

CURRICULUM

FOR THE TRADE OF

ELECTRONICS MECHANIC
(Dual Mode)

UNDER

DUAL TRAINING SYSTEM

BY



GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

**PROPOSED TIME DISTRIBUTION FOR ELECTRONICS MECHANIC TRADE UNDER
INDUSTRY INSTITUTE - TRAINING SCHEME**

BLOCK WITH DURATION	THEORY	PRAC.	WSC/ CAL	ENGG. DRG.	EMP.S KILL	ECA, LIB. & OTHERS	REM.
BLOCK – I (12 months/52 Weeks duration) Institute level trg.	510 hrs.	830 hrs.	170 hrs.	250 hrs.	110 hrs.	50 hrs.	160 hrs. Revision & Test
BLOCK – II (09 months /39 weeks duration) Industry level trg.	---	1560 HRS.	---	---	---	---	---
BLOCK – III (3 months/ 13 Weeks duration) Institute level trg.	100 hrs.	210 hrs. (Practical practice and submission of report related to industry training)	50 hrs.	60 hrs.	---	20 hrs.	Last 2 weeks revision & exam. (80 hrs.)
GRAND TOTAL	610 HRS.	2600 HRS.	220 HRS.	310 HRS.	110 HRS.	70 HRS.	240 HRS.
Total duration of training inclusive of Industry & Institute is 2 years (4160 HRS.)							

GENERAL INFORMATION

1. Name Of The Trade : ELECTRONIC MECHANIC (DUAL MODE)
2. NCO Code No. :7242.10, 7242.90, 7243.10, 7243.40, 7243.45,7243.50
3. Duration : 02 Years In Dual Training Mode
4. Power Norms :3.04 Kw (For Institute)
5. Space Norm :56 Sq Mts (For Institute)
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 from recognized university 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.

Desirable qualification: Preference will be given to a candidate with Craft Instructor Certificate (CIC).

Note:

- (i) Note: Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.
- (ii) Instructor qualification for WCS and E.D, as per the training manual.

Distribution of training on Hourly basis:

Total hours /week	Trade practical	Trade theory	Work shop Cal. &Sc.	Engg. Drawing	Employability skills	Extracurricular activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

SYLLABUS CONTENT WITH TIME STRUCTURE FOR ELECTRONICS MECHANIC TRADE

Block - I

Duration- 12 Months (52 weeks)

Institute Level Training: -

Sl. no	Trade Practical (Duration 830 hrs.)	Trade Theory (Duration 510 hrs.)
1	<p>Trade and Orientation</p> <ul style="list-style-type: none"> • 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>Introduction to NCVT and certification mechanism. Semester system and its flexibility for the trainee and to the institute.</p> <p>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.</p> <p>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	<p>Hand Tools and their uses</p> <ul style="list-style-type: none"> • Demonstration and uses of hand tools-screw drivers, pliers, tweezers, tester, wire stripper, electrician knife, steel rule, scriber, 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>
3	<p>Basics of AC and Electrical Cables</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 	<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>earthing.</p> <ul style="list-style-type: none"> Identify and test different AC mains cables. Skin the electrical wires /cables using the wire stripper and cutter. 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>
4	<p>Cells & Batteries</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>
5	<p>Passive Components</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. 	<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 circuits. 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,</p>

	<ul style="list-style-type: none"> • 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>significance of electro magnetism, types of cores. Electromagnetic Relays, types, construction, specifications- coil voltage and contact current capacity.</p>
6	<p>Transformers</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>
7	<p>AC & DC measurements</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>
8	<p>Soldering & De-soldering and switches</p> <ul style="list-style-type: none"> • Identify different types of 	<p>Different types of soldering guns, related to Temperature and wattages, types of tips. Solder materials and their grading. Use of</p>

	<p>soldering guns and practice soldering of different electronic active and passive components and IC bases on lug boards and PCBs</p> <ul style="list-style-type: none"> • 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>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>
9	<p>Rectifiers</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>
10	<p>IC Regulators</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 	<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>

	<ul style="list-style-type: none"> Construct a dual power supply by using the fixed IC regulators with current limiting and short circuit protection features 	
11	<p>Computer Hardware, OS, MS office Networking</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 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 	<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.</p> <p>Various ports in the computer. POST Booting concept. Windows O.S.</p> <p>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.</p> <p>Concept of word processing: MS word - Menu bar, standard tool bar, saving, titles, legends and gridlines, colouring charts, printing charts, placing charts in a word file. 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. Operating system -OS, types etc.</p> <p>Identify physical topology of a network and members of the network, Internet search engines and applications.</p>

	<p>the font and size of text.</p> <ul style="list-style-type: none"> • 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 <p>File using suitable software. <i>(use free downloadable software)</i></p> <ul style="list-style-type: none"> • 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 copying, deleting & retrieving files, 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>12</p>	<p>Transistor</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 P) 	<p>Construction, Working of a PNP and NPN Transistors. Purpose of E, B & C Terminals. Flow of currents into and out of terminals of PNP/ NPN Transistors and their relations. Significance of P 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>

