

## Maharashtra State Board of Vocational Examination, Mumbai 400 051

1	Name of Course	Diploma Course in Microprocessor & Microcontrollers									
2	Course code	301406									
3	Max no. of Students	25									
4	Duration	2 year									
5	Course Type	Full Time									
6	No. of Days per week	6 days									
7	No. of hours per day	7 Hrs									
8	Space require	Theory Class Room – 240 sqft Three Practical Lab – 3000 sqft									
9	Entry qualification	S.S.C. Pass									
10	Objective of syllabus	1) Awareness of Safety precautions 2) Knowledge of soldering techniques, use of tools in assembly. 3) Knowledge of Engineering Tools 4) Knowledge of electronic component used in Electrical & Electronics Instrument. 5) Knowledge of Radio & Audio Systems. 6) Ability to read schematic layouts / diagrams.. 7) Maintenance of Electrical / Electronics Instruments & Radio & Audio Systems.									
11	Employment opportunities	The trainee will either to be able to take up jobs with agencies which maintain and repair such equipments or with working experience will be in a position to start his own independent Business.									
12	Teachers Qualification	Master Degree in Arts for VTH1,2,3. & For VTH 4, 5, 6 Degree in Electronics Engineering or equivalent profession Qualification. With 1 year Teaching experience in Electronics Field.									
13	Teaching Scheme –										
	Sr.	Subject	Subject Code	Clock Hours / Week					Total		
				Theory	Practical						
	1	English (Communication Skill)	90000001	2 Hrs	1 Hrs				3 Hrs		
	2	Elective – I	--	2 Hrs	1 Hrs				3 Hrs		
	3	Elective – II	--	2 Hrs	1 Hrs				3 Hrs		
	4	Electronics Devices & Circuits	30140001	3 Hrs	8 Hrs				11 Hrs		
	5	Analog & Digital Electronics	30140002	3 Hrs	8 Hrs				11 Hrs		
	6	Microprocessor & Microcontrollers	30140008	3 Hrs	8 Hrs				11 Hrs		
	Total									42 Hrs	
14	Internship	Two Month Summer Internship from 1 <sup>st</sup> May to 30 <sup>th</sup> June is Compulsory.									
15	Examination Scheme – Final Examination will be based on syllabus of both years.										
	Paper	Subject	Subject Code	Theory			Practical			Total	
				Duration	Max	Min	Duration	Max	Min	Max	Min
	1	English (Communication Skill)	90000001	3 Hrs	70	25	3 Hrs	30	15	100	40
	2	Elective – I	--	3 Hrs	70	25	3 Hrs	30	15	100	40
	3	Elective – II	--	3 Hrs	70	25	3 Hrs	30	15	100	40
	4	Electronics Devices & Circuits	30140001	3 Hrs	100	35	3 Hrs	100	50	200	85
	5	Analog & Digital Electronics	30140002	3 Hrs	100	35	3 Hrs	100	50	200	85
	6	Microprocessor & Microcontrollers	30140008	3 Hrs	100	35	3 Hrs	100	50	200	85
	Total									900	375
16	Teachers – Three Teachers per batch for vocational component. For English, Elective-I & II guest faculty on clock hour basis.										
17	a) For Elective I – Student can choose any one subject Code Subject Name 90000011 Applied Mathematics 90000012 Business Economics 90000013 Physical Biology (Botany & Zoology) 90000014 Entrepreneurship 90000015 Psychology b) For Elective II – Student can choose any one subject Code Subject Name 90000021 Applied Sciences (Physics & Chemistry) 90000022 Computer Application 90000023 Business Mathematics										

