BCD to decimal decoder. BCD to 7 segment display circuits, Basics of Register, types and application of Registers.
18-21	<p><u>Op – Amp & Timer 555 Applications:</u></p> <ul style="list-style-type: none"> • Use analog IC tester to test the various analog ICs • Construction and testing of various Op- 	Block diagram and Working of Op-Amp, importance, Ideal characteristics, advantages and

	<p>Amp circuits Inverting, Non-inverting and Summing Amplifiers</p> <ul style="list-style-type: none"> • Construct and test Differentiator and Integrator • Construct and test a zero crossing detector • Construct and test Instrumentation amplifier • Construct and test a Binary weighted and R-2R Ladder type Digital-to-Analog Converters. • Construct and test Astable timer circuit using IC 555 • Construct and test mono stable timer circuit using IC 555 • Construct and test VCO (V to F Converter) using IC 555 • Construct and test 555 timers as pulse width modulator. 	<p>applications.</p> <p>Schematic diagram of 741, symbol, Non inverting voltage amplifier, inverting voltage amplifier, summing amplifier, Comparator, zero cross detector, differentiator, integrator and instrumentation amplifier, other popular Op-Amps.</p> <p>Block diagram of 555, functional description w.r.t. different configurations of 555 such as mono stable, Astable and VCO operations for various application</p>
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**SYLLABUS FOR WORKSHOP SCIENCE AND CALCULATION
SEMESTER-II**

Week No	Workshop calculation & Sc.
1-2	. Calculation of transistor currents and amplification factor(gain)
3-4	Gain dB calculation of voltage, current and power
5-6	Arithmetic and geometric progression, sum of n-terms, simple calculations Mensuration – Find the area of regular objects like triangle, rectangle, square and circle.
7-8	. Mensuration: volumes of cube, cuboid, sphere cylinder.
9	Calculation of frequency of LC and RC oscillator and multivibrator circuits
10	Calculation of LED, IRLED and photo diode currents
11	Trigonometry ratios, identities
12	Problems on conversion of Decimal numbers to binary, octal, and Hexadecimal
13	Bit, byte, nibble, KB, MB ,GB
14-16	Addition and subtraction of Binary, Octal and Hexadecimal Numbers
17-18	Calculation of frequency division in flip-flops/counters
19-21	Inverting and non inverting amplifier gain calculations Time period and frequency calculation of Astable, monostable multivibrators using IC555

SYLLABUS FOR ENGINEERING DRAWING SEMESTER-II

Week No	Engineering Drawing
1	Single stage amplifiers, Multistage amplifiers
2-4	Class 'A', Class 'B', Push pull, Complimentary symmetry circuits
5-6	Crystal and RC Oscillators circuits, Multivibrators
7	Symbols for different wave shapes, Square, saw tooth, sine, triangular, Pulse. clipper and clamper circuits
8-9	UJT, FET, MOSFET, DIAC, TRIC, SCR, IGBT symbols and circuits of FET Amplifier, SCR using UJT triggering, snubber circuit, light dimmer circuit using TRIAC, UJT based free running oscillator
10-11	Orthographic 3 rd angle projection of very simple objects
12	LED, IRLED, photo diode, photo transistor, opto coupler symbols symbols of Logic gates
13	Half adder, full adder, multiplexer and de-multiplexer
14-16	Logic diagram and symbols of Flip flops
17-18	Logic diagram of 3- bit asynchronous, synchronous and decade counters
19-21	Op-Amp block diagram Inverting and non-inverting configuration, pin diagram of 555,741 Functional block diagram of IC555 and Astable, Monostable circuits using IC555

A. Tools & Equipments for the trade **MECHANIC CONSUMER ELECTRONIC APPLIANCES** for First and Second Semester

TRAINEES TOOL KIT FOR 20 TRAINEES +1 INSTRUCTOR

Sl No.	Names of the Items	Quantity
1.	Connecting screwdriver 100 mm	10 Nos
2.	Neon tester 500 V.	6 Nos
3.	Screw driver set (set of 5)	10 Nos
4.	Insulated combination pliers 150 mm	6 Nos
5.	Insulated side cutting pliers 150 mm	8 Nos
6.	Long nose pliers 150 mm	6 Nos
7.	Soldering iron 25 W. 240 V.	10 Nos
8.	Electrician knife	6 Nos
9.	Tweezers 100mm	10 Nos
10.	Digital Multimeter (3 ½ digit)	10 Nos
11.	Soldering Iron Changeable bits 10 W	6 Nos
12.	De- soldering pump	10 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 Nos
4.	Tools maker vice 50mm (clamp)	1 Nos
5.	Crimping tool (pliers)	2 Nos
6.	Magneto spanner set	2 Nos
7.	File flat 200mm bastard	2 Nos
8.	File flat 200mm second cut	2 Nos
9.	File flat 200mm smooth	2Nos
10.	100mm flat pliers	4 Nos
11.	100mm round Nose pliers	4 Nos
12.	Scriber straight 150mm	2 Nos
13.	Hammer ball pen 0.5Kg	1 No
14.	Allen key set (set of 9)	1 No
15.	Tubular box spanner (set of 6Nos)	1 set
16.	Magnifying lenses 75mm	2 Nos
17.	Continuity tester	6 Nos
18.	Hacksaw frame adjustable	2 Nos
19.	Cold chisel 20mm	1 No
20.	Scissors 200mm	1 No
21.	Handsaw 450mm	1 No
22.	Hand Drill Machine	2 Nos
23.	First aid kit	1 No
24.	Fire Extinguisher	2 Nos
25.	Bench Vice	1 No
26.	Dual DC regulated power supply 30-0-30 V, 2 Amps	4 Nos
27.	DC regulated variable power supply 0-24 V, 1Amp	2 Nos
28.	LCR meter (Digital)	1 No

