MAHARASHTRA STATE BOARD OF VOCATIONAL EDUCATION EXAMINATION, MUMBAI -51

<table>
<tr><td>1</td><td>Name of Syllabus</td><td>C.C. IN MECHANIC OF INDUSTRIAL ELECTRONICS (301207)</td></tr>
<tr><td>2</td><td>Max. No's of Student</td><td>25 students</td></tr>
<tr><td>3</td><td>Duration</td><td>1 YEAR</td></tr>
<tr><td>4</td><td>Type</td><td>Full Time</td></tr>
<tr><td>5</td><td>No Of Days / Week</td><td>6 Days</td></tr>
<tr><td>6</td><td>No Of Hours /Days</td><td>7 Hrs</td></tr>
<tr><td>7</td><td>Space Required</td><td>Lab = 800 Sq feet
Class Room = 200 Sq feet
TOTAL = 1000 Sq feet</td></tr>
<tr><td>8</td><td>Entry Qualification</td><td>S.S.C. passed</td></tr>
<tr><td>9</td><td>Objective Of Syllabus/ introduction</td><td>• To develop professional competence in the field of electronics.
• To train the students to acquire skills and mastery in the use of electronic circuits.
• To train the students to assemble and test the electronic circuits required in the industries.
• To prepare for self and wage employment.
• To prepare competent electronic technicians for the small-scale industry.</td></tr>
<tr><td>10</td><td>Employment Opportunity</td><td>(a) Wage Employment:
• Junior Technician
• Circuit Assembler
• Electronic Instructor
(b) Self Employment:
• Electronic spares shop
• Electronic gadget repairing center.</td></tr>
<tr><td>11</td><td>Teacher's Qualification</td><td>a) Diploma in Industrial Electronics with 3 years teaching experience
b) NCVT/ITI /M.C.V.C. passed or any equivalent with 5 years experience</td></tr>
<tr><td>12</td><td>Training System</td><td>Training System Per Week
<table>
<tr><td>Theory</td><td>Practical</td><td>Total</td></tr>
<tr><td>18 Hours</td><td>24 Hours</td><td>42 Hours</td></tr>
</table></td></tr>
<tr><td>13</td><td>Exam. System</td><td>
<table>
<tr><th>Sr. No.</th><th>Paper Code</th><th>Name of Subject</th><th>TH/PR</th><th>Hours</th><th>Max. Marks</th><th>Mini. Marks</th></tr>
<tr><td>1</td><td>30120711</td><td>ELECTRONIC MATERIAL, COMPONENTS MICROPROCESSOR AND DIGITAL ELECTRONICS</td><td>TH-I</td><td>3 hrs.</td><td>100</td><td>35</td></tr>
<tr><td>2</td><td>30120712</td><td>ELECTRONIC & POWER ELECTORNIC DEVICES, CIRCUITS & APPLICATION</td><td>TH-II</td><td>3 hrs.</td><td>100</td><td>35</td></tr>
<tr><td>3</td><td>30120713</td><td>ELECTRONIC INSTRUMENTATION & POWER ELECTRONICS</td><td>TH-III</td><td>3 hrs.</td><td>100</td><td>35</td></tr>
<tr><td>4</td><td>30120721</td><td>ELECTRONIC MATERIAL, COMPONENTS MICROPROCESSOR AND DIGITAL ELECTRONICS</td><td>PR-I</td><td>3 hrs.</td><td>100</td><td>50</td></tr>
<tr><td>5</td><td>30120722</td><td>ELECTRONIC & POWER ELECTORNIC DEVICES, CIRCUITS & APPLICATION</td><td>PR-II</td><td>3 hrs.</td><td>100</td><td>50</td></tr>
<tr><td>6</td><td>30120723</td><td>ELECTRONIC INSTRUMENTATION & POWER ELECTRONICS</td><td>PR-III</td><td>3 hrs.</td><td>100</td><td>50</td></tr>
<tr><td></td><td></td><td>Total</td><td></td><td></td><td>600</td><td>255</td></tr>
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THEORY - I - ELECTRONIC MATERIAL, COMPONENTS MICROPROCESSOR AND DIGITAL ELECTRONICS