**Electronics Devices & Circuits – 1<sup>st</sup> year**  
**Subject Code 30140001**

Theory	Practical
Detailed Syllabus :	Detailed Syllabus
<b>1. Materials</b> <b>Classification of materials</b> Conducting, semi-conducting and insulating materials through a brief reference to their atomic structure <b>Conducting Materials</b> Resistors and factors affecting resistivity such as temperature, alloying and mechanical stressing. Classification of conducting materials into low resistivity and high resistivity materials <b>Insulating Materials</b> Important relevant characteristics (electrical, mechanical and thermal) and applications of the following material. Mica, Glass, Copper, Silver, PVC, Silicon, Rubber, Bakelite, Cotton, Ceramic, Polyester, Polythene and Varnish. <b>Magnetic Materials</b> Different Magnetic materials; (Dia, Para, Ferro) and their properties. Ferro magnetism, Domains, permeability, Hysteresis loop. Soft and hard magnetic materials, their examples and typical applications.	Identification of Various Materials. <ul style="list-style-type: none"> <li>• Identification of Types of Resistors.</li> <li>• Calculation of Values using Color Codes</li> <li>• Wattage of Resistance</li> <li>• Series &amp; parallel connection of Resistance.</li> <li>• Ohms Law</li> </ul> Identification of Various Insulating Materials Properties & Use.  Identification of Various Magnetic Materials Properties & Use.
<b>Components:- Capacitors</b> Concept of capacitance and capacitors, units of capacitance, types of capacitors, constructional details and testing specifications a) Capacity of parallel plate capacitors, spherical capacitors, cylindrical capacitor. b) Energy stored in a capacitor. c) Concept of di-electric and its effects on capacitance, di-electric constant, break down voltage. d) Series and parallel combination of capacitor. Simple numerical problems of capacitor. e) Charging and discharging of capacitor with different resistances in circuit, concept of current growth and decay, time constant in R-C circuits, simple problems. <b>Resistors:</b> Carbon film, metal film, carbon composition, wound and variable types (presets and potentiometers) <b>Transformer, inductors and RF coils:</b> Methods of manufacture, testing, Need of shielding, application and troubleshooting <b>Surface Mounted Devices (SMDs):</b> Constructional detail and specifications. <b>Connectors, Relays, switches and cables:</b> Different types of connectors, relays, switches and cables, their symbols, construction and characteristics. <b>Semi Conductors and Integrated Circuits :-</b> Basic characteristics of Semiconductor materials, testing of diodes, transistors, FETs and SCRs. Various processes in IC manufacturing. Hybrid IC technology Superconductivity and piezoelectric ceramic transducer elements	Identification of Various Materials. <ul style="list-style-type: none"> <li>• Identification of Types of Capacitor.</li> <li>• Calculation of Values using Color Codes</li> <li>• Wattage of Capacitor Series &amp; parallel connection of Capacitor.</li> </ul> Identification of various SMD Identification of Relay, Switches & Cables & its Testing.  Identification of Various Electronics Components. Lead Identification.

<p><b>Basics of Measurements</b> Measurement, method of measurement, types of instruments:- <b>Specifications of instruments:</b> Accuracy, precision, sensitivity, resolution, range, errors in measurement, sources of errors, limiting errors loading effect, requirements, importance and applications of standards, calibration</p> <p><b>Multimeter</b> Principles of measurement of DC voltage, DC current, AC voltage, AC current, moving coil and moving iron type instruments (voltmeter and Ammeter) Block diagram of multimeter and measurement of voltage, current and resistance using multimeter Specifications of multimeter and their applications. Limitations with regard to frequency and input impedance.</p> <p><b>Electronic Voltmeter</b> Advantages over conventional multimeter for volt measurement with respect to input impedance and sensitivity. Principles of voltage, current and resistance measurement (block diagram only) Specifications of electronics voltmeter</p> <p><b>AC Milli Voltmeter</b> Types of AC milli voltmeters and their block diagram description Typical specifications and their significance.</p> <p><b>Cathode Ray Oscilloscope</b> Construction and working of different blocks used in CRT Time base operation and need for blanking during fly back, synchronization Block diagram description of a basic CRO and triggered sweep oscilloscope, front panel controls Specifications of CRO and their explanation Measurement of current, voltage, frequency, time, period and phase uses CRO. CRO probes, special features of dual beam, dual trace, delay sweep Digital storage oscilloscope: block diagram and working principle.</p> <p><b>Signal Generators and Analysis Instruments</b> Explanation of block diagram specifications of low frequency and RF generators, pulse generator, function generator Distortion factor meter; wave analyser and spectrum analyser</p> <p><b>Impedance Bridges and Q Meters</b> Wheat stone bridge AC bridges: Maxwell's induction bridge, Hay's bridge, De-Sauty's bridge, Schering bridge and Anderson bridge Block diagram description of laboratory type RLC bridge, specifications of RLC bridge Block diagram and working principle of Q meter.</p> <p><b>Digital Instruments</b> Comparison of analog and digital instruments Working principle of ramp, dual slope and integration type digital voltmeter. Block diagram and working of a digital multimeter Measurement of time interval, time period and frequency using universal counter/frequency counter. Working principle of logic probe, logic pulser, logic analyzer, logic comparator, signature analyzer and logic analyzer.</p>	<ol style="list-style-type: none"> <li>1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance</li> <li>2. To observe the limitations of a multimeter for measuring high frequency voltage</li> <li>3. Measurement of voltage, frequency, time period and phase using CRO</li> <li>4. Measurement of rise time and fall time using CRO</li> <li>5. Measurement of Q of a coil and its dependence on frequency</li> <li>6. Measurement of voltage, frequency, time and phase using DSO</li> <li>7. Measurement of resistance and inductance of coil using RLC meter</li> <li>8. Measurement of distortion of RF signal generator using distortion factor meter</li> <li>9. Use of logic pulser and logic probe</li> <li>10. Measurement of time period, frequency, average period using universal counter/frequency counter</li> <li>11. Study of operation and features of a logic analyzer</li> </ol>
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Electronics Devices & Circuits – 2 <sup>nd</sup> year	
<b>Subject Code 30140001</b>	
<b>BASIC ELECTRICAL AND ELECTRONICS</b> Safety precautions and elementary First aid, Identification, uses and maintenance of hand tools, DC & AC current, terms and definitions used in circuits , frequency, waveform Measurement of AC & DC using Ammeter / Voltmeter , AC power, power factor, work, power & Energy - their units and measurements , Identification of AC / DC meters, Kirchoff's law, Ohms law, electric power and dissipation in resistance, IR voltage drops. Define magnetism, unit of measurement, types of magnetic properties, Magnet and its classification, materials used & its application, mutual & self inductance, unit of measurement, BH curve. Passive Components : Resistor -definition, types of resistors, their construction & specific use, color-coding, power rating,. Series /parallel combination of resistances and measurement of current in branches. Capacitance – define, construction, types of capacitors, color coding charge/energy stored in capacitor, capacitive reactance, series/ parallel combination of capacitors Inductors-define ,types & their application, series and parallel combination, Q factor, Current carrying conductor, Fleming rule Electromagnets –define, Solenoids & relays define ,construction & its application. Working principle , construction of Transformers & their types, various losses of transformers. RC,RL, RLC Circuits, Series and parallel resonance Electrons and protons in an atom, Structure of atom, valance & conduction electron, Conductors, Insulators, Semiconductors, charge in motion-current, units, electron flow, motion of +ve charge, Semiconductors, Crystal structure and bonds, Intrinsic & extrinsic semiconductors, N- type, P-type, Free electron & Hole charges, Fixed ion charges, The P-N junction, Barrier potential, Forward & Reverse voltage, Effect of temp., V-I characteristic, Special purpose diodes and symbols. Rectifier types i.e. Half-wave, full-wave & bridge rectifiers, measurement of different currents i.e. Im, Idc, Irms, d.c. out put voltage, efficiency, filter circuits and their types, i.e. capacitor input filter, Choke input filter, etc, Junction break down, Zener break down, Zener diode, Forward & Reverse bias, Voltage regulation using Zener diode ,Zener regulators	<ul style="list-style-type: none"> <li>• Identification of various Hand tools used</li> <li>• Identification of different types of cables, SWG practice.</li> <li>• Measure the power , power factor and energy in different circuits.</li> <li>• Construct &amp; verify Ohm's law.</li> <li>• Construct and verify Kirchoff's voltage law. Tracing the magnetic field of Bar magnet using compass.</li> <li>• Identification of different resistors i.e. carbon, wire-wound, variable, pot., preset, Rheostat etc.</li> <li>• Color-coding of resistors ,Construct a series &amp; parallel resistor circuits</li> <li>• Identification of capacitor and their codes, construct the series /parallel circuit of capacitor</li> <li>• Identification of inductor , construct the series /parallel circuit of inductor.</li> <li>• Identification of capacitor and their codes, construct the series /parallel circuit of capacitor</li> <li>• Construct an electromagnet and test it.</li> <li>• Testing and construction of different types relays.</li> <li>• Identification and testing of different types of transformers, measure the O/P voltage.</li> <li>• Identification of anode, cathodes of different types of diodes.</li> <li>• Study the specifications of a semiconductor diode using a data sheet</li> <li>• Construct a forward bias and a reverse bias circuit and plot V-I characteristic of diode</li> <li>• Construct a half wave rectifier, full wave (center tapped) rectifier and full wave (Bridge) rectifier.</li> <li>• Observe wave forms with/ without using filter.</li> <li>• Study the specifications of zener diode using data sheet.</li> <li>• Construct the Zener regulator circuit</li> <li>• Series parallel combination of batteries</li> <li>• Charging of batteries, maintenance of batteries</li> <li>• Calculate the shorted load and matched load current for given cell</li> </ul>

