

Maharashtra State Board of Vocational Examination, Mumbai 400 051

1	Name of Course	Diploma Course in Industrial Electronics																																																																																																				
2	Course code	301404																																																																																																				
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 used in Industry.																																																																																																				
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	<div>Teaching Scheme –<table><tr><th rowspan="2">Sr.</th><th rowspan="2">Subject</th><th rowspan="2">Subject Code</th><th colspan="2">Clock Hours / Week</th><th rowspan="2">Total</th></tr><tr><th>Theory</th><th>Practical</th></tr><tr><td>1</td><td>English (Communication Skill)</td><td>90000001</td><td>2 Hrs</td><td>1 Hrs</td><td>3 Hrs</td></tr><tr><td>2</td><td>Elective – I</td><td>--</td><td>2 Hrs</td><td>1 Hrs</td><td>3 Hrs</td></tr><tr><td>3</td><td>Elective – II</td><td>--</td><td>2 Hrs</td><td>1 Hrs</td><td>3 Hrs</td></tr><tr><td>4</td><td>Electronics Devices & Circuits</td><td>30140001</td><td>3 Hrs</td><td>8 Hrs</td><td>11 Hrs</td></tr><tr><td>5</td><td>Analog & Digital Electronics</td><td>30140002</td><td>3 Hrs</td><td>8 Hrs</td><td>11 Hrs</td></tr><tr><td>6</td><td>Industrial Electronics</td><td>30140006</td><td>3 Hrs</td><td>8 Hrs</td><td>11 Hrs</td></tr><tr><td colspan="5">Total</td><td>42 Hrs</td></tr></table></div>						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	Industrial Electronics	30140006	3 Hrs	8 Hrs	11 Hrs	Total					42 Hrs																																														
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14	Internship	Two Month Summer Internship from 1 st May to 30 th June is Compulsory.																																																																																																				
15	<div>Examination Scheme – Final Examination will be based on syllabus of both years.<table><tr><th rowspan="2">Paper</th><th rowspan="2">Subject</th><th rowspan="2">Subject Code</th><th colspan="3">Theory</th><th colspan="3">Practical</th><th colspan="2">Total</th></tr><tr><th>Duration</th><th>Max</th><th>Min</th><th>Duration</th><th>Max</th><th>Min</th><th>Max</th><th>Min</th></tr><tr><td>1</td><td>English (Communication Skill)</td><td>90000001</td><td>3 Hrs</td><td>70</td><td>25</td><td>3 Hrs</td><td>30</td><td>15</td><td>100</td><td>40</td></tr><tr><td>2</td><td>Elective – I</td><td>--</td><td>3 Hrs</td><td>70</td><td>25</td><td>3 Hrs</td><td>30</td><td>15</td><td>100</td><td>40</td></tr><tr><td>3</td><td>Elective – II</td><td>--</td><td>3 Hrs</td><td>70</td><td>25</td><td>3 Hrs</td><td>30</td><td>15</td><td>100</td><td>40</td></tr><tr><td>4</td><td>Electronics Devices & Circuits</td><td>30140001</td><td>3 Hrs</td><td>100</td><td>35</td><td>3 Hrs</td><td>100</td><td>50</td><td>200</td><td>85</td></tr><tr><td>5</td><td>Analog & Digital Electronics</td><td>30140002</td><td>3 Hrs</td><td>100</td><td>35</td><td>3 Hrs</td><td>100</td><td>50</td><td>200</td><td>85</td></tr><tr><td>6</td><td>Industrial Electronics</td><td>30140006</td><td>3 Hrs</td><td>100</td><td>35</td><td>3 Hrs</td><td>100</td><td>50</td><td>200</td><td>85</td></tr><tr><td colspan="9">Total</td><td>900</td><td>375</td></tr></table></div>						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	Industrial Electronics	30140006	3 Hrs	100	35	3 Hrs	100	50	200	85	Total									900	375
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16	Teachers – Three Teachers per batch for vocational component. For English, Elective-I & II guest faculty on clock hour basis.																																																																																																					
17	<div><div>a) For Elective I – Student can choose any one subject CodeSubject Name 90000011Applied Mathematics 90000012Business Economics 90000013Physical Biology (Botany & Zoology) 90000014Entrepreneurship 90000015Psychology</div><div>b) For Elective II – Student can choose any one subject CodeSubject Name 90000021Applied Sciences (Physics & Chemistry) 90000022Computer Application 90000023Business Mathematics</div></div>																																																																																																					