29.	CRO Dual Trace 20 MHz (component testing facilities)	2 Nos
30.	Signal Generator, 0-100 KHz	2 Nos
31.	Battery Charger	1 No
32.	Analog multimeter	4 Nos
33.	Function generator (Triangular, square and sine wave)	2 Nos
	Or ELECTRONIC WORK BENCH Instead of sr no's (26,27,29,31,34)	2 Nos
34.	Dimmer state, 3 Amps	2 Nos
35.	Analog Component Trainer	4 Nos
36.	Op Amp trainer	3 Nos
37.	Digital IC Trainer	4 Nos
38.	Digital IC Tester	1 No
39.	Digital and Analog Bread Board Trainer	6 Nos
40.	Rheostats various values and ratings	2 Nos
41.	POWER ELECTRONICS TRAINER with at least 6 no's of onboard applications	4 No
42.	Computers in the assembled form (including cabinet, motherboards, HDD, DVD, SMPS, Monitor, KB, Mouse, LAN card, Blu-Ray drive and player), MS Office education version.	4 Nos
43.	Laptops latest configuration	1 No
44.	Laser jet Printer	1 No
45.	INTERNET BROADBAND CONNECTION	1 No
46.	Electronic circuit simulation software with 6 user licenses	1 No
47.	Different types of electronic and electrical cables, connectors, sockets, terminations.	As required
48.	Different types of Analog electronic components, digital ICs, power electronic components, general purpose PCBs, bread board, MCB, ELCB	As required
49.	Crimping tools as necessary for performing terminations mentioned week no 17-21 of SEMSTER-1	As required

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	Steel Almirah, 2.5 m x 1.20 m x 0.5 m	2 Nos
6	Black board/white board	1 No

Syllabus for the Trade of “MECHANIC CONSUMER ELECTRONIC APPLIANCES”

Duration: 6 Months

Third Semester

Semester Code: MCE: SEM III Applications of Analog and Digital Electronic Circuits

OBJECTIVES:

- Operate DSO to perform various functions
- Practice SMD Soldering and De-soldering of various types of IC Packages
- Identify defects and do rework of PCB Repairs.
- Familiarize with AC/DC machines
- Construct and test simple electrical control circuits
- Identify and test various types of electrical protective devices
- Identify, prepare, terminate and test various types of electronic cables used in various systems
- Identify various functional blocks of a microcontroller system and monitor/test vital signals on them
- Identify various I/O Ports and its interface with field devices
- Interface a model application with the Microcontroller kit and run the application
- Construct and test various modulation/demodulation circuits
- Identify and test various types of sensors used in electronic industries
- Construct and test analog IC based application circuits
- Construct and test Digital IC based application circuits

SYLLABUS FOR TRADE PRACTICAL AND TRADE THEORY SEMESTER-III

Semester- III

Week No	Trade practical	Trade theory
1	<p><u>Digital Storage Oscilloscope:</u></p> <ul style="list-style-type: none"> Identify the different front panel control of a DSO. Measure the Amplitude, Frequency and time period of typical electronic signals using DSO Store a portion of signal waveform using DSO. Take a print of a signal from DSO by connecting it to a printer Construct and test function generator using IC 8038 	<p>Block diagram of DSO/CRO and applications of DSO/CRO application of digital CRO, block diagram of function generator. Differentiate a CRO with DSO. Advantages of DSO. Major features of DSO.</p>
2-3	<p><u>SMD Soldering and De-soldering:</u></p> <ul style="list-style-type: none"> Identify various connections and the setup required for SMD Soldering station Identification of crimping tools for various IC packages. Make the necessary settings on SMD soldering station to de-solder various ICs of different packages (at least four) by choosing proper clamping tools. Make the necessary settings on SMD soldering station to solder various ICs of different packages (at least four) by choosing proper clamping tools. 	<p>Soldering / de-soldering of above components Identification of Programmable Gate Array (PGA) packages Soldering / De-soldering of above PGA components Cold/Continuity check of PCBs Identification of loose /dry solders, broken tracks on printed wiring assemblies</p>
4	<p><u>PCB Rework:</u></p> <ul style="list-style-type: none"> Prevention of Static charges, Handling of static sensitive devices Familiarizations of various crimping tools, wire wrapping, Conductive adhesives, Chip on Board, Tape Automated bonding. Construction of Printed Circuit Boards (single, Double, multi-layer), Important tests for PCBs Identify different types of soldering guns and practice soldering of different electronic active and passive components and IC bases on lug boards and PCBs 	<p>ESD Control in Electronics Introduction to Static charges, Prevention of Static charges, Handling of static sensitive devices, Various standards for ESD Introduction to non soldering interconnections Introduction to crimping, wire wrapping, Conductive adhesives, Chip on Board, Tape Automated bonding. Introduction to components, Printed Circuit Boards Introduction to components, Construction of Printed Circuit</p>