<p>Battery: Electrochemical action, define symbol, types of cell, construction, principle charging ,specific gravity (Amp-hr capacity) specification of battery classification of battery, application, , service needs, storage, , lead acid battery ,. ideal voltage source, real voltage source, shorted load current, matched load current, Current source.</p>	
<p><b>Three Phase Supply</b> Advantages of 3 phase system over single phase system <b>Star delta connections</b> Relation between phase voltage and line Voltage, also between phase current and line current in a 3 phase system Power and power factor in 3 phase system and their measurements <b>Transformer</b> Principles of transformer, construction, voltage and current transformation. Methods of connection 3 phase transformers, current and voltage relationship, auto transformer and its uses, instruments transformer, voltage regulation and its significance, need for isolation, electrical and transients suppression, principles of isolation transformer, specifications of all types of transformers. Losses in a transformer. <b>DC Motor</b> Principles, significance of back emf, types of motors and their constructions, motor characteristics for shunt and series, speed control of DC motors and factors controlling the speed. Starting methods, Construction and working of 3 point starter, applications (simple problems) <b>Single Phase Motors</b> Principles, construction, working speed control, starting and applications of the following motors Induction motor, Universal motor. <b>Stepper Motor and Servo Motor</b> Types, construction, working and their applications</p>	<p><b>Introduction to electrical machines</b>  Measurement of the angular displacement of rotor of the three phase synchronous machine with respect to the stator on application of DC to the field winding and simultaneously to each phase-winding in sequence <b>DC machines</b> Speed control of dc shunt motor (i) Armature control method (ii) Field control method Study of dc series motor with starter (to operate the motor on no load for a moment). <b>Transformers (single phase)</b> To perform open circuit and short circuit test for determining parameter of a transformer To determine the regulation and efficiency from the data obtained from open circuit and short circuit test <b>Three-phase transformers</b> Checking the polarity of the windings of a three phase transformer and connecting the windings in various configurations.</p>