Electronics Devices & Circuits – 1st year
Subject Code 30140001

Theory	Practical
Detailed Syllabus :	Detailed Syllabus
1. Materials Classification of materials Conducting, semi-conducting and insulating materials through a brief reference to their atomic structure Conducting Materials Resistors and factors affecting resistivity such as temperature, alloying and mechanical stressing. Classification of conducting materials into low resistivity and high resistivity materials Insulating Materials 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. Magnetic Materials 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"> • Identification of Types of Resistors. • Calculation of Values using Color Codes • Wattage of Resistance • Series & parallel connection of Resistance. • Ohms Law Identification of Various Insulating Materials Properties & Use. Identification of Various Magnetic Materials Properties & Use.
Components:- Capacitors 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. Resistors: Carbon film, metal film, carbon composition, wound and variable types (presets and potentiometers) Transformer, inductors and RF coils: Methods of manufacture, testing, Need of shielding, application and troubleshooting Surface Mounted Devices (SMDs): Constructional detail and specifications. Connectors, Relays, switches and cables: Different types of connectors, relays, switches and cables, their symbols, construction and characteristics. Semi Conductors and Integrated Circuits :- 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"> • Identification of Types of Capacitor. • Calculation of Values using Color Codes • Wattage of Capacitor Series & parallel connection of Capacitor. Identification of various SMD Identification of Relay, Switches & Cables & its Testing. Identification of Various Electronics Components. Lead Identification.

<p>Basics of Measurements Measurement, method of measurement, types of instruments:- Specifications of instruments: Accuracy, precision, sensitivity, resolution, range, errors in measurement, sources of errors, limiting errors loading effect, requirements, importance and applications of standards, calibration</p> <p>Multimeter 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>Electronic Voltmeter 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>AC Milli Voltmeter Types of AC milli voltmeters and their block diagram description Typical specifications and their significance.</p> <p>Cathode Ray Oscilloscope 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>Signal Generators and Analysis Instruments 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>Impedance Bridges and Q Meters Wheat stone bridge AC bridges: Maxwell's induction bridge, Hay's bridge, De-Sauty's bridge, Schering bridge and Anderson bridgeBlock diagram description of laboratory type RLC bridge, specifications of RLC bridgeBlock diagram and working principle of Q meter.</p> <p>Digital Instruments 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"> 1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance 2. To observe the limitations of a multimeter for measuring high frequency voltage 3. Measurement of voltage, frequency, time period and phase using CRO 4. Measurement of rise time and fall time using CRO 5. Measurement of Q of a coil and its dependence on frequency 6. Measurement of voltage, frequency, time and phase using DSO 7. Measurement of resistance and inductance of coil using RLC meter 8. Measurement of distortion of RF signal generator using distortion factor meter 9. Use of logic pulser and logic probe 10. Measurement of time period, frequency, average period using universal counter/frequency counter 11. Study of operation and features of a logic analyzer
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Electronics Devices & Circuits – 2 nd year	
Subject Code 30140001	
BASIC ELECTRICAL AND ELECTRONICS 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"> • Identification of various Hand tools used • Identification of different types of cables, SWG practice. • Measure the power , power factor and energy in different circuits. • Construct & verify Ohm's law. • Construct and verify Kirchoff's voltage law. Tracing the magnetic field of Bar magnet using compass. • Identification of different resistors i.e. carbon, wire-wound, variable, pot., preset, Rheostat etc. • Color-coding of resistors ,Construct a series & parallel resistor circuits • Identification of capacitor and their codes, construct the series /parallel circuit of capacitor • Identification of inductor , construct the series /parallel circuit of inductor. • Identification of capacitor and their codes, construct the series /parallel circuit of capacitor • Construct an electromagnet and test it. • Testing and construction of different types relays. • Identification and testing of different types of transformers, measure the O/P voltage. • Identification of anode, cathodes of different types of diodes. • Study the specifications of a semiconductor diode using a data sheet • Construct a forward bias and a reverse bias circuit and plot V-I characteristic of diode • Construct a half wave rectifier, full wave (center tapped) rectifier and full wave (Bridge) rectifier. • Observe wave forms with/ without using filter. • Study the specifications of zener diode using data sheet. • Construct the Zener regulator circuit • Series parallel combination of batteries • Charging of batteries, maintenance of batteries • Calculate the shorted load and matched load current for given cell

