

**TRADE: ELECTRONIC MECHANIC**

Module: Trade Technology - I

Duration: 3 Months

Week No	Theory	Practical
1	<p><b><u>Basic Electricity &amp; Semiconductor Diodes and Rectifiers</u></b>                      Basic Electricity and Ohm's law, Series and parallel circuits, Kirchoff's laws, AC fundamentals.                      Overview of Semiconductor materials, Semiconductor Diodes, Half and Full-wave Rectifiers (Center- Tap &amp; Bridge), Filters, Zener diode, Zener Regulator</p>	<p>Study of Ohm's law, Kirchoff's laws, series and parallel circuits.</p> <p>Identification &amp; Interpretation specifications of Semiconductor Diodes from Data sheets</p> <p>Testing of Semiconductor Diodes Construction and Testing of Half wave / Full wave Rectifiers                      Testing of Effect of ripple filters on Rectifier circuits                      Zener diode as Voltage Regulator</p>
2	<p><b><u>Transistors</u></b>                      Transistors, Transistor as amplifier, Transistor Biasing-Need for it                      Biasing methods-fixed bias/Emitter bias/Voltage divider bias                      Bias stabilization                      CE,CB&amp; CC amplifiers, Comparison of Configurations,                      RC /Transformer /Direct coupled amplifiers                      Multistage amplifiers</p>	<p>Construction and testing of various transistor Biasing Circuits                      Frequency response of RC coupled amplifier                      Frequency response of Transformer coupled amplifier                      Construction and testing of multistage amplifiers</p>
3	<p><b><u>Large Signal Amplifiers (Power Amplifiers)</u></b>                      Types of Power Amplifiers- class A,B,AB &amp; C                      Class B push pull amplifier                      Complementary- Symmetry amplifiers                      Power Efficiency, Distortion and thermal considerations                      Feedback in Amplifiers and Oscillators</p>	<p>Construction and testing of Class B amplifier                      Construction and testing of Complementary- Symmetry amplifiers                      Circuit tracing and testing of Audio amplifier                      Fault finding and repair of simple problems in Audio amplifier                      Construction and testing of RC phase shift oscillator and Wein-bridge oscillator.</p>
4	<p><b><u>Power Electronics</u></b>                      Power Electronic Devices:                      Construction and characteristics of SCR, TRIAC, GTO, Power MOSFET, IGBT.</p>	<p>Interpretation of data sheets and testing of power electronic devices.                      Phase control circuits using UJT and SCR.                      Light Dimmer and Fan control</p>

	<p>Triggering Devices- DIAC, UJT, Power control using Thyristers – Dimmer control , DC motor and Fan Regulator .</p>	<p>circuit using TRIAC /DIAC Circuit tracing and Testing of SMPS Commissioning and testing of UPS Testing and charging of various batteries</p>
5	<p><b><u>Linear Integrated Circuits</u></b> Introduction to Linear Integrated Circuits Op-Amp basics, virtual ground concept, Op-Amp parameters. Op-Amp circuits – Inverting, Non-inverting and Summing amplifiers, Differentiator, Integrator and Instrumentation amplifiers. 555 Timer IC– Block Diagram and Applications like Astable and Monostable multivibrators Wave shaping circuits Waveform Generators and PLLs <b><u>Regulated Power Supplies</u></b> Series pass and Shunt voltage Regulators, , Feedback Regulators. IC voltage regulators-78XX / 79XX series. Switch mode power supplies – working principles Principles of Inverter Circuits UPS – working principles and types Batteries and Types, Maintenance methods of various Batteries</p>	<p>Construction and testing of various Op-Amp circuits like Inverting, Non-inverting and Summing Amplifiers, Differentiator, Integrator and Instrumentation Amplifiers.</p> <p>Construction and testing of various 555 IC Timer applications.</p> <p>Construction and testing of various other Linear IC applications like Wave shaping circuits ( Clipper, Clamper ), Waveform Generators , Phase-locked Loop circuits.</p> <p>Construction and testing of IC voltage Regulators Construction and testing of SMPS</p>
6	<p><b><u>Measuring Instruments</u></b> Working principles and study of Block diagrams / Schematic diagrams of Digital Multimeter, CRO, Function Generator , Digital Storage Oscilloscope, Frequency Counter and Digital LCR meter</p>	<p>Operation and familiarization with various measuring instruments like CRO, Function Generator, Digital Storage Oscilloscope, Frequency Counter and Digital LCR meter.</p> <p>Circuit tracing and fault-finding in CRO and Digital LCR meter.</p>