PART A

Sr. No.	Unit		Scope and Limitation
1	DC Circuit	1.1	Concepts of electricity, various applications of electricity.
		1.2	Current, voltage and resistance, potential difference, power, electrical energy and their units, advantages of electrical energy over other forms of energy.
		1.3	Ohm's law.
		1.4	Series and parallel combination of resistors, specific resistance, effect of temperature on resistance, co-efficient of resistance.
		1.5	
		1.6	Kirchoff's laws,
		1.7	Heating effect of current and concept of electric power. Sources of voltage: Primary and secondary cells. Types of cells: Carbon zinc dry cell, alkaline cell, Zinc-chloride cell, mercury cell, silver-oxide cell, and lithium cell, lead acid wet cell (only brief idea and use).
2	Electrostatics	2.1	Coulomb's law, unit charge.
		2.2	Electric flux and Gauss's Law, Electric field intensity and electric potential
		2.3	Concept of capacitance and capacitors, units of capacitance, types of capacitors, constructional details and testing specifications
		2.4	Capacity of parallel plate capacitors, spherical capacitors, cylindrical capacitor.
		2.5	
		2.6	Energy stored in a capacitor. Concept of di-electric and its effects on capacitance, di-electric constant, break down voltage.
		2.7	Series and parallel combination of capacitor. Simple numerical problems of capacitor.
		2.8	Charging and discharging of capacitor with different resistances in circuit, concept of current growth and decay, time constant in R-C circuits, simple problems.
3	Electro-magnetism	3.1	Concept of magnetic field production by flow of current,
		3.2	Concept of m m f, flux, reluctance, permeability, Analogy between
		3.3	electrical & magnetic circuits. Faraday's Laws of electromagnetic induction, self and mutually induced e m f.
4	AC theory	4.1	Concept of alternating voltage and current, difference between AC
		4.2	and DC. Concept of cycle, frequency, period, amplitude, instantaneous value, average value, r.m.s. value and peak
		4.3	value, form factor (definitions only.) Series and Parallel resonance, Resonance frequency, Q – Factor, Bandwidth, LR, RC, and LCR filters explanation with simple circuits only. Types of filters – L, T, and π.

5	Electronic Components / switches / PCB	5.1 5.2 5.3 5.4 5.5 5.6 5.7	Resistors: Carbon film, metal film, carbon composition, wound, Cermet and variable types (presets and potentio-meters). Rheostat Special types of resistors: VDR, LDR, Thermister. Concept of IC: – Various types of IC's various linear & digital IC's Inductors and RF coils: Types of Inductors, methods of manufacture, testing, Need of shielding, application and troubleshooting. Connectors, Relays, switches and cables: Different types of connectors, relays, switches and cables, their symbols, construction and characteristics, Function of Fuse, construction and application. Loudspeaker and Microphone: Types, applications and specifications of various types of Loudspeaker and microphone. Accessories for Basic circuit Assembly: Types of wires, lug / tag boards. PCB, types of PCB, Breadboard.
6	Transformer	6.1 6.2 6.3 6.4 6.5	Principles of transformer, construction, voltage and current transformation. Current and voltage relationship, autotransformer and its uses, Instrument transformer. Voltage regulation and its significance. Need for isolation, Different types of transformers, and specifications of all types of transformers. Losses in a transformer.
7	Soldering Technique	7.1	Principle and working of simple soldering iron, Solder metal, Types of solders, flux, and de-soldering and different soldering technique.

PART B

Sr. No.	Unit		Scope and Limitation
1	Operational Amplifiers	1.1 1.2 1.3 1.4 1.5 1.6	Distinction between analog and digital signal. Applications and advantages of digital signals. Operational Amplifiers: Characteristics of an ideal operational amplifier and its block diagram. Definition of differential voltage gain, CMRR, PSRR, slew rate and input offset current Operational amplifier as an inverter, scale changer, adder, Subtractor, differentiator, and integrator. Concept of Schmitt triggers circuit and sample/hold circuit using operational amplifier and their applications.
2	Number System	2.1 2.2	Binary and hexadecimal number system: conversion from decimal and hexadecimal to binary and vice-versa BCD representation. Binary addition, subtraction, multiplication and division including binary points. BCD addition. 1's and 2's complement method of addition/subtraction.