	<ul style="list-style-type: none"> • Join the broken PCB track and test • Practice the de-soldering using pump and wick • Prepare component for soldering • Demonstrate soldering and de soldering using soldering and de-soldering stations • Familiarizations of soldering technology, use of materials like solder, flux and cleaning solvents, Usage of correct tools, Component mounting, Solderability testing, • Practical's on soldering Inspection of solder joints, Defects of soldered joints • Familiarizations to rework and repair concepts • Practical on Types of conformal coating and its removal methods • Practical on Rework of through hole and surface mount soldered joints • Practical on Repair of damaged track • Practical on Repair of damaged pad • Practical on Repair of Plated through hole • Practical on Repair of solder mask 	<p>Boards(single, Double, multi-layer), Important tests for PCBs</p> <p>Soldering guns Different types of soldering guns, related to Temperature and wattages, types of tips. Solder materials and their grading. Selection of a soldering gun for specific requirement. Soldering and De-soldering stations and their specifications. Reliable Soldering Practices (Manual) Fundamentals of soldering technology, Materials selection like solder, flux and cleaning solvents, Usage of correct tools, Component mounting, Solderability testing, Process for soldering Inspection of solder joints, Defects of soldered joints</p> <p>Introduction to Surface Mount Technology (SMT) Introduction to surface mount technology – advantages Surface Mount components and packages, Introduction to solder paste (flux), Soldering of SM assemblies - Reflow soldering Tips for selection of hardware, Inspection of SM.</p> <p>Rework and Repair of Printed Circuit board assemblies Introduction to rework and repair concepts Types of conformal coating and its removal methods Rework of through hole and surface mount soldered joints Repair of damaged track Repair of damaged pad Repair of Plated through hole Repair of solder mask</p>
5	<p><u>Protection devices:</u></p> <ul style="list-style-type: none"> • Identify different types of fuses along with fuse holders. 	<p>Fuse ratings, types of Fuses, Fuse bases, single/three phase MCBs, single phase ELCBs.</p>

	<ul style="list-style-type: none"> • Wire an MCB to a motor and run it • Test and rectify defects associated with MCBs. • Connect an ELCB and test the leakage of an electrical motor control circuit. 	Types of Contactors, contactor coils and working voltages, contactor contact currents, protection to contactors and high current applications.
6	<p><u>Electrical control circuits:</u></p> <ul style="list-style-type: none"> • Measure the coil winding resistance of the given motor • Prepare the setup and Control an induction motor using a DOL Starter • Construct a direction control circuit to change direction of an induction motor • Connect an overload relay and test for its proper functioning. 	Fundamentals of single phase Induction motors, synchronous speed, slip, rotor frequency, torque – speed characteristics, Starters used for Induction motors.
7-8	<p><u>Electronic Cables & Connectors</u></p> <ul style="list-style-type: none"> • Identify various types of cables used for various applications viz. insulation, gauge, current capacity, flexibility etc. used in various electronics products. • Identify suitable connectors, solder/crimp /terminate & test the cable sets. • Read & follow markings on the connectors for testing the continuity of the prepared cable sets <p><i><u>The set of cables prepared should cover applications like computer, audio, video products, RF, DATA Transmission, IDE etc</u></i></p>	<p>Cable signal diagram conventions</p> <p>Classification of electronic cables as per the application w.r.t. insulation, gauge, current capacity, flexibility etc. different types of connector & their terminations to the cables. Male / Female type DB connectors, Ethernet 10 Base cross over cables and pin out assignments, UTP and STP, SCTP Cables</p> <p>Cable trays.</p> <p>Different types of connectors Servo 0.1” connectors, FTP, RCA,BNC,HDMI</p> <p>Audio/video connectors like XLR,RCA(phono),6.3mm PHONO,3.5/2.5mm PHONO, BANTAM,SPEAKON, DIN, mini DIN, RF connectors, USB, Firewire, SATA Connectors, VGA,DVI connectors, MIDI etc</p>
9-10	<p><u>Communication electronics:</u></p> <ul style="list-style-type: none"> • Modulate and Demodulate various signals using AM and FM on the trainer kit and observe waveforms • Construct and test IC based AM Receiver • Construct and test IC based FM transmitter • Construct and test IC based FM 	<p>Radio Wave Propagation – Principle, Fading, Need for Modulation, types of modulation. Demodulation techniques.</p> <p>Fundamentals of Antenna, various parameters, types of Antennas & application.</p>