	<ul style="list-style-type: none"> Construct a Transistorized amplifier vary the gain by changing the circuit components 	
13	<p>Amplifier</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 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>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 Introduction to positive feedback and requisites of an oscillator, Study of Colpitts, Hartley, Crystal and RC oscillators.Types of multi vibrators and study of circuit diagrams</p>
14	<p>Wave shaping circuits</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.Schmitt trigger circuits</p>
15	<p>Power Electronic Components</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 	<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>

	<ul style="list-style-type: none"> 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. 	
16	MOSFET & IGBT: <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 load 	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.
17	Opto Electronics: <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
18	Basic SMD (2,3,4 terminal components): <ul style="list-style-type: none"> Identification of 2,3,4 terminal SMD components De-solder the SMD components 	Introduction to SMD technology Identification of 2,3,4 terminal SMD components, advantages of SMD components over conventional lead components

	<p>from the given PCB</p> <ul style="list-style-type: none"> • 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 solder paste and machine. Soldering of SM assemblies - Reflow soldering</p> <p>Tips for selection of hardware, Inspection of SM</p>
19	<p>Basic Gates:</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>
20	<p>Combinational Circuits:</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 • Construct and Test a 4 to 1 Multiplexer • Construct and Test a 1 to 4 De Multiplexer 	<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</p> <p>Basic Binary Decoder and four bit binary decoders.. Concept of encoder and decoder, Need for multiplexing of data. 1:4 line Multiplexer /De-multiplexer.</p>
21	<p>Flip Flops:</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 	<p>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.</p>
22	<p>Electronic circuit simulation software</p> <ul style="list-style-type: none"> • Prepare simple digital and electronic circuits using the software • Simulate and test the prepared 	<p>Study the library components available in the circuit simulation software. Various resources of the software.</p>

	<p>digital and analog circuits</p> <ul style="list-style-type: none"> • Convert the prepared circuit into a layout diagram. • Explore various troubleshooting and fault finding resources provided in the simulation software. 	
23	<p>Counter & shift Registers:</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 	<p>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.</p>
24	<p>Op – Amp & Timer 555 Applications:</p> <ul style="list-style-type: none"> • Use analog IC tester to test the various analog ICs • Construction and testing of various Op-Amp circuits Inverting, Non-inverting and Summing Amplifiers • Construct and test Differentiator and Integrator • Construct and test a zero crossing detector • Construct and test Instrumentation amplifier 	<p>Block diagram and Working of Op-Amp, importance, Ideal characteristics, advantages and applications. Schematic diagram of 741, symbol, Non inverting voltage amplifier, inverting voltage amplifier, summing amplifier, Comparator, zero cross detector, differentiator, integrator and instrumentation amplifier, other popular Op-Amps. Block diagram of 555, functional description w.r.t. different configurations of 555 such as mono stable, Astable and</p>

	<ul style="list-style-type: none"> • 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 	VCO operations for various application
25	<p>Digital Storage Oscilloscope:</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 	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.
26	<p>PCB Rework: Practical will be conducted at Industry</p>	<p>ESD Control in Electronics Introduction to Static charges, Prevention of Static charges, Handling of static sensitive devices, Various standards for ESD</p> <p>Introduction to non soldering interconnections Introduction to crimping, wire wrapping, Conductive adhesives, Chip on Board, Tape Automated bonding.</p> <p>Introduction to components, Printed Circuit Boards</p> <p>Introduction to components, Construction of Printed Circuit 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.</p> <p>Soldering and De-soldering stations and their specifications.</p> <p>Reliable Soldering Practices (Manual) Fundamentals of soldering technology, Materials selection like solder, flux and</p>

		<p>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)</p> <p>Introduction to surface mount technology – advantages Surface Mount components and packages, Introduction to solder paste (flux), Soldering of SM assemblies - Reflow soldering</p> <p>Tips for selection of hardware, Inspection of SM.</p> <p>Rework and Repair of Printed Circuit board assemblies</p> <p>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>
27	<p>Protection devices:</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. Types of Contactors, contactor coils and working voltages, contactor contact currents, protection to contactors and high current applications.</p>
28	<p>Electrical control circuits:</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. 	<p>Fundamentals of single phase Induction motors, synchronous speed, slip, rotor frequency, torque - speed characteristics, Starters used for Induction motors.</p>
29	<p>Electronic Cables & Connectors: Practical will be conducted at Industry</p>	<p>Cable signal diagram conventions 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</p>