3	Logic Gates	3.1 3.2 3.3 3.4 3.5	Concept of negative and positive logic. Definition, symbols and truth tables of NOT, AND, OR, NAND, NOR, EXOR Gates, NAND and NOR as universal gates. Boolean algebra, DE Morgan's Theorems. Various identities. Formulation of truth table and Boolean equation for simple problem. Implementation of Boolean (logic) equation with gates. Logic family classification: Definition of SSI, MSI, LSI, VLSI, TTL and MOS families and their sub classification. Codes: a) Concept of code, weighted and non-weighted codes, examples of 8421, BCD, excess-3 and Gray code. b) Concept of parity, single and double parity and error detection c) Alpha numeric codes: ASCII and EBCDIC.
4	Arithmetic circuits and Latches and flip flops	4.1 4.2 4.3 4.4 4.5 4.6	Half adder and Full adder circuit, design and implementation. Half and Full Subtractor circuit, design and implementation. 4-bit adder/Subtractor. Concept and types of latch with their working and applications. Operation using waveforms and truth tables of RS, T, D, JK, and Master/Slave JK flip-flops. Difference between a latch and a flip-flop.
5	Multiplexer / De-Multiplexer and Counters	5.1 5.2 5.3 5.4 5.5 5.6 5.7	Basic functions and block diagram of MUX and DEMUX. Different types and applications. Binary counters. Divide by N ripple counters (including design), Decade counter. Pre settable and programmable counters. Down counter, up/down counter. Synchronous counters (only introduction). Difference between Asynchronous and Synchronous counters Ring counter with timing diagram.
6	Shift Register	6.1 6.2 6.3	Introduction and basic concepts including shift left and shift right. Serial in parallel out, serial in serial out, parallel in serial out, parallel in parallel out. Universal shift register.
7	Memories	7.1	Basic RAM cell, N × M bit RAM, Expansion of word length and capacity, static and dynamic RAM, basic idea of ROM, PROM, EPROM and EEPROM.
8	A/D and D/A Converters	8.1	General principle of A/D and D/A conversion and brief idea of their applications. Binary resister network and resistor ladder network methods of D/A conversion. Dual slope and successive approximation types of ADCs.

9	Microprocessor – 8085	9.1	Introduction: Microprocessors – evolution, importance and Application.
		9.2	Architecture of a Microprocessor – 8085: Concept of bus and bus organisation. Functional block diagram and function of each block. Pin details of 8085 and related signals. Demultiplexing of address/data bus and memory read/write cycles.
		9.3	Instruction Set for Intel 8085 Instruction and data format – opcode and operand and its word size Different addressing modes, Status flags and their importance.
		9.4	Data transfer, arithmetic and logical operation, branding, and machine control instructions. Use of stacks and subroutines. Assembly language programming. Peripheral Devices: 8255 PPI and 8253 PIT, 8257 DMA Controllers, 8259 PIC, 8279 Programmable KB/Display Interface, 8251 Communication Interface Adapter

PRACTICAL - I

ELECTRONIC MATERIAL, COMPONENTS MICROPROCESSOR AND DIGITAL ELECTRONICS

PART A

Practical Paper – 1

1. Safety precaution to be observed while working with electronic equipments and systems.
2. Drawing electrical symbols as per ISI specifications.
3. Verification of Ohm's law, using resistors in series and in parallel.
4. Measurement of electrical power consumption in simple AC/DC circuit by VI method.
5. Identification of various materials tools and devices.
6. Testing of resister, capacitors, & semiconductors by Multimeter & colour coding method.
7. Testing of resisters, capacitors, & Inductors by LCR meter / Bridge.
8. Testing of RELAYS verifying conditions, such as normally "ON" and "OFF" etc.
9. Verification of Kirchoff's Laws.
10. To study the different types of Cable and connectors.
11. Characteristics of Thermister
12. Characteristics of LDR.
13. To study the Loudspeaker and Microphone.
14. Study of AC and DC sources (power suppliers) available in the laboratory with their specifications.
15. Series & Parallel resonance circuit, determination of its resonant frequency, bandwidth.
16. Testing a transformer, continuity, installation and turn ratio.
17. Measurement of I/P and O/P resistance of power supply & verification of maximum power transfer theorem.
18. Prepare PCB artwork and etching using any simple circuit
19. Study of different types of batteries.
20. Study of soldering practice.

RECOMMENDED BOOKS

1. Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Sons, New Delhi
2. Electronics Instrumentation by Cooper, Prentice Hall of India, New Delhi
3. Electronics Test and Instrumentation by Rajiv Sapra, Ishan Publications, Ambala
4. Electronics Instrumentation by JB Gupta, Satya Prakashan, New Delhi
5. Electronic components and Materials by SM Dhir, Tata McGraw Hill, New Delhi
6. Electronic Engineering Materials by ML Gupta, Dhanpat Rai and Sons; New Delhi.
7. Electrical Technology, Fifth Edition by Edward Hughes, Longman Publishers
8. Basic Electrical and Electronics Engineering by SK Sahdev; Dhanpat Rai and Sons, New Delhi
9. Electrical Technology by BL Theraja, S Chand and Co, New Delhi
10. Electronic Material and components by K S Patil, BPB Publications.