	<p>Receiver</p> <ul style="list-style-type: none"> • Dismantle the given FM receiver set and identify different stages (AM section, audio amplifier section etc) • Modulate and Demodulate a signal using PAM,PPM,PWM Techniques 	<p>Introduction to AM, FM & PM, SSB-SC & DSB-SC, block diagram of AM and FM transmitter. FM Generation & Detection Radio Receivers: Types, Super heterodyne receiver Blocks, Principle, characteristics, advantages and disadvantages, Block diagram of FM Receives, RF, IF & AF Amplifier Sections, AM/FM RF Alignment. Digital modulation and demodulation techniques, sampling, quantization & encoding. Concept of multiplexing and de multiplexing of AM/FM/PAM/ PPM /PWM signals. <u>A simple block diagram approach to be adopted for explaining the above mod/demo. techniques.</u></p>
11-12	<p style="text-align: center;"><u>Microcontroller (8051)</u></p> <ul style="list-style-type: none"> • Identify various ICs & their functions on the given Microcontroller Kit • Identify the address range of RAM & ROM. • Write data into RAM & observe its volatility • Measure the crystal frequency, connect it to the controller. • Identify the port pins of the controller & configure the ports for Input & Output operation • Connect an input switch & control a lamp using necessary program • Demonstrate the initialization, load & turn on a LED with delay using Timer. • Demonstrate the use of a Timer as an Event counter to count external events. • Demonstrate entering of simple programs, execute & monitor the results 	<p>Introduction to 8051 Microcontroller, architecture, pin details & the bus system. Function of different ICs used in the Microcontroller Kit. Differentiate microcontroller with microprocessor. Interfacing of memory to the microcontroller. Internal hardware resources of microcontroller. I/O port pin configuration. Different variants of 8051 & their resources. Register banks & their functioning. SFRs & their configuration for different applications. Utilization of on chip resources such as ADC. Availability of assembly software & compiler for 8051. Application of microcontroller in domestic, consumer & industries. Comparative study of 8051 with 8052. Introduction to PIC Architecture.</p>
13-14	<p><u>Sensors ,Transducers and Applications</u></p>	<p>Basics of passive and active</p>

	<ul style="list-style-type: none"> • 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 • Measure temperature of a lit fire using a Thermocouple and record the readings referring to data chart. • Measure temperature of a lit fire using RTD and record the readings referring to data chart. • Measure the strain of a given material using strain gauge • Measure the DC voltage of a LVDT • Detect different objectives using capacitive, inductive and photoelectric proximity sensors 	<p>transducers. Role, selection and characteristics. Working principles of RTD, PT-100 Thermocouple, Sensor voltage and current formats. Thermistors – salient features –operating range, composition, advantages and disadvantages. Thermocouples – basic principle – commonly used combinations, operating range, advantages and disadvantages. Strain gauges – principle, gauge factor, types of strain gauges. Load cell –definition, uses, working of strain gauge load cell Principle of operation of capacitive transducers,- advantages and disadvantages Principle of operation of inductive transducers,- advantages and disadvantages Principle of operation of LVDT-its advantages and disadvantages Proximity sensors – applications, working principles of eddy current , capacitive and inductive proximity sensors</p>
15-17	<p><u>Analog IC Applications</u></p> <p>Make simple projects/Applications using ICs 741, 723, 555, 7106, 7107 Sample projects:</p> <ul style="list-style-type: none"> • Laptop protector • Mobile cell phone charger • Battery monitor • Metal detector • Mains detector • Lead acid battery charger • Smoke detector • Solar charger • Emergency light • Water level controller • Door watcher <p>(Instructor will pick up any five of the projects for implementation)</p>	<p>Discussion on the identified projects with respect to data of the concerned ICs, components used in the project</p>
18-21	<p><u>Digital IC Applications</u></p>	

<p>Make simple projects/Applications using various digital ICs (digital display, event counter, stepper motor driver etc)</p> <ul style="list-style-type: none"> • Duty cycle selector • Frequency Multiplier • Digital Mains Resumption Alarm • Digital Lucky Random number generator • Dancing LEDs • Count down timer • Clap switch • Stepper motor control • Digital clock • Event counter • Remote jammer <p>(Instructor will pick up any five of the projects for implementation)</p>	<p>Discussion on the identified projects with respect to data of the concerned ICs, components used in the project</p>
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**SYLLABUS FOR WORKSHOP SCIENCE AND CALCULATION
SEMESTER-III**

Week No	Workshop calculation & Sc.
1	Magnitude and frequency calculations on waveforms of CRO
2-3	Work, power and energy- definition, units, and simple problems
4-5	Problems on Boolean algebra.
6	Ac motor speed, frequency calculations
7-8	Electrical HP, KVA, wattage conversions
9-10	Frequency , wavelength relations Modulation index, carrier and sideband power, bandwidth relations in AM circuits
11-12	Memory address calculation
13-14	Stress and strain, modulus of elasticity.
15-17	Force. Speed, Velocity and Acceleration.
18-21	Calculation of the cost of the project.