7-9	<p><b><u>Digital Electronics</u></b>  Number systems, Logic gates and Digital logic families, voltage levels of TTL and CMOS circuits, Number Systems , Boolean Laws. Combinational Circuits- Arithmetic circuits like Half adder and Full adder, ALU, etc., Multiplexers, Demultiplexers, Encoders/Decoders. Sequential circuits: RS, D, JK- Flip Flops, Edge-triggered and Master/ Slave Flip Flops, Shift Registers and Counters – Asynchronous ( Ripple) and Synchronous types. Display Devices –LED, Seven-segment LED, LCD Display, Display Drivers, Dot-matrix Displays.</p> <p><b><u>D/A &amp; A/D Converters and Semiconductor Memories</u></b>  Digital-to Analog Converters: Binary weighted and R-2R Ladder types. Analog-to-Digital Converters: Comparator , Single-slope and Dual-slope types. Conversion times. Applications of A/D converters- Digital Volt Meter / DMM. Semiconductor Memories: Types of memories – ROM, PROM, EPROM, EEPROM. Read/Write Memories (RAM)- Static and Dynamic RAMs. Flash Memories. Memory Organization.</p>	<p>Interpretation of TTL, CMOS and ECL ICs data from Data Sheets. Construction and Truth-tables of various logic gates ( TTL and CMOS ICs). Construction and testing of various Arithmetic Circuits like Half-adder, Full-adder and ALU circuits. Construction and testing of Multiplexer / Demultiplexer circuits Construction and testing of various Encoder / Decoder Circuits Construction and testing of Seven-segment LED / Decoder-Driver circuits. Construction and testing of Dot-matrix / LCD Displays. Construction and testing of Binary weighted and R-2R Ladder type Digital-to-Analog Converters.</p> <p>Construction and testing of Digital Voltmeter using ADC IC</p> <p>Familiarization with various types of Memory ICs</p> <p>Identification of Flash Memories of various capacities.</p> <p>Connecting a Thumb-wheel switch and displaying the set number on a Seven-segment display</p>
10	<p><b><u>Microprocessors / Microcontrollers</u></b>  Introduction to Microprocessors. 8085 Architecture, Programmer’s model of 8085, Addressing modes and Instruction set. Interfacing Peripheral ICs to Microprocessor - concepts . Introduction to 8051 Microcontroller and its applications in embedded systems. 8051 Architecture and Register set Simple examples of Programming the 8051 Microcontroller. 8051 programming examples in C.</p>	<p>Familiarization with 8085 Microprocessor trainer kit. Coding and execution of simple assembly language programs on 8085 Microprocessor trainer kit. Interfacing and testing of Application modules like Traffic Lights Controller / Stepper Motor Controller to 8085 Microprocessor trainer kit. Familiarization with 8051 Microcontroller trainer kit. Coding and testing of simple 8051</p>

	Overview of Assemblers and compilers used in Microprocessors / Microcontrollers.	C language programs using C compiler ( like KEIL IDE).
11	<p><b><u>Electronic Instrumentation and Industrial Sensors</u></b>  Introduction to Electronic Instrumentation and Transducers  Industrial sensors – Thermocouples, RTDs, Pressure/ Flow / Level Transmitters, Load cells , etc.</p>	<p>Study of Thermo-couples and RTDs using Simulators /Calibrators</p> <p>Study of Industrial Sensors like Pressure / Flow/ Level Transmitters and Load Cells  Demonstration of Electronic Temp. controller</p>
12	<p><b><u>PCBs, Soldering &amp; SMDs</u></b>  Electric circuit elements like Relays, Circuit Breakers, contactors and Solid State Switches.  PCBs-Design concepts , Types of PCBs , Repair of PCBs.  Basics Schematic Capture Software.  SMD Technology , SMD components, SMD repair and rework stations.  DC/ AC Drives -Basics</p>	<p>Study of different Electric circuit elements like Relays, Circuit Breakers, contactors and Solid State Switches.  Practicing soldering and desoldering of electronic components including ICs on PCBs.  Making a simple PCB  SMD soldering and Desoldering Practice  Demo on DC /AC Drives</p>