<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>Three Phase Supply Advantages of 3 phase system over single phase system Star delta connections 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 Transformer 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. DC Motor 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) Single Phase Motors Principles, construction, working speed control, starting and applications of the following motors Induction motor, Universal motor. Stepper Motor and Servo Motor Types, construction, working and their applications</p>	<p>Introduction to electrical machines 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 DC machines 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). Transformers (single phase) 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 Three-phase transformers 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
Hand tools	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
Instruments and general shop out fit per unit	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 – 1st year

Subject Code 30140002

Theory	Practical
<p>Multistage Amplifiers 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>Large Signal Amplifier 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>Feedback in Amplifiers 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>Sinusoidal Oscillators 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>Wave Shaping Circuits 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>Multivibration Circuits 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>Operational Amplifiers 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>Regulated DC Power Supplies 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"> Plot the frequency response of two stage RC coupled amplifier and calculate the bandwidth and compare it with single stage amplifier To measure the gain of push-pull amplifier at 1KHz To measure the voltage gain of emitter follower circuit and plot its frequency response Plot the frequency response curve of Hartley and Colpitts Oscillator Plot the frequency response curve of phase shift and Wein bridge Oscillator To observe the output waveforms of series and shunt clipping circuits To observe the output for clamping circuits To observe the output waveform of a Bistable multivibrator Use of IC 555 as monostable multivibrator and observe the output for different values of RC Use of IC 555 as astable multivibrator and observe the output at different duty cycles To use IC 741 (op-amplifier) as <ol style="list-style-type: none"> Inverter Adder Subtractor Integrator To realize positive and negative fixed voltage AC power supply using three terminal voltage regulator IC (7805, 7812, 7905)

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
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11. Electronics Devices and Circuits-II by Naresh Gupta, Jyotesh Malhotra and Harish C. Saini, Eagle Prakashan, Jalandhar

Analog & Digital Electronics – 2nd year**Subject Code 30140002**

Theory	Practical
<p>Introduction Define digital and analog signals and systems, difference between analog and digital signals Need of digitization and applications of digital systems.</p> <p>Number Systems 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>Logic Gates 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>Logic Simplification 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>Arithmetic Circuits Half adder, full adder circuits and their operation Parallel binary adder, 2-bit and 4-bit binary full adder, block diagram, working.</p> <p>Multiplexer/Demultiplexer 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>Decoders, Display Devices and Associated Circuits 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>Encoders and Comparators 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"> 1. Study of logic breadboard with verification of truth table for AND, OR, NOT, NAND, EX-OR, NOR gate 2. Verification of NAND and NOR gate as universal gates 3. Construction of half-adder and full adder circuits using EX-OR and NAND gate and verification of their operation 4. Verify the operation of <ol style="list-style-type: none"> a) multiplexer using an IC b) de-multiplexer using an IC 5. <ol style="list-style-type: none"> a) Verify the operation of BCD to decimal decoder using an IC b) Verify the operation of BCD to 7 segment decoder using an IC