**SYLLABUS FOR ENGINEERING DRAWING
SEMESTER-III**

Week No	Engineering Drawing
1	Block diagram of CRO, Lissajous figures
2-3	SMD IC Packages.
4	741 & 555 pin diagrams. Summing amplifier, zero cross detector.
5	Differentiator, integrator and instrumentation amplifier.
6	Symbols of MCB, ELCB, MOV, Relays, contactors.
7-8	Free hand sketches various audio, video and RF Connectors as mentioned in the theory.
9-10	Block diagram of AM & FM transmitter and receiver. AM and FM modulated waveforms
11-12	Block diagram and Pin diagram of 8051
13-14	Symbols of Thermistor, thermo couple, strain gauges, LVDT, proximity sensors. Cross sectional view of LVDT
15-17	Practice on project related drawing (not for examination purpose)
18-21	Practice on project related drawing (not for examination purpose)

A. Tools & Equipments for the trade of MECHANIC CONSUMER ELECTRONIC APPLIANCES for Third Semester

Sl No.	Names of the Items	Quantity
1	DSO (colour)	1 No
2	Soldering & De soldering Station	1 No
3	SMD Soldering & De soldering Station with necessary accessories	2 Nos
4	DOL starter	1 No
5	AC motor ¼ HP	1 No
6	OR ELECTRICAL TRAINER FITTED WITH RESOURCES MENTIONED AT SL NO (DOL starter, contactors, relays, MCB, Motor suitable for electrical control circuit exercises)	2 Nos
7	Frequency modulator and Demodulator trainer kit	2 Nos
8	PAM, PPM,PWM trainer kit	2 Nos
10	AM/FM Commercial radio receivers	2 Nos
11	Microcontroller kits (8051) along with programming software (Assembly level Programming)	4 Nos
12	Application kits for Microcontrollers 6 different applications	1 set
13	Sensor trainer kit (containing Various sensors like Thermocouple, RTD, Thermocouple, load cell, strain gauge, LVDT, smoke sensors, speed sensor)	2 Nos
14	Various analog and digital ICs useful for doing project works mentioned in the digital and analog IC applications modules	As required
15	Different types of electronic and electrical cables, connectors, sockets, terminations.	As required
16	Discrete computer system components such as HDD, DVD, memory modules, SMPS, cables	As required
17	Crimping tools as necessary for performing terminations mentioned in the exercises of week no's 1 and 2	As required

Syllabus for the Trade of “MECHANIC CONSUMER ELECTRONIC APPLIANCES”

Duration: 6 Months

Fourth Semester

Semester Code: MCE: SEM IV

Trouble shooting of electronic appliances and utility equipments

- Identify and test various mechanical and electrical modules of the given appliance
- Identify electronic parts/components/modules of the given appliance
- Aware of models of different appliances and features
- Use reference manuals and identify the information required to service the appliance
- Practice the standard troubleshooting procedures as suggested in the product manuals
- Install the given appliance as recommended by manufacturer
- Identify and Test necessary components to install a SET TOP BOX
- Install the SET TOP BOX and check its performance
- Explain the working of SET TOP BOX
- Fault finding as per the recommendation in the manuals
- Check all parameters of STB like Transponder/signal strength/Audio & Video quality
- Operate and rectify faults with Remote
- Work with tools required for installation like drilling machine, satellite meter or QAM meter and multimeter
- Install DISH
- Identify and configure the components of a typical Home theatre system
- Trouble shoot the simulated faults of the given Home theatre system
- Dismantle, identify and troubleshoot the printer faults of the given printers
- Dismantle, identify and troubleshoot the LED projector for various faults
- Dismantle, identify and troubleshoot the given cell/smart phone
- Connect various phones to the EPABX system and troubleshoot various simulated faults
- Dismantle, identify and troubleshoot the LCD/LED TV for various faults