**TRADE: ELECTRONIC MECHANIC**

Module: Trade Technology - II

Duration: 3 Months

Week No	Theory	Practical
1-3	<p><b><u>TV Receivers (both CRT &amp; LCD)- Troubleshooting and Repair</u></b>                      TV Systems and TV standards                      TV Tuners                      Functional block diagram of TV set.                      Schematic diagrams of TV sets.                      Explanation of various stages of a TV Receiver using Block / Schematic diagrams like Power supply ( SMPS), Tuning section, Video IF, Video Amplifier &amp; Picture Tube section, Sweep Section &amp;EHT, Chroma (Color) section ,and Sound Section.                      TV Antennae &amp; Feeder Cables.                      Color Monitors                      Study of Various ICs used in TV sets using Block diagrams and Pin diagrams                      Standard Definition vs. High Definition ( HD)                      HDTV standards and HDTV sets</p>	<p>Familiarization with various controls of color TV Receiver.</p> <p>Study of color TV set schematic diagrams and identification of ICs associated to various stages like SMPS, Tuning section, Video IF, Video Amplifier &amp; Picture Tube section, Sweep Section &amp;EHT, Chroma (Color) section ,and Sound Section.</p> <p>Fault-finding and repair of various problems in TV sets (covering all the stages of color TV set).</p> <p>Installation of TV antennae.</p> <p>Familiarization and fault-finding in HDTV sets.</p>
4	<p><b><u>Audio System / PA System</u></b>                      Working of Audio System / PA System                      Microphone types / loudspeakers- Types ( Woofer, Midrange &amp; Tweeters).                      Stereo System and Stereo Amplifiers.                      Crossover networks.                      Ampli-speakers.                      Surround Sound systems &amp; Sound Processors</p>	<p>Identification , testing &amp; repair of various types of Microphones                      Identification , testing &amp; repair of various types of Speakers                      Arrangement of Stereo Systems / Surround Sound Systems and testing their operation                      Familiarization with sound processor ICs</p>
5	<p><b><u>CD, VCD/DVD, Blue-Ray Disc Players</u></b>                      Study of Optical Disk Players ( CD / DVD) working using Block / Schematic diagrams                      Standards used in CD/ DVD systems (audio / video) like MP3, MPEG-1, MPEG-2,MPEG-4 etc.                      Working of Drive systems of Disk Players                      Solid state Audio / Video players</p>	<p>Experimental study of Disk players using Schematic diagrams</p> <p>Stage location and Identification of components in Disk Players</p> <p>Study of ICs used in Disk Players.</p> <p>Common faults in Disk Players - Troubleshooting and Repair .</p>

	<p>Portable Media players Working of Blue-ray Disk players</p>	<p>Demonstration on Disk Drive Mechanism Troubleshooting and Repair of Blue-ray Disk Players.</p>
6	<p><b><u>Electronic communications</u></b> Modulation, Demodulation, Amplitude Modulation, Frequency Modulation and Phase Modulation, Modulation Index, Noise, Bandwidth &amp; Power considerations. Demodulation Techniques-Detectors SSB,DSB-SC. Radio Wave Propagation Ground wave, Sky wave and Space wave propagations. Overview of various types of Antennae.</p>	<p>Experimental study and operation of A.M., F.M., P.M. using Trainer kits.</p> <p>Experimental study of various types of Antennae.</p>
7	<p><b><u>Digital Communications / Cable TV/ DTH Systems</u></b> Introduction to Digital Communications, Analog vs. Digital communications, Waveform coding by Sampling &amp; Quantization. Delta Modulation &amp; Adaptive Delta modulation techniques Multiplexing – need for it and types of Multiplexing Working of Dish Antenna and cable TV systems, Different stages of Cable TV systems and setup, Satellite communications – uplink &amp;downlink, TVRO setup.. Study of DTH system and IPTV system.</p>	<p>Study of PCM, PAM, PPM and PWM.</p> <p>Setup and experimental study of Cable TV system. Setup and experimental study of DTH Receiver system.</p> <p>Demonstration (visit to) of satellite communication setup</p> <p>Experimental study of IPTV system</p>
8	<p><b><u>Telephony / Cellular Communications</u></b> Concept of telephone Switching Networks Working of Pushbutton and wireless Telephone sets Cellular Telephony concepts, Base stations GSM vs. CDMA technologies Working of cell phone set using Block diagrams and Schematic diagrams WLL technology and WLL telephone sets</p>	<p>Demonstration of Push-button and Wireless Telephone sets and faultfinding in these sets. Study of Schematic diagrams of cell phone sets Faultfinding and Repair of cell phone sets Faultfinding and Repair of WLL telephone sets</p>