PART B

1. Logic gates - AND, OR, NOT, NAND, NOR, EX-OR, and EX-NOR (Using IC's).
2. NAND or NOR gates as an Universal gates.
3. IC 741 (op-amplifier) as Inverter and non-inverter.
4. IC 741 (op-amplifier) as Adder and Subtractor.
5. Verification of truth tables of RS flip flop using NOR and NAND gates.
6. JK and Master Slave JK Flip Flop.
7. Half Adders - Subtractor (Using IC Logic gates)
8. Full adder - Subtractor (Using IC Logic gates)
9. To study details of counters IC's like 7490
10. Observe the output of decade counter 7490 on a seven segment display using a decoder
11. To construct and test 4/8 bit A/D converter using IC.
12. To construct and test 4/8 bit D/A converter using IC.
13. To study shift register IC's like 7495.
14. Study of Multiplexer using IC 74153.
15. Study of Demultiplexer using IC 74139.
16. Familiarization of 8085-microprocessor kit.
17. Writing and execution of ALP for addition and sub station of two 8-bit numbers.
18. Writing and execution of ALP for multiplication and division of two 8-bit numbers.
19. Writing and execution of ALP for arranging 10 numbers in ascending/descending order.
20. Writing and execution of ALP for 0 to 9 BCD counters (up/down counter according to choice stored in memory)

RECOMMENDED BOOKS

1. Digital Electronics and Applications by Malvino Leach, Tata McGral 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. Microprocessor Architecture, Programming and Applications with 8085 by RS Gaonkar
6. Operational Amplifiers and Linear Integrated Circuits by Ramakant A. Gaykwad

THEORY - II - ELECTRONIC & POWER ELECTORNIC DEVICES, CIRCUITS & APPLICATION
PART A

Sr. No.	Unit		Scope and Limitation
1	Semi conductor physics	1.1	Review of basic atomic structure and energy levels, concept of insulators, conductors and semi conductors, atomic structure of Germanium (Ge) and Silicon (Si), covalent bonds.
		1.2	Concept of intrinsic and extrinsic semi conductor, P and N impurities, doping of impurity.
		1.3	P and N type semiconductors and their conductivity. Effect of temperature on conductivity of intrinsic semi conductor.
		1.4	Energy level diagram of conductors, insulators and semi conductors; minority and majority carriers.
2	Semi conductor diode	2.1	PN junction diode, mechanism of current flow in PN junction, Drift and diffusion current, depletion layer, forward and reverse biased PN junction, potential barrier, and concept of junction capacitance in forward and reverse bias condition.
		2.2	V-I characteristics, static and dynamic resistance and their calculation from diode characteristics, applications.
		2.3	Diode as half wave, full wave and bridge rectifier. PIV, rectification efficiencies and ripple factor calculations, shunt capacitor filter, series inductor filter, LC filter and π filter.
		2.4	Comparison between three rectifiers. Types of diodes, characteristics and applications of Zener diodes. Zener and avalanche breakdown.
3	Introduction to Bipolar Transistor	3.1	Concept of bipolar transistor, structure, PNP and NPN transistor, their symbols and mechanism of current flow; Current relations in transistor; concept of leakage current.
		3.2	CB, CE, CC configuration of the transistor; Input and output characteristics in CB and CE configurations; input and output dynamic resistance in CB and CE configurations; Current amplification factors. Comparison of CB CE and
		3.3	CC Configurations. Transistors as an amplifier in CE Configurations; d.c load line and calculation of current gain, voltage gains using d.c. Load line. H- Parameters and their significance.
4	Transistor biasing Circuits	4.1	Concept of transistor biasing and selection of operating point. Need for stabilization of operating point.
		4.2	Different types of biasing circuits. Transistor as a switch.
5	Amplifiers	5.1	Introduction, Types of Amplifiers, Various Applications of Amplifiers. Transistor as an Amplifier, Amplifier using IC, Calculation of Voltage, Current and Power gain of an amplifier circuit.
		5.2	Explanation of phase reversal of output voltage with respect to input voltage.
		5.3	Concepts, Types of multistage Amplifiers, Construction, working, advantages, disadvantages, frequency response and applications.
		5.4	Basic principles and types of feedback