SYLLABUS FOR TRADE PRACTICAL AND TRADE THEORY SEMESTER-IV

Week No	Trade practical	Trade theory
1	<p><u>Fiber optic communication:</u></p> <ul style="list-style-type: none"> • Identify the resources and their need on the given fiber optic trainer kit • Make optical fiber setup to transmit and receive analog and digital data • Demonstrate FM modulation and demodulation using OFC trainer kit using audio signal and voice link • Demonstrate PWM modulation and demodulation using OFC trainer kit using audio signal and voice link • Demonstrate PPM modulation and demodulation using OFC trainer kit using audio signal and voice link 	<p>. Introduction to optical fiber as a transmission media, its advantages over other media, properties of optic fiber, testing, losses , types of fiber optic Cables and specifications. Encoding of light.</p> <p>Fiber optic joints, splicing, testing and the related equipments/measuring tools, precautions to be taken laying of cables, safety aspects while handling optical cables.</p>
2-5	<p><u>SMPS:</u></p> <ul style="list-style-type: none"> • 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. • Apply input and measure outputs using a multi meter. • Test capacity of the given SMPS. • Identify major sections/ ICs/components of SMPS. • Measure / Monitor major test points of computer SMPS. • Identify and replace the faulty components. • <i>Use SMPS used in TVs and PCs for Practice</i> <p><u>Inverters, battery maintenance and UPS</u></p> <ul style="list-style-type: none"> • Identification of front panel controls & indicators of inverter • Identification of back panel sockets & connections of inverter • Connect battery and load to inverter and test on battery load • Measure battery current & load current when inverter is working in battery mode • Open top cover of inverter, Identify isolator transformer & inverter 	<p>Concept and block diagram of manual & automatic and servo voltage stabilizer , 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. Block Diagram of Switch mode power supplies and their working principles</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> <p>The principle, operation, power rating and change over period of inverter. Block diagram of</p>

	<p>transformer</p> <ul style="list-style-type: none"> • Identification of various circuit boards in inverter & monitor voltages at various test points • Identification of the faults In the given inverter and rectify • Identification of front panel controls & indicators of UPS • Identification of back panel sockets & connections of UPS • Connect battery and load to UPS and test on battery load • Measure battery current & load current when UPS is working in battery mode • Open top cover of UPS, Identify isolator transformer , UPS transformer and other additional circuits Identification of various circuit boards in UPS & monitor voltages at various test points • Identify the faults in the given UPS and rectify 	<p>inverter. Installation of inverters, protection circuits used in inverters- battery level, over load, over charging etc. Principle and working of three phase inverter circuits. Installation of single phase & three phase inverters Concept of UPS, Difference between inverters & UPS. Basic block diagram of UPS & operation principle of rectifier, battery, inverter, static transfer switch. Types of UPS: OFF line UPS, ON line UPS, Line interactive UPS & their comparisons. UPS specification, load power factor & types of indications and protections. UPS circuit description & working of control circuits, microcontroller circuits, charging circuits, power circuits, alarm circuits, & indicator circuits.</p>
6-8	<p><u>LCD and LED TV</u></p> <ul style="list-style-type: none"> • Identification and use of different Controls LCD/LED TV • Identify various connectors provided on a LCD TV and test the healthiness. • Dismantling the panel of LCD/LED TV • Identification of components and different sector of LCD and LED TV. • Dismantle, Identify the parts of the remote control • Trace and rectify the faults of a various remote controls • Identify various connectors and Connect the cable operator's external decoder (set top box) to the TV. <p><u>LCD/ LED Projector</u></p> <ul style="list-style-type: none"> • Identify various front panel controls on the given LCD/LED Projector and operate the projector using them • Identify rear connectors and terminate them using proper cables to the desktop computer • Make necessary adjustments of the display using remote 	<p>Difference between a conventional CTV with LCD & LED TVs, Principle of LCD and LED TV and function of its different section. Basic principle and working of 3D TV. IPS panels and their features Different types of interfaces like HDMI, USB, RGB etc with latest TVs. 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.</p> <p>Differentiate LCD and LED projectors. Specifications of LED Projector Working principle of LED Projector Most frequently occurring faults in a LED projector and their remedies.</p>

	<ul style="list-style-type: none"> • Dismantle the projector and identify all major functional modules • Test the healthiness of power supply, exhaust fan etc. <p>Identify the LCD/LED lamp stack and monitor the necessary voltages</p>	
9-10	<p><u>DTH System</u></p> <ul style="list-style-type: none"> • Identification & use of DTH system assembly • Identification & use of different tools and equipments used in DTH installation procedure & cabling procedure • Identification of Various types of connectors and cables and connection procedure. • Install a DTH system & get a TV station • Site selection, installation mounting tracking for azimuth and elevation angles using SAT meter. • Identify the faults in DTH system & rectify • Identification & use of various I/O ports of STB • STB connection and first installation • Identify the faults in STB & rectify. 	<p>Basic satellite communication, Merits & Demerits of satellite communication, applications, types of satellite & its orbits, Satellite Frequency Bands. Basic components of DTH system: PDA, LNBC, Satellite receiver terminal, dish installation aspects, Azimuth & elevation settings of dish/ DTH receiver. Types of cables used in DZTH system, impedance and specification</p> <p>Multi-dwelling unit design, headed amplifier, line amplifier, cascaded in/out multi-switch, tap, and splitter. Set top box features, block diagram of set top box, I/O ports, Cable modem termination system, software & customer premises equipments.</p>
11-15	<p><u>Domestic Appliances</u></p> <ul style="list-style-type: none"> • Identification & use of controls on touch key pad of Microwave oven • Dismantle and identification of various parts, wiring, tracing of various controls of Microwave oven • Identify the faults in the given Microwave oven & rectify • Dismantle and identification of various parts, sensors, wiring, tracing of various controls, Electronic circuits, in various types of washing M/C. • Identify the faults in the given washing M/C. & rectify • Dismantle and identification of various parts, wiring, tracing of various controls, Electronic circuits in various types of Vacuum cleaners. • Identify the faults in various types of Vacuum cleaners & rectify • Dismantle and identification of various parts, wiring, tracing of 	<p>Microwave oven: Different types of oven, study the various functions of Oven, Block diagram of microwave oven, Electrical wiring diagram of microwave oven, Microwave generation system-circuit, description & working, working of Power supply.</p> <p>Washing M/c: different types of machines, washing techniques, (Block diagram) parts of manual, semi automatic and fully automatic machines basic working principle of manual, semi automatic and fully automatic machines, study the working of motors, different types of timers, power supply circuits .</p> <p>Vacuum cleaner (Block</p>