<p>9-10</p>	<p><b><u>PC Hardware and Peripherals</u></b>  Explanation of PC system using Block / Schematic diagrams.  Working of various stages / components of a PC - Processor, , Mother Board, Cache memory, Sound Card and Graphics Acceleration Card, SMPS and Cabinet, HDD/SSD, Optical Disk Drives including Blue-ray Disk Drive, USB Drive, Keyboard, Monitor, Mouse, Joysticks, etc.  Peripherals - Monitors- CRT, LCD/LED types, Printers ( LASER and Inkjet), Scanners, etc.  Bus systems – ISA, EISA, PCI, ePCI and AGP  USB standards, BIOS, cooling technologies / heat dissipation systems.  Memory modules and memory organization, and types of memories used in PCs like DDR2RAM, DDR3RAM and Video Memory.  Introduction to Operating Systems (Windows / Mac OS, Unix/ Linux, etc)  Mobile / Notebook computers – Processors and components used in mobile computers  Notebook PCs vs. Desktop PCs - differences</p>	<p>Familiarization with various Microprocessors used in both Desktop PCs and Notebook PCs of different manufactures ( mainly Intel and AMD processors).  Identification of major components of a PC  Identification and study of various components on Mother Board like Chipsets used, various sockets for Memory Modules, PCI / ePCI slots for Sound card and other cards like Graphic cards, AGP slot, cooling fan on the processor, and various other components like ICs, connectors , switches, etc.</p> <p>Assembly of PC and configuring BIOS and loading of Device Drivers  Installation of Windows OS and Application Software on a PC</p> <p>Troubleshooting and repair of common faults in PCs</p> <p>Troubleshooting and repair of common faults in Notebook / Mobile PCs</p>
<p>11</p>	<p><b><u>Networking and Data communications</u></b>  Networking basics:  Network Components – Hubs, Switches, Bridges and Routers.  Securing the network and Firewall concepts  Local Area Network (LAN)  Client-server Networks and Network Operating System ( Windows Server 2008)  Serial and Parallel communications – RS 232, RS 485 , Ethernet.  Cables used in Data communications - Cat 5, Cat 5E, Cat 6, etc.</p>	<p>Familiarization with network hardware components like Hubs, Switches, Routers, cables, etc.</p> <p>Setup and demonstration of Windows based LAN.</p> <p>Windows Server 2008 installation</p> <p>Familiarization with WAN ( by visiting WAN installations)</p>

12	<p><b><u>Opto-electronics and Fiber-Optic Communications</u></b>  LED, LCDs, Photo Diodes / Detectors, Opto-couplers</p> <p>Fiber-optic networks</p> <p>Fiber optic communication components like Fiber-optic cables, Transmitters, Receivers and connectors</p> <p>Spicing of Fiber-optic cables.</p> <p>Tests on Fiber-optic cables</p>	<p>Study of Opto-electronic components like LEDs, LCDs, LED seven-segment Displays, Dot-matrix Displays, Photo Diodes, Photo Transistors, IR LEDs, Opto-couplers.</p> <p>Simple experiments using photo transistor / Photo Diode</p> <p>Study of Fiber optic communication components like light sources. LEDs/Laser Diodes) and Receivers, connectors , fiber optic cables (Single-mode &amp; Multi-mode).</p> <p>Splicing of fiber optic cables using Splicing Machine.</p> <p>Tests on fiber-optic cables</p>
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**LIST OF TOOLS AND EQUIPMENTS FOR THE TRADE OF ELECTRONIC MECHANIC ( CITS ) FOR THE BATCH OF 20 TRAINEES.**