### RECOMMENDED BOOKS

- Basic Electronics and Linear Circuits by NN Bhargava, Tata McGraw Hills, New Delhi
- Electronics Principles by Malvino, Tata McGraw Hills, New Delhi
- Electronic Devices and Circuits by Millman and Halkias, McGraw Hills, New Delhi
- Basic Electronics by Grob, Tata McGraw Hills, New Delhi
- Art of Electronics by Horowitz
- Electronic Principles by Sahdev, Dhanpat Rai and Sons, New Delhi.
- Electronic Circuit Theory by Boylestad
- Electronic Devices and Circuits by BL Theraja, S Chand and Co Ltd. New Delhi
- Operational Amplifiers and Linear Integrated Circuits by Ramakant A. Gaykwad
- Electronics Devices and Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi
- Electronics Devices and Circuits-II by Naresh Gupta, Jyotesh Malhotra and Harish C. Saini, Eagle Prakashan, Jalandhar
- Electronic components and Materials by Grover and Jamwal; Dhanpat Rai and Sons, New Delhi
- Basic Electronics and Linear Circuits by NN Bhargava and Kulshreshta; Tata McGraw Hill, New Delhi
- Electronic components and Materials by SM Dhir, Tata McGraw Hill, New Delhi
- Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi
- Electronic Engineering Materials by ML Gupta, Dhanpat Rai and Sons; New Delhi.
- Electrical Machine by SK Bhattacharya, Tata McGraw Hill, New Delhi
- Electrical Machines by SK Sahdev, Unique International Publications, Jalandhar
- Electrical Machines by Nagrath and Kothari, Tata McGraw Hill, New Delhi
- Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai & Sons, Delhi
- Electronics Instrumentation by Cooper, Prentice Hall of India
- Electronics Test and Instrumentation by Rajiv Sapra, Ishan Publications, Ambala
- Electronics Instrumentation by JB Gupta, Satya Prakashan, New Delhi

### List of Tools & Equipments:-

Category	Sr. No	Name of Tool & Equipment	Quantity
<b>Hand tools</b>	1	Rule wooden 4 fold	25
	2	Scriber	25
	3	Pincer insulated Screw Driver Knife double bladed electrician	25
	4	Insulated handle thin connector screw driver	25
	5	Tester	25
	6	Heavy duty screw driver	25
	7	Combination plier	25
	8	Long nose plier Tweezer	25
	9	Heat sink plier	25
	10	Watch maker screw driver	25
	11	Adjustable spanner /slide wrench	25

Category	Sr. No	Name of Tool & Equipment	Quantity
<b>Instruments and general shop out fit per unit</b>	1	Wire stripper	4
	2	Soldering iron	4
	3	Wire gauge set	4
	4	Feeler gauge	4
	5	Permanent magnet bar	8
	6	Solenoid with core	8
	7	Electric bell	8
	8	Battery storage lead acid/Maintenance free	8
	9	Hydrometer	4
	10	Battery charger	4
	11	Rheostat variable values	8
	12	Variable resistance /potentiometer	4
	13	Transformer 500 VA	4
	14	DC& AC ammeter 0-50 uA	4
	15	DC& AC ammeter 0-500 uA	4
	16	DC& AC ammeter 0-1mA	4
	17	DC& AC ammeter 0-500 mA	4
	18	DC& AC ammeter 0-1 A	4
	19	Multimeter small & big	4 each
	20	Bread board for connecting various components i.e. diode, resistances ,capacitors etc,	8
	21	0-12 V DC ,2 Amp power supply	4
	22	Transformer 0-12 V, 6-0-6 V , 1 Amp	4
	23	Rubber gloves	8

Category	Sr. no	Name of Tool & Equipment	Quantity
<i>Furniture</i>	1	WORK BENCH / TABLE / TEST BENCH	As required
	2	REVOLVING CHAIR / STOOL [FOR PARTICIPANTS]	16
	3	STAFF TABLE	1
	4	REVOLVING CHAIR [FOR STAFF]	1
	5	STEEL RACKS	As required
	6	STEEL ALMIRAH	As required
	7	STEEL LOCKERS FOR 16 PARTICIPANTS	As required
	8	Fire Extinguisher	As required
	9	Rubber mat	As required