		<p>cables.</p> <p>Male / Female type DB connectors, Ethernet 10 Base cross over cables and pin out assignments, UTP and STP, SCTP Cables 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, Fire wire, SATA Connectors, VGA,DVI connectors, MIDI etc.</p>
30	<p>Communication electronics:</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 Receiver • 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>Radio Wave Propagation -Principle, Fading, Need for Modulation, types of modulation. Demodulation techniques.</p> <p>Fundamentals of Antenna, various parameters, types of Antennas & application. Introduction to AM, FM & PM, SSB-SC & DSB-SC, block diagram of AM and FM transmitter. FM Generation & Detection</p> <p>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.</p> <p>Digital modulation and demodulation techniques, sampling, quantization & encoding. Concept of multiplexing and de multiplexing of AM/FM/PAM/ PPM /PWM signals.</p>
31	<p>Microcontroller (8051)</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 	<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>

	<p>external events.</p> <ul style="list-style-type: none"> • Demonstrate entering of simple programs, execute & monitor the results 	
32	<p>Sensors .Transducers and Applications</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 	<p>Basics of passive and active 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>
33	<p>Analog IC Applications 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>
34	<p>Digital IC Applications 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 	<p>Discussion on the identified projects with respect to data of the concerned ICs, components used in the project</p>

	<ul style="list-style-type: none"> • 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>	
35	<p>Fiber optic communication:</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. 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>
36	<p>Digital panel Meter: Practical will be conducted at Industry</p>	<p>Different types of seven segment displays, decoders and driver IC s for them. Concept of multiplexing and its advantages. Block diagrams of 7106 and 7107 and their configuration for different measurements. Use of DPM (Digital Panel Meter) with seven segment displays to display different voltage & current signals. Principles of working of LCD. Different sizes of LCDs. Decoder/Driver ICs used with LCDs and their pin-out diagrams. Scrolling displays and its design. Use of DPM (Digital Panel Meter) with LCD to display different voltage & current signals</p>
37	<p>SMPS: Practical will be conducted at Industry</p>	<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 stabilizer. Block Diagram of Switch mode</p>

		<p>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>
38	<p>UPS:</p> <p>Practical will be conducted at Industry</p>	<p>Concept of UPS,</p> <p>Difference between Inverters and UPS.</p> <p>Basic block diagram of UPS & operating principle,-explanation of rectifier, battery, inverter, static transfer switch.</p> <p>Types of UPS : Off line UPS, On line UPS, Line interactive UPS & their comparison</p> <p>UPS specifications. Load power factor & types of indications & protections</p> <p>UPS circuit description and working - controlling circuits, Micro controller circuits, power circuits, charging circuits, alarm circuits, Indicator circuits.</p> <p>Three phase UPS Circuits.</p> <p>Installation of single phase & three phase UPS</p> <p>Electrical wiring for Single phase and Three phase systems, Earthing and earth resistance measurement, calculation of load power and power factor of a power source.</p> <p>Protection circuits used in inverters– battery level, over load, over charging etc.</p> <p>Various faults and its rectification</p>
39	<p>Solar Power (Renewable Energy System)</p> <p>Practical will be conducted at Industry</p>	<p>Need for renewable energy sources, Solar energy as a renewable resource. Materials used for solar cells. Principles of conversion of solar light into electricity.</p> <p>Basics of photovoltaic's cell. Types of solar cells. Mono crystalline and poly crystalline PV cells.</p> <p>Define Components like Solar cell, Module, panel and Arrays. Factors that influence the output of a PV module. SPV systems and the key benefits. Difference between SPV and conventional power.</p> <p>Define solar charge controller or regulator and its role.</p> <p>Safety precautions while working with solar systems.</p>
40	<p>Cell phones</p> <ul style="list-style-type: none"> • Dismantle, identify the parts 	<p>Introduction to mobile communication, concept cell site, hand off, frequency reuse,</p>

	<p>and assemble different types of smart phones</p> <ul style="list-style-type: none"> • Dismantle the cell phone/smart phone replace the display • Dismantle the cell phone/smart phone remove the key pad and clean it, test for the continuity of the matrix/tracks • Interface the cell phone/smart phone to the PC and transfer the data • Enhance the memory capacity of the cell phone/smart phone • Connect internet on cell phone and browse popular web sites • Flash the various brands of cell phone/smart phone (at least 3) • Upgrade the OS • Format the cell phone/smart phone for virus(approach the mobile repair shop/service centre) • Unlock the handsets through codes and software • Identify the defective parts and rectify. • Clean the water damage sets using CTC with vibrator tubs • Replace various faulty parts like mic, speaker, data/charging/audio jack etc. 	<p>block diagram and working of cell phones, cell phone features, GSM and CDMA technology. Use IEMI number to trace lost/misplaced mobile phone.</p>
41	Revision & Examination	

NOTE: - Maximum uses of video demonstration and other IT based teaching aids may be adopted to deliver the theoretical knowledge.