			Effect of feedback on gain, stability, distortion and bandwidth of an amplifier with negative feedback.
		5.5	Class A, Class B, Class AB, and Class C amplifiers, collector efficiency and Distortion in class A, B, & C. Comparison between them.
		5.6	Single ended power amplifiers, Graphical method of calculation (without derivation) of out put power; heat dissipation curve and importance of heat sinks. Push-pull amplifier, and complementary symmetry push-pull amplifier.
		5.7	Importance of impedance matching in amplifiers.
6	Wave Shaping Circuits	6.1	General idea about different wave shapers. RC and RL integrating and differentiating circuits with their applications.
		6.2	Diode clipping and clamping circuits and simple numerical problems on these circuits
7	Oscillator	7.1	Principle of oscillator, use of positive feedback in oscillator. Types of oscillators, R.C. Phase shift oscillator. Resonance circuit LC oscillator, Wein bridge oscillator, Colpitts oscillators, Hartley oscillators, and Crystal oscillators.

PART B

Sr. No.	Unit		Scope and Limitation
1	DC Amplifiers	1.1	Need for DC amplifiers, DC amplifiers—Drift, Causes, Darlington Emitter Follower, Cascade amplifier, Stabilization, Differential amplifiers—Chopper stabilization, Operational Amplifiers, Ideal specifications of Operational Amplifiers, Instrumentation Amplifiers.
2	Sensors	2.1	Sensors, Angular Velocity Sensors, Proximity Sensors, Load Sensors, Pressure Sensors, Temperature Sensors, Flow Sensors, Liquid-Level Sensors, Vision Sensors.
3	Industrial Detection Sensors and Interfacing	3.1	Introduction, Limit Switches, Proximity Detectors, Inductive Proximity Switches, Capacitive Proximity Switches, Hall-Effect Sensor, Photoelectric Sensors, Methods of Detection, Photoelectric Package Styles, Operating Specifications, Sensor Interfacing.
4	Industrial Applications 1	4.1	Industrial timers -Classification, types, Electronic Timers – Classification, RC and Digital timers, Time base Generators. Electric Welding – Classification, types and methods of Resistance and ARC wielding, Electronic DC Motor Control.
		4.2	
5	Industrial Applications 2	5.1	High Frequency heating – principle, merits, applications, High frequency Source for Induction heating.
		5.2	Dielectric Heating – principle, material properties, Electrodes and their Coupling to RF generator, Thermal losses and Applications.

6	Industrial Applications 3 Simple Circuits	6.1	To study the various Industrial Application, which is, used for security/safety purpose, such as Fire alarm, Water level indicator, Token No. Indicator, Audio level Indicator, Temperature control, Running light, Light / Sound sensitive switch, LDR Street Light, Emergency Tube light, Battery charger & Timer circuit, etc.
7	Ultrasonic	7.1 7.2 7.3	Introduction to Ultrasonic. Ultrasonic – Generation. Various Applications of Ultrasonic.

PRACTICAL - II - ELECTRONIC & POWER ELECTORNIC DEVICES, CIRCUITS & APPLICATION

PART A

1. To study the semiconductor devices.
2. a) P-N Diode Characteristics.
   b) Study diode as a clipping and clamping.
3. Transistor characteristics - CE,CB and CC.
4. Study of half wave rectifier with or without filters.
5. Study of full wave rectifier with or without filters.
6. Study of bridge rectifier with or without filters.
7. Zener diode Characteristics.
8. Study of Zener as a voltage stabilizer.
9. Line regulation and measurement of percentage of regulation.
10. Load regulation and measurement of percentage of regulation.
11. Study of single stage CE amplifier with potential divider biasing. Measure the voltages and hence calculate the gain.
12. RC coupled amplifier: obtain the frequency response and calculate the gain.
13. Study of Push pull power Amplifier.
14. Study of commercially available audio amplifier IC (CA 810 or equivalent.).
15. Demonstration experiment of negative and positive feedback concept.
16. Study the integrating and differentiating circuit.
17. Measurement of frequency of Hartley oscillators.
18. Measurement of frequency of Colpitts oscillators.
19. Measurement of frequency of R-C Phase shift oscillators.
20. Measurement of frequency of Wein bridge oscillators.