<b>SL .</b>	<b>DESCRIPTION</b>	<b>QTY.</b>
<b>TRAINEES KIT</b>		
01	Digital Multimeter ( 3 ½ Digit)	20
02	Long e insulated pliers 15 cm	20
03	Diagonal cutter 15 cm insulated	20
04	End cutting nipper insulated 15 cm	20
05	Tweezers 10 cm insulated	20
06	Soldering Iron 25 W	20
07	Combination pliers 15 cm insulated	20
08	Neon glow Tester	20
09	Knob screw driver insulated 10 cm	20
10	Screw driver set of 6	20
11	Watch maker screw driver set	20
12	Knife with disposable blades	20
13	Wire stripper	20
<b>WORKSHOP TOOLS</b>		
1	Soldering Iron 35 W	6.
2	Soldering Iron 25 W	6 .
3	Soldering Iron 10 W	4 .
4	Crimping tool ( RJ-45 )	2
5	Logic probe	4
6	Logic Pulsar	4
7	I.C Tweezers / Puller	8
8	Heat sink pliers	4
9	Thermocouples	4
10	RTD	2
11	Electric drill 10 mm with polishing and buffing accessories.	2
12	Grinder bench electric	1 .
13	Electric PCB drill	1
14	PCB Hand drill	3
15	Loud speakers ( assorted sizes / ratings)	12
16	Batteries – assorted	2 each
17	Rheostats- assorted values and ratings	8 .
18	Head phone / ear phone	4
<b>LAB EQUIPMENTS</b>		
1	Multi meter analog	4
2	D M M ( 4 ½ Digit )	6
3	Variable DC power supply 30-0 – 30 V	8
4	C.R.O – 30 MHz	6

5	C.R.O. Trainer kit	1
6	Digital Storage Oscilloscope	1
7	Digital frequency Counter – 100 MHz	1
8	Signal Generator AM / FM	2
9	Distortion Meter	1
10	Component Development System ( for Analog & Digital)	6
11	Digital IC Trainer	2
12	A F Output meter	2
13	Pulse Generator	2
14	Microprocessor training kit 8085 / 8086	2
15	8051 Micro controller Trainer Kit	2
16	Application modules for 8051 controller ( Traffic light controller, Stepper motor control, ADC/DAC)	2 each
17	DC Drive with DC motor ( Fractional HP )	1
18	AC Drive with 1 AC motor ( VVVF type) ( Fractional HP )	1
19	Temp. controlled soldering / desoldering station	2
20	SMD Repair and Rework station /PCB Repair Kit	1
21	Micro processor based Digital IC tester ( universal )	1
22	Electronic Temp. controller	1
23	Constant voltage transformer / Auto transformer	4
24	Notebook PC	3
25	Thermo couple Simulator / Calibrator	1
26	RTD Simulator / Calibrator	1
27	Digital EPBX- 8 lines	1
28	UPS -5 KVA	1
29	8051 C compiler / IDE software ( like KEIL IDE )	1
30	Software ( M.S. Office latest version )	1
31	Antivirus software ( latest )	1.
32	Circuit Design / Schematic Capture software	1
33	SMPS	2
34	Strain gauge with load cell	2
35	Coil winding m/c ( manual )	1 .
36	Educational CDs / DVDs	As Reqd.

<b>EQUIPMENTS ADDITIONALLY REQUIRED FOR TT-2</b>		
1	TV Trainer kit	1
2	HDTV Sets	2
3	DTH Receiver Set	1
4	TV sets ( CRT & LCD)	3 each
5	Pattern generator- color	2 .
6	P.A Amplifier	2
7	A.M. Trainer ( modulation and de modulation )	1
8	F.M Trainer kit ( modulation and de modulation )	1
9	P.M. Trainer kit	1
10	DVD Player	3
11	CD / MP3 / MPEG 4 Player	3

12	Blue-ray Disc Player	2
13	Visual fault Locator ( for OFC)	1
14	Cleaver (for cutting Fiber optic cables)	1
15	Fiber Optic Trainer Kit	1

<b>AUDIO VISUAL AIDS</b>		
1	LCD /DLP Projector	1
2	PC with latest configuration	1+ 10
3	Laser printer	1
4	OHP Projector	1
5	Interactive Panel Board	1

<b>FURNITURE</b>		
1	Modern Class room chairs	20
2	White Boards	2
3	Instructor Table	1
4	Instructor chair	1
5	Work benches 120 x 400 x 75 cm	4
6	Steel cabinet 120 x 60 x 40 cm	4
7	Steel lockers with 20 drawers	2 .
8	Computer Chairs	20
9	Computer Table	10
10	Split type ACs for lab and class room	As reqd.