	<p>various controls, Electronic circuits in various types of Mixers/grinders</p> <ul style="list-style-type: none"> • Identify the faults in various types of Mixers/grinders & rectify • Dismantle and identification of various parts, wiring, tracing of various controls, Electronic circuits in steam Iron • Identify the faults in steam iron & rectify • Identify various components of Electric rice cooker, controls and trace the circuit and rectify the simulated faults. • Identify various component of Water purifier, Mantling and dismantling of water purifier ,connection between different parts of water purifier. • Clean and replace the worn out consumable parts following the troubleshooting manual • Simulate and rectify the faults • Repeat the above exercise for UV type water purifier. • Dismantle and identification of various parts, wiring and connections of immersion heater • Replacing of coil and fixing insulation failure problems. Remove scale formation from heating element. • Identify the faults in Induction cook-top and rectify. • Dismantle and identification of various parts, wiring and tracing of various controls, Electrical and electronics circuit in Induction cook-top. • Replacing the Induction tube (coil) in Induction cook-top. 	<p>diagram) working principle, main parts of Vacuum cleaner , study of different features of the machine, study & working of motor used , Electronic circuit, power supply.</p> <p>Various parts & functions of Mixer/Grinder, speed control circuit & auto over load protector.</p> <p>Principle of electric iron, parts of steam iron, thermostat heat controls.</p> <p>Working principal of RO and UV type of water purifiers, Different components of water purifier, consumables required, Most frequently occurring faults and there remedial procedures referring to the manual.</p> <p>Principal of Immersion heater, part of immersion heater, Insulation in Immersion heater.</p> <p>Working principal of Induction cook top, study of different features of machine. Types of induction tubes, study of different component of induction cook top, Fault identification, Heat sinking in induction cook top.</p>
16-17	<p><u>Printers</u></p> <ul style="list-style-type: none"> • Identification & use of controls/ switches/ sockets of a dot matrix printer • Identification of internal assembly/ section/parts of DMP • Testing of the paper sensor, print head coils, home position sensor, print head needle coil & cleaning of ribbon mask, paper feed motor gears, printer head movement gears & print head guide • Identify the faults in DMP & rectify 	<p>Printer & its types, principle, parts, working of dot matrix , ink jet & Laser printer, Advantages, disadvantages of each, comparison between impact & non impact printers & cables used to connect the various printers o computer.</p>

	<ul style="list-style-type: none"> • Identification & use of controls/ switches/ sockets of an ink jet printer • Interconnect printer to computer & perform printer test & cleaning of an ink cartridge • Identification of internal assembly/ section/parts of an ink jet printer • Identify the faults of an ink jet printer & rectify • Identification & use of controls/ switches/ sockets of an Laser printer • Interconnect printer to computer & perform printer test & cleaning of an ink cartridge • Identification of internal assembly/ section/parts of Laser printer • Identify the faults of an Laser printer & rectify 	
18-19	<p style="text-align: center;"><u>CCTV</u></p> <ul style="list-style-type: none"> • Identification of 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. • Identification of connectors and sockets used on DVRs • Test the healthiness cables and connectors. • Connect CCTV Cameras to DVR, Record and Replay. • Dismantle DVR and identify major functional blocks and test for the healthiness. <p><i>Take the students to any nearby commercial CCTV installation to carry out the above tasks.</i></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
20-21	<p><u>Home theatre</u></p> <ul style="list-style-type: none"> • Identification of different parts of home theatre • Testing of speakers, woofers & tweeters • Set up of home theatre using specific devices • Identification of different parts of AV receiver • Identify the faults in AV receiver & rectify 	Introduction to Home theatre, surround sound system, basic components, block diagram of home theatre & working

**SYLLABUS FOR WORKSHOP SCIENCE AND CALCULATION
SEMESTER-IV**

Week No	Workshop calculation & Sc.
1-2	Bandwidth and modulation index, percentage modulation calculations in FM
3-4	Density and relative density. Archimedes principle. Laws of flotation. Series and parallel battery connections and their voltage current relations
5-8	Property of material such as ductility, malleability, Hardness, brittleness, elasticity, plasticity, toughness, Addition and subtraction of vectors.
9-13	Arithmetic progression and geometric progression. Sum of n series.
14-15	Vector – definition of scalar and vector, notations.
16-18	Representation of vectors, Vector addition & subtraction
19-21	Triangle law of vectors, parallelogram law of vectors.