RECOMMENDED BOOKS

1. Basic Electronics and Linear Circuit by NN Bhargava and Kulshreshta, Tata McGraw Hill, New Delhi.
2. Principles of Electrical and Electronics Engineering by VK Mehta; S Chand and Co., New Delhi
3. Electronic Components and Materials by SM Dhir, Tata McGraw Hill, New Delhi
4. Electronics Devices and Circuits by Millman and Halkias; McGraw Hill.
5. Principles of Electronics by Albert Paul Malvino; Tata McGraw Hill, New Delhi
6. Electronic Devices and Applications Nair, Prentice-hall, New- Delhi,
7. Electronic Devices and Circuit Theory Boylestad & Nashelsky, Prenticehall,New- Delhi,
8. Electronic Devices and Circuits Bell, Prentice-hall, New- Delhi, 4thEdition
9. Functional Electronics K.V. Ramanan
10. Engineering Electronics John D. Dyder
11. Electronic Devices & circuits Mottershead, Allen, Prentice Hall,India, New Delhi
12. Integrated Electronics Millian & Halikyas
13. Electronic devices & circuits, volume- I G.K. Mittal, Khanna Publishers,New Delhi, 22nd 1999
14. Laboratory manual for electronic devices and circuits Bell, Prentice-hall, New- Delhi, 4th Edition
15. Electrical Devices & Circuits Bogart, T.F., Universal Book Staff, New Delhi, 1st , 1991

PART B

1. To study of different types of DC amplifiers.

2. To study of different types of Sensors.
3. Study of RF Heating.
4. To study of different types circuit used in Industrial purpose. (such as Fire alarm, Water level indicator, Token No. Indicator, Audio level Indicator, Temperature control, Running light, Light / Sound sensitive switch, LDR Street Light, Emergency Tube light, Battery charger & Timer circuit, etc.
5. To study generation of Ultrasonic.
6. To study different application of Ultra Sonics.
7. Industrial Visit
8. Industrial Visit

RECOMMENDED BOOKS

1. Industrial and Power Electronics – G.K. Mithal and Maneesha Gupta, Khanna Publishers.
2. Industrial Electronics and Power Control, H.C. Rai, Umesh Publications.
3. Thyristors and applications – M. Rammurthy, East-West Press.
4. Md. H.Rashid, Power Electronics: Circuits, Devices and Applications 2nd edition, Prentice Hall of India
5. Jai P. Agrawal, Power electronic Systems: Theory and Design, Pearson Education
6. Michael Jacob, Power Electronics Principle and Application, Thomson Delmar Series
7. P.C Sen. Modern Power Electronics, Wheeler Publishers.
8. "Power electronics", Rashid, PHI pbs.
9. "An introduction to thyristor and its applications", Ramamurthy, EWP.
10. "A text book of power electronics", S.N Singh, Dhanpat Rai.
11. Power electronics, Murthy, Oxford.
12. Industrial Electronics and Power Control, H.C. Rai, Umesh Publications.& string efficiency Of combination, firing circuit,

THEORY - III - ELECTRONIC INSTRUMENTATION & POWER ELECTRONICS

PART A

Sr. No.	Unit		Scope and Limitation
1	Power supplies	1.1	Block diagram of load and line regulation, DC or average value, ripple and output frequency.
		1.2	Concept of voltage regulation using transistor (series and shunt type).
		1.3	Block diagram and brief description of each block.
		1.4	Fixed and adjustable types. IC regulators (like 7805, 7905, LM 317), and variable voltage regulator like (IC 723).
		1.5	Protection Techniques— Short Circuit, Over voltage and Thermal Protection.
		1.6	Introduction to S.M.P.S. and its advantages (with the help of block diagram).
			Circuit diagram of typical S.M.P.S.