Syllabus for

EMPLOYABILITY SKILLS

GENERAL INFORMATION
(Employability Skill)

1. Name of the subject : EMPLOYABILITY SKILLS
2. Hours of Instruction : 110 Hrs.
3. Examination : The examination will be held at the end of the training.
4. Instructor Qualification : MBA or BBA with two years experience OR Graduate in Sociology/Social Welfare/Economics with Two years experience OR Graduate/Diploma with Two years experience.

AND

Must have studies English/Communication Skills and Basic Computer at 12th /Diploma level and above.

OR

Existing Social Studies Instructors duly trained in Employability Skills from DGET Institute.

5. Instructor : One full time regular instructor shall be engaged on every 240 numbers of trainees for teaching subject "Employability Skills". One additional full time regular instructor would be required on increase in every 240 trainees.
Whatever the trainees are less than 240 or part thereof, a part-time instructor may be engaged to teach the subject.

ALLOTMENT OF TIME AND MARKS AMONG THE TOPICS

Sl. No.	Topics	Allotted Hours	Marks Allotted	To be covered in
1.	English Literacy	20 hrs.	9	Block - I
2.	I.T. Literacy	20 hrs.	9	
3.	Communication Skills	15 hrs.	7	
4.	SUB TOTAL:	55	25	
5.	Entrepreneurship Skills	15 hrs.	6	
6.	Productivity	10 hrs.	5	
7.	Occupational safety , health and Environment Education	15 hrs.	6	
8.	Labour Welfare Legislation	05 hrs.	3	
9.	Quality Tools	10 hrs.	5	
	SUB TOTAL:	55	25	
	TOTAL	110 hrs.	50	

Detail of Syllabus

1. English Literacy	
Hours of Instruction: 20 Hrs. Marks Allotted: 09	
Pronunciation	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
Functional Grammar	Transformation of sentences, Voice change, Change of tense, Spellings.
Reading	Reading and understanding simple sentences about self, work and environment
Writing	Construction of simple sentences Writing simple English
Speaking / Spoken English	Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
2. I.T. Literacy	
Hours of Instruction: 20 Hrs. Marks Allotted: 09	
Basics of Computer	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.
Computer Operating System	Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.
Word processing and Worksheet	Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets
Computer Networking and INTERNET	Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. formation Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.
3. Communication Skills Hour of Instruction: 15 Hrs. Marks Allotted: 07	
Topic	Contents

Introduction to Communication Skills	<p>Communication and its importance</p> <p>Principles of Effective communication</p> <p>Types of communication - verbal, non verbal, written, email, talking on phone.</p> <p>Non verbal communication -characteristics, components- Para-language</p> <p>Body - language</p> <p>Barriers to communication and dealing with barriers.</p> <p>Handling nervousness/ discomfort.</p>
Listening Skills	<p>Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening.</p> <p>Triple- A Listening - Attitude, Attention & Adjustment.</p> <p>Active Listening Skills.</p>
Motivational Training	<p>Characteristics Essential to Achieving Success</p> <p>The Power of Positive Attitude</p> <p>Self awareness</p> <p>Importance of Commitment</p> <p>Ethics and Values</p> <p>Ways to Motivate Oneself</p> <p>Personal Goal setting and Employability Planning.</p>
Facing Interviews	<p>Manners, Etiquettes, Dress code for an interview</p> <p>Do's & Don'ts for an interview</p>
Behavioral Skills	<p>Problem Solving</p> <p>Confidence Building</p> <p>Attitude</p>
4. Entrepreneurship Skills Hour of Instruction: 15 Hrs.	
Marks	
Allotted: 06	
Concept of Entrepreneurship	<p>Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue</p> <p>Entrepreneurship vs. management, Entrepreneurial motivation. Performance & Record, Role & Function of</p>

Ecosystem	Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.
Pollution	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.
Energy Conservation	Conservation of Energy, re-use and recycle.
Global warming	Global warming, climate change and Ozone layer depletion.
Ground Water	Hydrological cycle, ground and surface water, Conservation and Harvesting of water
Environment	Right attitude towards environment, Maintenance of in -house environment
7. Labour Welfare Legislation Hour of Instruction: 05 Hrs. Marks Allotted: 03	
Welfare Acts	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.
Hour of Instruction: 10 Hrs. Marks Allotted: 05	
8. Quality Tools	
Quality Consciousness	Meaning of quality, Quality characteristic.
Quality Circles	Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.
Quality Management System	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
House Keeping	Purpose of Housekeeping, Practice of good Housekeeping.
Quality Tools	Basic quality tools with a few examples

Tools & Equipments for Employability Skills:

Sl. No.	Name of the Equipment	Quantity
1	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	10 nos.
2	UPS - 500Va	10 nos.
3	Scanner cum Printer	1 no.
4	Computer Tables	10 nos.
5	Computer Chairs	20 nos.
6	LCD Projector	1 no.
7	White Board 1200mm x 900mm	1 no.