# Analog & Digital Electronics – 1<sup>st</sup> year

**Subject Code 30140002**

Theory	Practical
<p><b>Multistage Amplifiers</b>            Need for multistage amplifier            Gain of multistage amplifier            Different types of multistage amplifier like RC coupled, transformer coupled, direct coupled, and their frequency response and bandwidth</p> <p><b>Large Signal Amplifier</b>            Difference between voltage and power amplifiers            Importance of impedance matching in amplifiers            Class A, Class B, Class AB, and Class C amplifiers            Single ended power amplifiers, push-pull amplifier, and complementary symmetry push-pull amplifier.</p> <p><b>Feedback in Amplifiers</b>            Basic principles and types of feedback            Derivation of expression for gain of an amplifier employing feedback            Effect of feedback (negative) on gain, stability, distortion and bandwidth of an amplifier            RC coupled amplifier with emitter bypass capacitor            Emitter follower amplifier and its applications.</p> <p><b>Sinusoidal Oscillators</b>            Use of positive feedback            Barkhausen criterion for oscillations            Different oscillator circuits-tuned collector, Hartley Colpitts, phase shift, Wien's bridge, and crystal oscillator. Their working principles and simple numerical problems            Series and parallel resonant circuits and bandwidth of resonant circuits            Single and double tuned voltage amplifiers and their frequency response characteristics</p> <p><b>Wave Shaping Circuits</b>            General idea about different wave shapers            RC and RL integrating and differentiating circuits with their applications            Diode clipping and clamping circuits and simple numerical problem on the circuits.</p> <p><b>Multivibration Circuits</b>            working principle of transistor as switch            Concept of multi-vibrator: astable, monostable, and bistable and their applications            Block diagram of IC555 and its working            IC555 as monostable and astable multi-vibrator.</p> <p><b>Operational Amplifiers</b>            Characteristics of an ideal operational amplifier and its block diagram            Definition of differential voltage gain, CMMR, PSRR, slew rate and input offset current            Operational amplifier as an inverter, scale changer, adder, subtractor, differentiator, and integrator            Concept of Schmitt trigger circuit and sample/hold circuit using operational amplifier and their applications.</p> <p><b>Regulated DC Power Supplies</b>            Concept of DC power supply. Line and load regulation            Concept of fixed voltage, IC regulators (like 7805, 7905), and variable voltage regulator like (IC 723)            Idea of SMPS.</p>	<ol style="list-style-type: none"> <li>Plot the frequency response of two stage RC coupled amplifier and calculate the bandwidth and compare it with single stage amplifier</li> <li>To measure the gain of push-pull amplifier at 1KHz</li> <li>To measure the voltage gain of emitter follower circuit and plot its frequency response</li> <li>Plot the frequency response curve of Hartley and Colpitts Oscillator</li> <li>Plot the frequency response curve of phase shift and Wein bridge Oscillator</li> <li>To observe the output waveforms of series and shunt clipping circuits</li> <li>To observe the output for clamping circuits</li> <li>To observe the output waveform of a Bistable multivibrator</li> <li>Use of IC 555 as monostable multivibrator and observe the output for different values of RC</li> <li>Use of IC 555 as astable multivibrator and observe the output at different duty cycles</li> <li>To use IC 741 (op-amplifier) as               <ol style="list-style-type: none"> <li>Inverter</li> <li>Adder</li> <li>Subtractor</li> <li>Integrator</li> </ol> </li> <li>To realize positive and negative fixed voltage AC power supply using three terminal voltage regulator IC (7805, 7812, 7905)</li> </ol>



**RECOMMENDED BOOKS**

1. Basic Electronics and Linear Circuits by NN Bhargava, Tata McGraw Hills, New Delhi
2. Electronics Principles by Malvino, Tata McGraw Hills, New Delhi
3. Electronic Devices and Circuits by Millman and Halkias, McGraw Hills, New Delhi.
4. Basic Electronics by Grob, Tata McGraw Hills, New Delhi
5. Art of Electronics by Horowitz
6. Electronic Principles by Sahdev, Dhanpat Rai and Sons, New Delhi.
7. Electronic Circuit Theory by Boylestad
8. Electronic Devices and Circuits by BL Theraja, S Chand and Co Ltd. New Delhi
9. Operational Amplifiers and Linear Integrated Circuits by Ramakant A. Gaykwad
10. Electronics Devices and Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi
11. Electronics Devices and Circuits-II by Naresh Gupta, Jyotesh Malhotra and Harish C. Saini, Eagle Prakashan, Jalandhar