Latches and Flip-Flops 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. Counters 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 Shift Registers 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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RECOMMENDED BOOKS:- 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

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
Instruments and general shop out fit per unit	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
Instruments and general shop out fit per unit	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 : Industrial Electronics – 1st year

Subject Code : 30140006

Theory	Practical
Introduction to thyristors and other power electronics devices Construction, Working principles of SCR, two transistor analogy of SCR, VI characteristics of SCR. a) SCR specifications & ratings. b) Different methods of SCR triggering. c) Different commutation circuit for SCR. d) Series & parallel operation of SCR. e) Construction & working principle of DIAC, TRIAC & their V-I characteristics. f) Construction, working principle of UJT, VI characteristics of UJT. UJT as relaxation oscillator. g) Brief introduction to Gate Turn off thyristor (GTO), Programmable uni-function transistor (PUT), MOSFET, IGBT. h) Basic idea about the selection of Heat sink for thyristors. i) Application such as light intensity control, speed control of universal motors, fan regulator, battery charger.	1. To plot VI characteristic of an SCR. 2. To plot VI characteristics of TRIAC. 3. To plot VI characteristics of UJT. 4. To plot VI characteristics of DIAC. 5. Study of UJT relaxation oscillator. And observe I/P and O/P wave forms 6. Observation of wave shape of voltage at relevant point of single-phase half wave controlled rectifier and effect of change of firing angle. 7. Observation of wave shapes of voltage at relevant point of single phase full wave controlled rectifier and effect of change of firing angle.
Controlled Rectifiers a) Single phase half wave controlled rectifier with load (R, R-L) b) Single phase half controlled full wave rectifier (R, R-L) c) Fully controlled full wave bridge rectifier. d) Single phase full wave centre tap rectifier.	8. Observation of wave shapes and measurement of voltage at relevant points in TRIAC based AC phase control circuit for . 9. Varying lamp intensity of AC fan speed control.
Inverters, Choppers, Dual Converters and Cyclo converters. i) Principle of operation of basic inverter circuits, concepts of duty cycle, series & parallel. Inverters & their application. ii) Choppers: Introduction, types of choppers (Class A, Class B, Class C and Class D). Step up and step down choppers. iii) Dual Converters & cyclo converters: Introduction, types & basic working principle of dual converters & cyclo converters & their application.	10. Installation of UPS system and routine maintenance of batteries. 11. Speed control of motor using SCRs
Thyristorised Control of Electric drives a) DC drive control i) Half wave drives. ii) Full wave drives iii) Chopper drives (Speed control of DC motor using choppers) b) AC drive control i) Phase control (Speed control of induction motor using variable frequency) ii) Constant V/F operation iii) Cycloconverter/Inverter drives. iv) Slip power control of AC drives.	
Uninterrupted Power supplies i) UPS, on-line, off line & its specifications ii) Concept of high voltage DC transmission	

RECOMMENDED BOOKS:-
<ol style="list-style-type: none"> 1. Power Electronics by P.C. Sen Tata Mc Graw Hill. New Delhi 2. Power Electronics by P.S. Bhimbhrah, Khanna Publishers, New Delhi 3. Power Electronics by M.S. Berde, Khanna Publishers, New Delhi. 4. Power Electronics by MH Rashid 5. Industrial Electronics and Control by SK Bhattacharya and S. Chatterji, New Age Publications. New Delhi 6. Power Electronics by S Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi 7. Power Electronics by Sugandhi and Sugandhi 8. Power Electronics – Principles and Applications by J Michael Jacob, Vikas Publishing House, New Delhi