* Note: Above Tools & Equipments not required, if Computer LAB is available in the institute.

Syllabus for

ENGINEERING DRAWING

GENERAL INFORMATION
(Engineering Drawing)

1. **Name of the Subject** : ENGINEERING DRAWING
2. **Hours of Instruction** : 310 hrs.
3. **Instructor Qualification** : Degree in Engineering with one year experience
OR

Diploma in Engineering with two years
experience

OR

NTC/NAC in the Draughtsman (mechanical /
civil) with three years experience.

4. **Desirable:** Craft instructor certificate in RoD & A course under NCVT

5. Instructor:

One full time instructor is required for 144 engineering seats sanctioned in the institute. Additional instructor will be required on increase in every 144 students.

For seats less than 144, the instructor may be out sourced/ hired on contract basis.

Details of syllabus

Sl. No.	Topics (Total duration - 310 hrs.)
1.	Engineering Drawing: Introduction and its importance <ul style="list-style-type: none"> - Relationship to other technical drawing types - Conventions - Viewing of engineering drawing sheets. - Method of Folding of printed Drawing Sheet as per BIS SP:46-2003
2.	Drawing Instruments : their Standard and uses <ul style="list-style-type: none"> - Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips.
3.	Lines : <ul style="list-style-type: none"> - Definition, types and applications in Drawing as per BIS SP:46-2003 - Classification of lines (Hidden, centre, construction, Extension, Dimension, Section) - Drawing lines of given length (Straight, curved) - Drawing of parallel lines, perpendicular line - Methods of Division of line segment
4.	Drawing of Geometrical Figures: Definition, nomenclature and practice of - Angle: Measurement and its types, method of bisecting. <ul style="list-style-type: none"> - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements.
5.	Lettering and Numbering as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case.
6.	Dimensioning: <ul style="list-style-type: none"> - Definition, types and methods of dimensioning (functional, nonfunctional and auxiliary) - Types of arrowhead - Leader Line with text
7.	Free hand drawing of <ul style="list-style-type: none"> - Lines, polygons, ellipse, etc. - geometrical figures and blocks with dimension - Transferring measurement from the given object to the free hand sketches.
8.	Sizes and Layout of Drawing Sheets <ul style="list-style-type: none"> - Basic principle of Sheet Size - Designation of sizes - Selection of sizes

	<ul style="list-style-type: none"> - Title Block, its position and content - Borders and Frames (Orientation marks and graduations) - Grid Reference - Item Reference on Drawing Sheet (Item List)
9.	<p>Method of presentation of Engineering Drawing</p> <ul style="list-style-type: none"> - Pictorial View - Orthogonal View - Isometric view
10.	<p>Symbolic Representation (as per BIS SP:46-2003) of :</p> <p>Fastener (Rivets, Bolts and Nuts) - Bars and profile sections</p> <ul style="list-style-type: none"> - Weld, brazed and soldered joints. - Electrical and electronics element - Piping joints and fittings
11.	Construction of Scales and diagonal scale
12.	Practice of Lettering and Title Block
13.	<p>Dimensioning practice:</p> <ul style="list-style-type: none"> - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of dimension and dimensional tolerance. - Text of dimension of repeated features, equidistance elements, circumferential objects.
14.	<p>Construction of Geometrical Drawing Figures:</p> <ul style="list-style-type: none"> - Different Polygons and their values of included angles. Inscribed and Circumscribed polygons. - Conic Sections (Ellipse & Parabola)
15.	Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions.
16.	Free Hand sketch of hand tools and measuring tools used in respective trades.
17.	<p>Projections:</p> <ul style="list-style-type: none"> - Concept of axes plane and quadrant. - Orthographic projections - Method of first angle and third angle projections (definition and difference) - Symbol of 1st angle and 3rd angle projection as per IS specification.
18.	Drawing of Orthographic projection from isometric/3D view of blocks
19.	Orthographic Drawing of simple fastener (Rivet, Bolts, Nuts & Screw)
20.	Drawing details of two simple mating blocks and assembled view.
21.	<p>CRO: - Block diagram of Cathode Ray Oscilloscope (CRO). Block diagram of Digital storage Oscilloscope (DSO). Front panel view of CRO & DSO.</p>
22.	<p>Surface Mounting devices (SMD):- Front panel view of SMD station. IC package of SMD.</p>