2	Meters	2.1	Measurement, method of measurement, types of instruments Specifications of instruments: Accuracy, precision, sensitivity, resolution, range, errors in measurement, sources of errors, limiting errors.
		2.2	Galvanometer, DC Ammeter, DC voltmeter, Ohmmeter Series and shunt type. Principle of working of above types. Analog multimeter.
3	Impedance Bridges	3.1	Wheat stone bridge.
		3.2	AC bridges: Circuit diagram, advantages, disadvantages, and application of Maxwell's induction bridge, Hay's bridge, De-Sauty's bridge, Schering bridge and
		3.3	Anderson bridge. Block diagram of LCR bridge /meter and application.
4	Test Instruments	4.1	CRO: Block diagram of CRO, Specifications of CRO and their explanation front panel controls, applications of CRO. Types of CRO: - Single beam, Dual trace etc. Application of CRO: - Measurement of current, voltage, frequency, time period and phase using CRO using Internal time base generator. Component testing using
		4.2	CRO. Construction & working of CRT. Generator: Types of AF generator, RF generator, and function generator. Block diagram and brief description of each block. Application of each.
5	Multivibrator Circuits	5.1	Working principle of transistor as switch.
		5.2	Concept of multi-vibrator: astable, monostable, and bistable and their applications.
		5.3	Block diagram of IC555 and its working and applications of IC555 as monostable and astable multi-vibrator.
6	Digital Instruments	6.1	Comparison of analog and digital instruments. Working principle of ramp, dual slope and integration type digital
		6.2	voltmeter.
		6.3	Block diagram and working of a digital Multimeter. Measurement of time interval, time period and frequency
		6.4	using universal counter / frequency counter. LED, LCD, seven segment display, basic operation of
		6.5	various commonly used display devices. Four bit decoder circuits for 7 segment display and decoder/driver IC's.
7	DC Motor	7.1	Principles, significance of back emf, types of motors and their constructions.
		7.2	Motor characteristics for shunt and series, speed control of DC motors and factors controlling the speed.
		7.3	Single Phase Motors: Principles, construction, working speed control, starting and applications of the following motors:
		7.4	a) Induction motor a) Universal motor. Stepper Motor and Servo Motor: Types, construction, working and their applications.

8	Other semiconductor devices	8.1 8.2 8.3	Structure, working and application of Diac, SCR, Triac, and UJT. Their characteristics. Structure, working of FET (N channel and P channel). Features of F.E.T. and applications and characteristics. CMOS – merits & demerits. Comparison of JFET, MOSFET and BJT. FET amplifier circuit and its working principle. Structure, working of MOSFET (depletion and enhancement type). Features and applications and characteristics.
9	Special devices	9.1	Special purpose diodes: Tunnel diode, Schottky, Varactor, Photo, diode, Switching (step recovery), Gunn diode, PIN diode, Laser diode, and Op-to coupler.

PART B

Sr. No.	Unit		Scope and Limitation
1	Introduction to thyristors and other power electronics devices	1.1 1.2 1.3 1.4 1.5 1.6	Construction, Working principles of SCR, two transistor analogy of SCR, VI characteristics of SCR. SCR specifications & ratings. Different methods of SCR triggering. Different commutation circuit for SCR Series & parallel operation of SCR. Construction & working principle of DIAC, TRIAC & their V-I characteristics. Construction, working principle of UJT, VI characteristics of UJT. UJT as relaxation oscillator. Brief introduction to Gate Turn off thyristors (GTO), Programmable uni-function transistor (PUT), MOSFET. Basic idea about the selection of Heat sink for thyristors. Application such as light intensity control, speed control of universal motors, fan regulator, battery charger.
2	Protection cooling and Mounting of Thyristors:	2.1 2.2	Introduction, Over voltage Conditions, Over voltage Protection, Practical Over voltage Protection in Naturally-commutated Circuits, Over voltage Protection In Forced-commutated Circuits, Over current Fault Conditions, Over current Protection, Gate Protection, Heating, Cooling and Mounting of Thyristors, SCR Reliability.
3	Power Diodes	3.1	Construction, Principle of Operation, characteristics, power diode types, series and parallel-connected diodes, diode circuits.
4	Commutation Techniques	4.1	Types of commutation; Natural commutation, Forced commutation, Series resonance/current commutation, Voltage commutations, Auxiliary thyristors for commutation, External pulse commutation.
5	Controlled rectifier	5.1 5.2 5.3.	Single phase half controlled full wave rectifier (R, R-L) Fully controlled full wave bridge rectifier. Single-phase full wave center tap rectifier.

6	Choppers, Dual Converters and Cyclo converters	6.1 6.2 6.3	Choppers: Introduction, types of choppers (Class A, Class B, Class C and Class D, Class E). Step up and step down choppers, Jones chopper circuit Morgon chopper circuit Dual Converters & cyclo converters: Introduction, types & basic working principle of dual converters & cyclo converters & their application.
7	Thyristorised Control of Electric drives	7.1 7.2	DC drive control; Half wave drives, Full wave drives, Chopper drives (Speed control of DC motor using choppers) AC drive control; Phase control (Speed control of induction motor using variable frequency), Constant V/F operation, Cyclo converter/Inverter drives, Slip power control of AC drives.
8	Invertors and UPS	8.1 8.2 8.3 8.4 8.5 8.6 8.7	Working principle of inverter Inverter circuits using transistor and thyristors and their comparisons Series inverter using thyristors Parallel inverter using thyristors Use of pulses width modulation (PWM) circuit Concept of UPS Block diagram of UPS.