Industrial Electronics – 2nd year

Theory	Practical
Introduction Microprocessors – evolution, importance and Application	
Architecture of a Microprocessor – 8085 <ol style="list-style-type: none"> 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 	<ol style="list-style-type: none"> 1. Familiarisation of different keys of 8085 microprocessor kit and its memory map 2. Steps to enter, modify data/program and to execute a programme on 8085 kit 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
Introduction Set for Intel 8085 <ol style="list-style-type: none"> 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 	<ol style="list-style-type: none"> 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)
Interfacing and Data Transfer Schemes <ol style="list-style-type: none"> 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 	<ol style="list-style-type: none"> 7. Interfacing exercise on 8255 like LED display control 8. Interfacing exercise on 8253 programmable interval timer
Peripheral Devices Detailed study of the following <ol style="list-style-type: none"> a) 8255 PPI b) 8253 PIT c) 8257 DMA Controllers d) 8259 PIC e) 8279 Programmable KB/Display Interface f) 8251 Communication Interface Adapter Introduction to other 8-bit microprocessor like Z-80, 6800 and their comparison with 8085	<ol style="list-style-type: none"> 9. Interfacing exercise on 8279 programmable KB/display interface like to display the hex code of key pressed on display 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
6.	8051 by Mcakenzie, Prentice Hall of India, New Delhi

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.	
TRAINEE'S PERSONAL TOOL KIT		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	Plier insulated 150 mm	1 No	
5.	Multimeter	1 No	
	Soldering iron,15W,230 V(temperature controlled)	1 No	

List of Tools & Equipments of Workshop

S.No.	Name of Item	Quantity
1.	Screw Driver 100 mm with handle	4 Nos.
2.	Screw driver kit (set of six blades with	4 Nos.
3.	common insulated handle)	4 Nos.
4.	Screw Driver 150 mm with insulated handle	4 Nos.
5.	Plier insulated 200 mm	4 Nos.
6.	Plier round nose 100 mm	4 Nos.
7.	Tweezer 100 mm	4 Nos.
8.	Wire striper 200 mm	2 Nos.Each.
9.	Soldering iron 25 watt , 65 watt ,250 watt	2 Nos.
10.	Desoldering pump.	2 Nos.
11.	Soldering gun	2 Nos.
12.	Soldering iron 250 watt.	1 No.
13.	Drill machine electric portable 0 to 6mm	1 set.
14.	capacity	4 Nos.
15.	Allen Key	! No.
16.	Oil cane 0.12 liter	1 No.
17.	Grease gun (small size).	2 Nos.
18.	Grinder Bench Motorised	4 Nos.
19.	Hammer hard plastic with handle	1 set.
20.	Hammer Ball Pein 0.4 Kg.	4 Nos.
21.	Spanner Kit (Double ended).	4 Nos.
22.	Hacksaw frame 300mm	4 Nos.
23.	Hacksaw frame200mm	1 set.
24.	Snip straight 150mm	2 Nos.
25.	Drill SS twist block (2 mm – 8 mm)	2 Nos.
26.	File flat 200mm smooth	2 Nos.
27.	File round 200mm 2 nd cut	2 Nos.
28.	File half round 250mm.	4 Nos.
29.	File triangular 150mm	2 Nos.
30.	Vice hand 50mm jaw	2 Nos.
31.	Vice table 150 mm jaw	2 Nos.
32.	Pipe cutter to cut 5cm dia.	2 Nos.
33.	Crimping Tool	1 No.
34.	Multi meter (digital)	2 Nos.
35.	Ammeter AC, 0 –1 A .	2 Nos.
36.	Ammeter M.I. 0 – 5 – 10 – 15 A	1 No.
37.	Voltmeter M.I. 0 – 150 – 300 – 600 V	1 No.
38.	Wheat stone measuring Bridge (complete	1 No.
39.	with galvanometer and Battery)	1 set.
40.	Power electronics Trainer	1 No.
41.	Microprocessor Trainer Kit	1 No.
42.		1 No.
43.		1 No.
44.		1 No.
45.		1 No.
46.		