23.	Electrical Protective Devices:- Symbol of MCB (Miniature Circuit Breaker), ELCB (Earth Leakage Circuit Breaker), DOL starter, Relays.
24.	Microcontroller:- Block diagram of 8051. Pin configuration of 8051.
25.	Modulation:- Block diagram of super Heterodyne Radio Receiver. Block diagram of AM and FM receiver.
26.	Power supply: Block diagram of SMPS. Block diagram of UPS-ONLINE, OFFLINE, LINE INTERACTING.
27.	Symbol of electronic component:- A. Thermocouple B. Strain Gauge C. LVDT(Linear variable differential transformer) D. Proximity Sensor
28.	DTH system:- Block diagram connections of Home system. Direct To Home(DTH).
29.	Cell Phone:- Block diagram of cell phone receiver system.
30.	Generator:- Front panel control for function Generator.
31.	Project related Drawings:- A. Dancing LED's B. Smoke detector C. Mobile charger D. Metal detector
32.	- Solution of NCVT test papers.
33.	Revision
34.	Examination

LIST OF TOOLS & EQUIPMENTS

Sl. No.	NAME OF TOOLS / EQUIPMENTS	QUANTITY
1.	Drawing Board	20 Nos.
2.	Models : Solid & cut section	As required
3.	Table for trainees	20 Nos.
4.	Stool for trainees	20 Nos.
5.	Cupboard (big)	01 No
6.	White Board (size: 8ft. x 4ft.)	01 No
7.	Trainer's Table	01 No
8.	Trainer's Chair	01 No

Syllabus for

Workshop Calculation & Science

GENERAL INFORMATION
(Workshop Calculation & Science)

1. Name of the subject : WORKSHOP CALCULATION & SCIENCE
2. Hours of Instruction : 220 hrs.
3. Examination :The examination for the subject will be held at the end of training.
4. Instructor Qualification : Degree in Engineering with two years experience OR
Diploma in Engineering with one year experience
5. Desirable : Craft Instructor Certificate in RoD & A course under NCVT.
6. Instructor: One full time instructor is required for 144 engineering seats sanctioned in the institute. Additional instructor will be required on increase in every 144 students.
For seats less than 144, the instructor may be out sourced/ hired on contract basis.

SYLLABUS FOR WORKSHOP CALCULATION AND SCIENCE

(Total duration – 220 hrs.)

Topic No	Workshop Calculation	Workshop Science
1.	Unit: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	Material Science : properties -Physical & Mechanical, Types -Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous metals, Non-Ferrous Alloys.
2.	Fractions: Fractions, Decimal fraction, L.C.M., H.C.F., Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Scientific Calculator.	Mass ,Weight and Density : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals.
3.	Square Root: Square and Square Root, method of finding out square roots, Simple problem using calculator.	Speed and Velocity: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple related problems.
4.	Ratio & Proportion : Simple calculation on related problems.	Work, Power and Energy: work, unit of work, power, unit of power, Horse power of engines, Mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.
5.	Percentage: Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	
6.	Algebra: Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	Heat & Temperature: Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.
7.	Mensuration: Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids - cube, cuboid, cylinder and Sphere. Surface area of solids -cube, cuboid, cylinder and Sphere.	Basic Electricity: Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections - series, parallel, electric power, Horse power, energy, unit of electrical energy.
8.	Trigonometry: Trigonometrical ratios, measurement of angles. Trigonometric tables	Levers and Simple Machines: levers and its types. Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine,

		Relationship between Efficiency, velocity ratio and Mechanical Advantage.
9.	Indices: Laws of indices related problems. Quadratic Equation: Introduction, solution of simple Quadratic equation and related problems.	Elasticity: Stress, strain, Modulus of elasticity, elastic limit, Hooks law, young's modulus.
10.	Solution of simple A.C. circuit with R.L.C. Calculation of power factor etc.	Material: Introduction, types and properties. Uses of Conducting, Semi-conducting and insulating materials.
11.	A.C Waveform Calculation: Calculation of r.m.s, average, instantaneous value, peak value. Peak to peak value, Frequency and wavelength calculation and their relationship	Magnetism: Magnetic material, magnetic field, flux density, magnetic moment, m.m.f. Reluctance, permeability, susceptibility, electromagnet, solenoid and its practical applications.
12.	Series And Parallel Connection of Electrical and Electronic components: 1. Calculation Series and parallel connection of Resistors. 2. Calculation Series and parallel connection of Capacitors. 3. Calculation Series and parallel connection of Inductors. 4. Calculation Series and parallel connection of Batteries. Conversion of power flow to H.P. Calculation of KVA.	Pressure:- Pneumatic pressure, PSI, bar, atmospheric pressure, pressure gauge and absolute pressure, Heat treatment process.
13.	Power supply: Calculation of SMPS, regulation, Calculation of load and wattage for selection of UPS, calculate of back up time of Battery related to UPS and Load, calculate of voltage regulation , firing angle calculation of ripple factor, voltage regulation of DC voltage. Calculate the regulation of solar power.	Power transmission by shaft, belts and ropes.
14.	Motor parameters & Calculation: Speed and frequency calculation of A.C motors, D.C motors.	Friction: Law of friction, co-efficient of friction, angle of friction, advantage and disadvantage of friction.
15.	Modulation: AM/FM modulation index calculation, calculation of Bandwidth, Percentage of modulation in FM/AM.	Force: Resolution and Composition of forces. Representation of forces by vectors, simple problems on lifting tackles like Jib wall, crane solution of problems with the aid of vectors, General condition of equilibrium for series of forces on a body.
16.	Number Systems: Introduction, Decimal, Binary, Octal, Hexadecimal, BCD code, ASCII code, Bit, Byte, KB, MB, GB, Conversion,	Gravity: Centre of Gravity, simple experiments stable, unstable and neutral equilibrium.