**SYLLABUS FOR ENGINEERING DRAWING
SEMESTER-IV**

Week No	Engineering Drawing
1-2	Block diagram of SMPS Circuit diagram step up and step down chopper circuits Block diagram of UPS
3-6	Block diagram of LCD and LED TV Block diagram of Remote Block diagram of LCD/LED Projector.
7-8	Draw the free hand sketch for set top box and connection of DTH system with TV receiver
9-12	Block diagram of Microwave oven. Electrical wiring diagram of Microwave oven, washing M/c. Electrical wiring diagram of induction cook top.
13-14	Block diagram of working mechanism of printer.
15-18	Layout of CCTV system. Block diagram of DVR
19-21	Block diagram of home theatre and lay out plan.

TOOLS & EQUIPMENTS for the trade of **Mechanic Consumer Electronic Appliances for Fourth Semester**

Sl.No	Name of the items	Quantity
1.	Fibre optic communication trainer	2 nos
2.	SMPS trainer	1 No
3.	SMPS of different make	4 Nos
4.	UPS trainer	1No
5.	UPS 3 KVA	1 No
6.	Precision set of screw drivers- T5, T6, T7	2 Nos
7.	LCD TV Trainer kit	1 No
8.	LED TV Trainer kit	1 No
9.	LCD and LED TV	1 each
10.	Allen key screw driver	1 No
11.	Regulated power supply variable for cell phone repair	1 No
12.	CCTV set up	1 system
13.	Washing machine (auto and semi automatic)	1 each
14.	Vacuum cleaner	2 No
15.	Microwave oven 20 liters (two technologies)	1 No each
16.	Mixer cum grinder	2 Nos
17.	Steam iron	4 Nos
18.	Electric rice cooker	3 Nos
19.	Water purifier(RO and UV technologies)	1 No
20.	Immersion Heater	4 Nos
21.	Induction cooktop	2 Nos
22.	Home theatre system	1 set
23.	Printers (DMP, laser)	1 each
24.	LCD / LED Projector	1 No each
25.	DTH with accessories	1 set
26.	SAT meter	1 No

27.	Co- Axial cable cutter	1 No
28.	Jacket stripper/ Coring tool for 500 series cable	1 No
29.	Centre conductor cleaner	1 No
30.	Universal drop trimmer for RG 6/11 cables	1 No
31.	F - connector tool for RG 6/11 cables	1 No
32.	F – connector compression tool for RG 6/11 cables	1 No

List of the Trade Committee Members

Sl. No.	Name & Designation	Organization	Remarks
1	M.R.K Naidu ,Head (CR&D)	ECIL, Hyderabad	Chairman
2	Pradeep Doshi , SVP	ESSCI, NewDelhi	Member
3	T. Venkataswamy, Assit. Engg.	BHEL, Hyderabad	Member
4	A Prasanna Lakshmi, Faculty	BHEL, Hyderabad	Member
5	T. Venkateswara Sharma, Sr. Officer HR	BEL, Hyderabad	Member
6	P. Chandrashekhar, MD	Techno Design Group, Hyderabad	Member
7	S.CH. Appa rao, Managers(operations)	BEL, Hyderabad	Member
8	T. Ram Mohan Rao, Sr.Manager	BDL, Hyderabad	Member
9	B Udaya Bhaskar Rao, DGM Electronics	BDL, Hyderabad	Member
10	M Manoharan, MD	Automation Solution, Hyderabad	Member
11	S K Sastry, MD	EPROSYS, Hyderabad	Member
12	KBR Siva Prasad	HAL, Hyderabad	Member
Mentor			
1.	R.L Singh, DDG(T)	DGET, MOLE, NewDelhi	Mentor
Members of Core Group			
2.	C.S Murthy, DDT	ATI-EPI, Hyderabad	Member
3.	C.H Ravi , DDT	ATI-EPI, Mumbai	Member
4.	L K Mukherjee, DDT	CSTARI, Kolkata	Member
5.	N.R Aravindan JDT	NIMI, Chennai	Member
6.	C. Ramasubramanian, DDT	AHI, Bangalore	Member
7.	H.C Goyal, DDT	ATI-EPI, Dehradun	Member
8.	Avinash Kishore, ADT	DGET, MOLE, NewDelhi	Member
9.	R. Malthi, TO	RVTI(W), Bangalore	Member
10.	D K Ojha, DDT	ATI-EPI, Dehradun	Member
11.	DM Basha, TO	ATI, Mumbai	Member
12.	Ashwini Koli, JTA	RVTI, Bangalore	Member
13.	H N Bargal, TO	ITI, Mumbai	Member
14.	R S Nemade, TO	ITI, Mumbai	Member
15.	Z A Gadyal, JTO	ITI, Belgaum	Member
16.	M V Pillai, GI	ITI, Thane	Member