**Analog & Digital Electronics – 2<sup>nd</sup> year****Subject Code 30140002**

Theory	Practical
<p><b>Introduction</b> Define digital and analog signals and systems, difference between analog and digital signals Need of digitization and applications of digital systems.</p> <p><b>Number Systems</b> Decimal, binary, octal, hexadecimal number systems Conversion of number from one number system to another including decimal points Binary addition, subtraction, multiplication, division, 1's and 2's complement method of subtraction BCD code numbers and their limitations, addition of BCD coded numbers, conversion of BCD to decimal and vice-versa Excess-3 code, gray code, binary to gray and gray to binary conversion Concept of parity, single and double parity, error detection and correction using parity.</p> <p><b>Logic Gates</b> Logic gates, positive and negative logic, pulse waveform, definition, symbols, truth tables, pulsed operation of NOT, OR, AND, NAND, NOR, EX-OR, EX-NOR gates. NAND and NOR as universal logic gates.</p> <p><b>Logic Simplification</b> Rules and laws of Boolean algebra, logic expression, Demorgan's theorems, their proof Sum of products form (minterm), Product of sum form (maxterms), simplification of Boolean expressions with the help of Rules and laws of Boolean algebra Karnaugh mapping techniques upto 4 variables and their applications for simplification of Boolean expression.</p> <p><b>Arithmetic Circuits</b> Half adder, full adder circuits and their operation Parallel binary adder, 2-bit and 4-bit binary full adder, block diagram, working.</p> <p><b>Multiplexer/Demultiplexer</b> Basic functions, symbols and logic diagrams of 4-inputs and 8-inputs multiplexers, Function/utility of 16 and 32 inputs multiplexers, Realization of Boolean expression using multiplexer/demultiplexers.</p> <p><b>Decoders, Display Devices and Associated Circuits</b> Basic Binary decoder, 4-line to 16 line decoder circuit BCD to decimal decoder, BCD to 7-segment decoder/driver, LED/LCD display.</p> <p><b>Encoders and Comparators</b> Encoder, decimal to BCD encoder, decimal to BCD priority encoder, keyboard encoder Magnitude comparators, symbols and logic diagrams of 2-bit and 4-bit comparators.</p>	<ol style="list-style-type: none"> <li>1. Study of logic breadboard with verification of truth table for AND, OR, NOT, NAND, EX-OR, NOR gate</li> <li>2. Verification of NAND and NOR gate as universal gates</li> <li>3. Construction of half-adder and full adder circuits using EX-OR and NAND gate and verification of their operation</li> <li>4. Verify the operation of             <ol style="list-style-type: none"> <li>a) multiplexer using an IC</li> <li>b) de-multiplexer using an IC</li> </ol> </li> <li>5.             <ol style="list-style-type: none"> <li>a) Verify the operation of BCD to decimal decoder using an IC</li> <li>b) Verify the operation of BCD to 7 segment decoder using an IC</li> </ol> </li> </ol>

<b>Latches and Flip-Flops</b> Latch, SR-latch, D-latch, Flip-flop, difference between latch and flip-flop S-R, D flip-flop their operation using waveform and truth tables, race around condition JK flip-flop, master slave and their operation using waveform and truth tables. <b>Counters</b> Asynchronous counter, 4-bit Asynchronous counter, Asynchronous decade counter Asynchronous counter, 4-bit synchronous binary counter, Asynchronous decade counter Up/down Asynchronous counters, divide by N counter MOD-3, MOD-5, MOD-7, MOD-12 counters Ring counter, cascaded counter, counter applications <b>Shift Registers</b> Shift registers functions, serial-in-serial out, serial-in-parallel-out, parallel-in-serial-out, parallel-in-parallel out Universal shift register, shift register counter and applications of shift registers.	6. Verify operation of SR, JK, D-flip-flop master slave JK flip-flop using IC 7. Verify operation of SISO, PISO, SIPO, PIPO shift register. (universal shift register) 8. Study of ring counter, Up/down counter 9. Construct and verify the operation of an asynchronous binary decade counter using JK flip-flop 10. Verification of truth tables and study the operation of tristate buffer IC 74126 or similar IC and construction of 4/8 bit bi-directional bus by using an IC 11. Testing of digital ICs using IC tester
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<b>RECOMMENDED BOOKS:-</b> 1. Digital Electronics and Applications by Malvino Leach, Tata McGraw Hill, New Delhi 2. Digital Logic Designs by Morris Mano, Prentice Hall of India, New Delhi 3. Digital Fundamentals by Thomas Floyds, Universal Book Stall 4. Digital Electronics by RP Jain, Tata McGraw Hill, New Delhi 5. Digital Electronics by KS Jamwal, Dhanpat Rai & Co., New Delhi 6. Digital Electronics by Rajiv Sapra, Ishan Publication, Ambala 7. Digital Electronics by BR Gupta, Dhanpat Rai & Co., New Delhi 8. Digital Systems: Principles and Applications by RJ Tocci, Prentice Hall of India, New Delhi 9. Digital Electronics by Rajaraman V., Prentice Hall of India, New Delhi
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**Tools & Equipments:---**

Category	Sr. No	Name of Tool & Equipment	Quantity
Hand tool	1	Rule wooden 4 fold	25
	2	Scriber	25
	3	Pincer insulated Screw Driver Knife double bladed electrician	25
	4	Insulated handle thin connector screw driver	25
	5	Tester	25
	6	Tweezer	25
	7	Combination plier	25
	8	Long nose plier	25
	9	Heat sink plier	25
	10	Watch maker screw driver	25
	11	Adjustable spanner /slide wrench	25
	12	Soldering iron	25
	13	Digital Multimeter 3 ½ digit	25