	Addition, Subtraction, Multiplication, Division, 1st and 2s complement method, 9s and 10s complement method. Boolean Algebra: Simplification of Boolean Algebra and equations.	
17.	Project costing: Project selection, cost of project, Simple estimation, simple problems on profit and loss , Balance sheet etc.	

BLOCK – II

DURATION: 09 MONTHS (39 weeks)

Industry level training

BROAD LEARNING TO BE COVERED IN INDUSTRY FOR ELECTRONICS MECHANIC

TRADE:

- 1. Safety and best practices (5S, KAIZEN etc.)**
- 2. Record keeping and documentation**
- 3. Identification and testing of electronic components/devices**
- 4. Repair & Maintenance work**

BLOCK II- INDUSTRIAL TRAINING	
DURATION: 09 MONTHS (39 WEEKS)	
SL NO	LIST OF OPERATIONS/SKILLS TO BE COVERED DURING INDUSTRIAL TRAINING
1	Identification, placement, and populate using different soldering and de-soldering techniques for different SMD and discrete components and IC's.
2	Identify defects and do rework of PCB Repairs.
3	Construct and test simple electrical control circuits
4	Identify and test various types of electrical protective devices and power devices like MCB, ELCB, FUSES,VARIAC.
5	Series and parallel stacking of Rectifiers for high voltage/current applications, use of MOSFET, IGBT, Optoelectronics devices in different power processing systems.
6	Identify, prepare, terminate and test various types of electronic cables used in various systems.
7	Identify different application of programmable system & test/troubleshoot the various components of it and apply the knowledge to service different domestic programmable systems.
8	Understand the operation of different process sensors, identify, wire & apply the knowledge to test various sensors of different industrial processes by selecting appropriate instruments.
9	Select a project, understand the requirements to construct the project and install it for a domestic /commercial applications based on various analog and digital IC's .
10	Knowledge of preparation of fiber cable using crimping method and Prepare fibre optic setup to transmit and receive various analog and digital data using fibre optic cable by understanding various constraints and following proper care.
11	Identify the various applications, components, connectors and trouble shoots the different ratings SMPS, UPS and inverter with due care and follow the safety norms.
12	Understand the solar energy and various factors and instruments involved in the generation of solar energy. Install a solar panel and connect the panel to the inverter and batteries and test the system.
13	Understanding the different LED Lightings and factors associated and dismantle

	and assemble the given LED light stack, rectify the faults and follow the remedial procedures referring to manuals.
14	Interface the LCD, LED DPM panels to various circuits for monitoring and testing.
15	Identify, operate various controls, troubleshoot and replace modules of the LCD/LED TV & its remote.
16	Understanding the operations of various sensors like temperature sensors (Thermistor/RTD/ Thermocouple), Pressure Sensors, flow Sensors also its applications on industrial automations.

NOTE: It is suggested by the industry representatives that, if any Industry able to cover up to 75% of the syllabus by itself as suggested in the practical skills curriculum, the remaining 25% can be covered using E-media or any other training centre mutually agreed by the industry and the Institute with an undertaking.

BLOCK – III

DURATION: 3 months (13 weeks)

Institute level training

For last three months candidates will be engaged in following works: -

1. Revision of theoretical components covered during Block – I.
2. Practical practice and report submission
3. Preparing candidate to face interview, preparation of bio-data and awareness about different jobs in the related field and grooming to be an entrepreneur.
4. Self study and final AITT examination

Note:-

1. The training may be conducted in Block mode i.e. few months in ITI & few in Industry.
2. The training may be conducted in flexible mode i.e. few days of a week in ITI & few days in Industry.
3. Nine months industrial training is mandatory.
4. Last three months of training in ITI is mandatory.
5. No admission of trainees without signing MOU with industry.
6. To sign MOU with ITI, industry must ensure the training facility should be available to impart different skill sets as indicated in Block-II. At least 75% of total skill set in Block-II to be covered in industry.
7. However, Industry should ensure 100% skill training indicated in Block-II & necessary arrangement to be made to cover training on rest skill set (beyond the % indicated in sl.6) in collaboration with any other related industries. Extensive use of e-learning process may also be adopted.

Tools & Equipments for the trade of Electronics Mechanic in Dual Training Mode for the Institute

A. TRAINEES TOOL KIT FOR 20 TRAINEES

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
34.	Dimmer start 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.	DSO (colour)	1 No
50.	Soldering & De soldering Station	1 No
51.	SMD Soldering & De soldering Station with necessary accessories	2 Nos
52.	DOL starter	1 No
53.	AC motor 1/4 HP	1 No
54.	Or ELECTRICAL TRAINER FITTED WITH RESOURCES MENTIONED (DOL starter, contactors, relays, MCB, Motor suitable for electrical control circuit exercises)	2 Nos
55.	Frequency modulator and Demodulator trainer kit	2 Nos
56.	PAM, PPM, PWM trainer kit	2 Nos
57.	AM/FM Commercial radio receivers	2 Nos
58.	Microcontroller kits (8051) along with programming software (Assembly level Programming)	4 Nos
59.	Application kits for Microcontrollers 6 different applications	1 set
60.	Sensor trainer kit (containing Various sensors like Thermocouple, RTD, Thermocouple, load cell, strain gauge, LVDT, smoke sensors, speed sensor)	2 Nos
61.	Various analog and digital ICs useful for doing project works mentioned in the digital and analog IC applications modules	As required

62.	Different types of electronic and electrical cables, connectors, sockets, terminations.	As required
63.	Fiber optic communication trainer	2 Nos
64.	Seven segment DPM	6 Nos
65.	LCD based DPM	6 Nos
66.	SMPS of different make	4 Nos
67.	UPS trainer	1No
68.	UPS 3 KVA with backup time minimum 30 minutes	1 No
69.	Mobile phone (different models) at least one 3 G mobile	3 Nos
70.	Smart phones of different make (android/Windows)	4 Nos
71.	Precision set of screw drivers- T5, T6, T7	2 Nos
72.	Tweezers - Bend tip	2 Nos
73.	Cell phone power source with charger chords for different cell phones	1 No
74.	LCD TV (Trainer kit)	1 No
75.	LCD TV (21")	2 No
76.	LED TV (Trainer kit)	1 No
77.	LED TV (21")	2 No
78.	Home theatre system	1No
79.	Solar Power Inverter 500VA	1 No
80.	LED lighting system	2 sets

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

ALLOTMENT OF TIME & MARKS AMONG

THE SUBJECTS FOR EXAMINATION

Sl. No.	SUBJECTS	Duration of exam (in Hrs.)	Full Marks	Pass Marks
1.	Trade Theory + E/S (150+50)	3	200	80
2.	Workshop Cal. & Sc.	3	50	20
3.	Engineering Drawing	4	50	20
4.	Internal Marks (ITI)	--	50	30
5.	Trade Practical –I*	4	50	30
6.	Internal Marks (Industry)	--	50	30
7.	Trade Practical-II** + Project work (200+50)	8	250	150
GRAND TOTAL			700	360

Note:-

- a. “*” represents practical conducted at ITI
- b. “**” represents practical conducted at Industry at the end of training
- c. 40% pass marks for theory subjects and 60% pass marks for practical
- d. The project work will be conducted at industry and industry will allot marks for the same.

Format for Internal Assessment

Name & Address of the Assessor :							Year of Enrollment :							
Name & Address of ITI (Govt./Pvt.) :							Date of Assessment :							
Name & Address of the Industry :							Assessment location: Industry / ITI							
Trade Name :			Block:				Duration of the Trade/course:							
Operation/Skill:														
Sl. No	Maximum Marks (Total 100 Marks)		15	5	10	5	10	10	5	10	15	15	Total internal assessment Marks	Result (Y/N)
	Candidate Name	Father's/Mother's Name	Safety consciousness	Workplace hygiene	Attendance/ Punctuality	Ability to follow Manuals/ Written instructions	Application of Knowledge	Skills to handle tools & equipment	Economical use of materials	Speed in doing work	Quality in workmanship	VIVA		
1														
2														

LIST OF TRADE COMMITTEE MEMBERS

Sl no.	Name & Designation	Representing Organization	Remarks
1	Smt. Sandhya Salwan, Director of Training	DGT, New Delhi	Chairperson
2	Shri A Mahendran, Director	FTI, Bangalore	Member
3	Shri Satya Shankar.BP , Director	AHI, Bangalore	Member
4.	Shri B Ashfaq Ahmed, Joint Director	AHI, Bangalore	Member
5	Shri CS Murthy, Joint Director	ATI-EPI, Hyderabad	Member
6	Shri LK Mukherjee, Deputy Director	CSTARI, Kolkata	Member
7	Shri PG Rajendran, ADT	ATI-EPI, Hyderabad	Member
8	Shri Raju Kannam, ADT	AHI, Bangalore	Member
9	Shri Mohammad Mustafa, Engineer	Sciencetech Technologies, Bangalore.	Member
10	Shri Jayachandra Aradya, Director	Silicon Micro Systems, Bangalore	Member
11	Nagaraj S, Director	Sourish Automation, Bangalore	Member