Category	Sr. No	Name of Tool & Equipment	Quantity
<b>Instruments and general shop out fit per unit</b>	1	Basic Electronics Trainer for conducting practical of LDR, Transistorized Amplifier and Oscillators with bread board facility for connecting components & DC regulated power supply for the experiment along with different passive components on board . Necessary current meters and Volt meters should also be provided	5
	2	Linear IC trainer for conducting practical of 741& 723 Op-AMP with bread board facility for connecting components & DC regulated power supply for the experiment along with different passive components on board . Necessary current meters and Volt meters should also be provided	5
	3	Power Electronic trainer for conducting practical of UJT, FET. SCR. DIAC, TRIAC, MOSFET, OPTO COUPLER with bread board facility for connecting components & DC regulated power supply for the experiment along with different passive components on board . Necessary current meters and Volt meters should also be provided	5
	4	SMPS trainer (IC & Transistorized based) with various test points for check the voltage and wave form having 4 O/P 110v,24V,12V,5 V	5
	5	Power supply trainer having facility of IC regulators using 78 & 79 series	5
	6	Bread board	8
	7	Oscilloscope 20 MHz with probes	4
<b>Instruments and general shop out fit per unit</b>	8	Oscilloscope 50MHz with probes	2
	9	Electronic Multimeter	8
	10	Function generators 0.1 Hz to 100KHz Sine Square,Triangular	5
	11	Pulse generator	5
	12	Sine wave generator	5
	13	Audio frequency generator	5
	14	Signal generator	5
	15	Digital Multimeter	5
	16	Magneto scope	2
	17	Soldering iron 25Watt	4
	18	1200 VA Inverter	1
	19	0-12 V DC regulated Power supply	4
	20	Auto Transformer	2

Category	Sr. no	Name of Tool & Equipment	Quantity
<i>Furniture</i>	1	WORK BENCH / TABLE / TEST BENCH	As required
	2	REVOLVING CHAIR / STOOL [FOR PARTICIPANTS]	25
	3	STAFF TABLE	1
	4	REVOLVING CHAIR [FOR STAFF]	1
	5	STEEL RACKS	As required
	6	STEEL ALMIRAH	As required
	7	STEEL LOCKERS FOR 16 PARTICIPANTS	As required
	8	FIRE EXTIGUISER	As required
	9	RUBBER MAT	As required

**Subject : Microprocessor & Microcontrollers –1<sup>st</sup> year****Subject Code : 30140008**

<b>Theory</b>	<b>Practical</b>
<b>Introduction</b> Microprocessors – evolution, importance and Application	1. Familiarisation of different keys of 8085 microprocessor kit and its memory map
<b>Architecture of a Microprocessor – 8085</b> a) Concept of bus and bus organisation b) Functional block diagram and function of each block c) Pin details of 8085 and related signals d) Demultiplexing of address/data bus and memory/IO read/write control signals	2. Steps to enter, modify data/program and to execute a programme on 8085 kit
<b>Introduction Set for Intel 8085</b> a) Instruction and data format – opcode and operand and its word size b) Instruction cycle, machine cycle, T-states, fetch cycle, and execute cycle c) Different addressing modes d) Status flags and their importance e) Data transfer, arithmetic and logical operation, branching, and machine control instructions f) Use of stacks and subroutines g) Assembly language programming	3. Writing and execution of ALP for addition and subtraction of two 8 bit numbers 4. Writing and execution of ALP for multiplication and division of two 8 bit numbers
<b>Interfacing and Data Transfer Schemes</b> a) Memory mapped I/O and I/O mapped I/O schemes b) Interrupts of 8085 c) Programmable data transfer, DMA data transfer and interrupt driven data transfer schemes with their applications	5. Writing and execution of ALP for arranging 10 numbers in ascending/descending order 6. Writing and execution of ALP for 0 to 9 BCD counters (up/down counter according to choice stored in memory)
<b>Peripheral Devices</b> Detailed study of the following a) 8255 PPI b) 8253 PIT c) 8257 DMA Controllers d) 8259 PIC e) 8279 Programmable KB/Display Interface f) 8251 Communication Interface Adapter	7. Interfacing exercise on 8255 like LED display control 8. Interfacing exercise on 8253 programmable interval timer 9. Interfacing exercise on 8279 programmable KB/display interface like to display the hex code of key pressed on display
<b>Introduction to other 8-bit microprocessor like Z-80, 6800 and their comparison with 8085</b>	10. Study and use of interfacing 8 bit A/D card 11. Study and use of interfacing 8 bit D/A card 12. Use of 8085 emulator for hardware testing

**RECOMMENDED BOOKS:-**

1. Microprocessor Architecture, Programming and Applications with 8085 by RS Gaonkar
2. Microprocessor and Applications by B Ram
3. Comprehensive Study of Microprocessor by Naresh Grover
4. Introduction to Microprocessor by Adithya P Mathur, Tata McGraw Hill Publishers, New Delhi
5. Microprocessor by SK Goel

## Microprocessor & Microcontrollers – 2<sup>nd</sup> year

Theory	Practical
<b>Microcontroller series (MCS) – 51 Overview</b> <ul style="list-style-type: none"> <li>• Pin details</li> <li>• I/O Port structure</li> <li>• Memory Organization</li> <li>• Special Function Registers (SFRS)</li> <li>• External Memory</li> </ul>	Familiarization of MC kit Program Execution using -Data Transfer Group, Logic Group, Arithmetic Group, Branch Group Study of interfacing techniques
<b>Instruction Set; Addressing Modes, Instruction types</b> <ul style="list-style-type: none"> <li>• Timer operation</li> <li>• Serial Port operation</li> <li>• Interrupts</li> </ul>	Interfacing of MC using 8255 and study the working of: Traffic light controller ,DAC, ADC, Stepper motor ,Elevator, LCD KEYBOARD
<b>Assembly language programming</b> <ul style="list-style-type: none"> <li>• Assembler directives</li> <li>• Assembler operation</li> </ul>	Hard ware and software Exercises in ports & Read the status of a switch using MC port pin
<b>Design and Interface</b> Examples like keypad interface, 7- segment interface etc	Drive a relay using MC port pin Develop & run programs using Timer, Counter & Interrupt applications
<b>Introduction to PLCs</b> Architectural details – Processor <ul style="list-style-type: none"> <li>• Memory structure, I/O Structure</li> <li>• Programming terminal, Power Supply</li> </ul>	Install the PLC Software on the PC. Configure the software to communicate with a PLC. Familiarization with the software and use of different Data files/ function blocks etc.
<b>Working of PLC</b> Basic principle, response time, effects of response time, relay replacing, Basic instructions, PLC registers and program scan	Develop simple programs and Download them for execution for simple digital I/O Develop programs using timers and counters and execute. Develop programs to cover different instructions and execute.
<b>Instruction Set</b> Latching, counter, timers one shot, shift register, math, Boolean instructions	Develop and run simple tasks such as control of a relay, contactor, lamp & motor etc for different input conditions. Monitor the status of the application ONLINE. Perform some Force operations.
<b>Ladder diagram programming</b>	Develop programs to acquire analog data using Analog input card. Develop programs to display/control data using Analog output card.
<b>RECOMMENDED BOOKS:-</b>	
1. The 8051 Micro controller by I Scot Mackenzie, Prentice Hall International, London 2. The 8051 Micro Controllers Architecture, Programming and Applications by Ayala; Penram International 2. Process Control Instrumentation Technology by Johnson, Curtis; EEE Edition, Prentice Hall of India, New Delhi 4. Programmable Logic Controller by Job Dan Otter; P. H. International, Inc, USA	

## LIST OF TOOLS & EQUIPMENTS

NUMBER OF UNITS ONE ( 25 trainees )

### (A) TRAINEES TOOL KIT

Sr. No.	Name of Items	No.s Required	
1.	Measuring Tape Steel 100cm	25 Nos.	
2.	Rule Steel 300cm	25 Nos.	
3.	Screw Driver heavy duty 200mm insulated thick	25 Nos.	
4.	stem	25 Nos.	
5.	Screw Driver heavy duty 250mm with insulated	25 Nos.	
6.	thick stem handle	25 Nos.	
7.	Plier Insulated combination 200 mm	25 Nos.	
8.	Knife double blade electrician 100mm	25 Nos.	
9.	Pincer 150mm	25 Nos.	
10.	Scriber 150mm x 4mm	25 Nos.	
11.	Punch center 150mm x 8mm	25 Nos.	
12.	Hammer ball pien 0.75kg with handle	25 Nos.	
13.	Hammer cross pien 115gms with handle	25 Nos.	
14.	Saw Tenon 250mm	25 Nos.	
15.	Firmer chisel wood 12mm	25 Nos.	
16.	Gimlet 6mm	25 Nos.	
25.	Bradawl 100mm	25 Nos.	
	Wire stripper 150 mm	25 Nos.	
	Heat sink plier	25 Nos.	
<b>TRAINEE'S PERSONAL TOOL KIT</b>		Quantity Required	
1	Voltage sensor (pencil type)/ Electronic Tester	1 No	To be brought by Trainees.
2.	Screw Driver Kit ( Set of six blades with common	1 No	
3.	insulated handle with neon tester )	1 No	
4	<b>Plier insulated 150 mm</b>	1 No	
5.	Multimeter	1 No	
	Soldering iron,15W,230 V(temperature controlled)	1 No	

### List of Tools & Equipments of Workshop

Sl No	Description of Item	Qty
1	8085 based Microprocessor Kit	4
2	8051 Based Microcontroller kit	4
3	Interfacing Modules such as DAC,ADC,TRAFFIC LIGHT ,STEPPER MOTOR,LCD Display & Key board	4 each
4	8086 based 16 bit Trainer Kit	4
5	Pic Microcontroller Kit	4
6	P IV Computer Server configuration	1
7	P IV Computers	4
8	Compiler on C language	1
9	Window 2000 software	1
10	8 Port Hub	1
11	NIC cards,cables and peripherals	4
12	Bread Boards	2
13	Microcontroller Programmer	1
14	Components (MC, Memories,Resistors, cap, wires ETC)	As required
15	Soldering Iron (Temperature Controlled)	6
16	PIC programmer	1
17	In-circuit emulator	1
18	Oscilloscope (100MHZ)	1
19	Digital Multimeter	6

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