PRACTICAL - III - ELECTRONIC INSTRUMENTATION & POWER ELECTRONICS
PART A

1. Study of different types of motors.
2. Use of PMMC movement to construct multi range ammeter & voltmeter
3. Study Series and shunt type regulated power supplies.
4. Build and study a fixed and variable DC voltage supply using 3 pin IC and test it.
5. Test various components like resistors, capacitors and diodes using CRO.
6. Measure frequency and amplitude using internal time base of CRO.
7. Phase Measurement using internal time base and Lissajous figure.
8. Study and test the Diac, SCR, and Triac.
9. Study and test the FET, JFET, & MOSFET.
10. SCR, Characteristics
11. FET Characteristics.
12. Familiarization of ammeter, voltmeter, multimeter (analog, digital) and understanding their Specifications.
13. Study Different types of LED display.
14. Study seven segment decoder driver circuit.
15. Study Astable multiviabrator using IC 555.
16. Study Monostable multiviabrator using IC 555.
17. Study front panel of CRO.
18. Study front panel of Pattern generator.
19. Study front panel of AF / RF generator.
20. Study stepper motor with forward and reverse direction circuit

RECOMMENDED BOOKS

1 Electrical & Electronic Measurements & Instrumentation A K. Sawhney Dhanpat Rai & Sons Publication
2 Modern Electronic Instrumentation and Measurement Technique Elbert D Helfrick & W D Cooper PHI Publication
3 Electrical Measurements & Measuring Instruments Sauryanarayana, Tata McGrowHill Publiscations, New Delhi.
5 Electrical Measurement & Measuring Instruments Golding & Widdis.
6. Electronic instruments and instrumentation technology Anand, Prentice Hall of India, New Delhi, 2004.
7. Electronic Instrumentation & Measurement Bell, Prentice Hall of India, New Delhi, 2004.
8. Basic Electronics and Linear Circuit by NN Bhargava and Kulshreshta, Tata McGraw Hill, New Delhi.
9. Principles of Electrical and Electronics Engineering by VK Mehta; S Chand and Co., New Delhi
10. Electronic devices & circuits, volume- I G.K. Mittal, Khanna Publishers,New Delhi, 22nd 1999
11. Laboratory manual for electronic devices and circuits Bell, Prentice-hall, New- Delhi, 4th Edition

PART B

1. To plot VI characteristic of DIAC, SCR, TRIAC & UJT.
2. Study of UJT relaxation oscillator. And observe I/P and O/P waveforms.
3. Observation of wave shape of voltage at relevant point of single-phase half wave controlled rectifier and effect of change of firing angle. 08 Hr.
4. Observation of wave shape of voltage at relevant point of single phase full wave controlled rectifier and effect of change of firing angle.
5. Observation of wave shapes and measurement of voltage at relevant points in TRIAC based AC phase control circuit for Varying lamp intensity and AC fan speed control.
6. Installation of UPS system and routine maintenance of batteries.
7. SCR commutating circuits.
8. Chopper circuit-using SCR.
9. Study of Cyclo converter circuit using thyristors.
10. Power control using SCR.
11. Power control using TRIAC.
12. Perform experiment on triggering circuits for SCR.
13. UJT triggering circuit.
14. Study of DC Chopper power circuit.
15. Study of Series inverter circuit.
16. Study of parallel inverter circuit.
17. Study of single-phase inverter power circuit.
18. Study of three-phase inverter power circuit.
19. Speed control of three-phase induction motor.
20. Performance of IGBT & GTO.

RECOMMENDED BOOKS

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
9. Power Electronics Dubey, G.K.,
10. Power Electronics Ramamurthy
11. Power Electronics Rashid, M.H., Prentice Hall of India,New Delhi, 199
12. Thyristor Engineering Berde, M.S. Khanna Pub., New Delhi,1990
13. Power Electronics Bimbhra, P.S., Khanna Pub., New Delhi,1996
14. Power Electronics Vithayathil, Joseph, McGraw Hill, NewYork, 1994

List of Materials and Instruments :

Sr. No.	Name of the equipment with Specifications	Quantity
1	Combination Pliers 15 Cms insulated	10
2	Long nose insulated pliers 15 Cms	10
3	Side cutter 15 Cms	10
4	End Cutting nipper insulated 15 Cms	10
5	Tweezers 10 Cms	10
6	Neon glow tester	10
7	Screw driver set of 6	10
8	Watch maker screw	05
9	Allen Key	01
10	Drill beat set	01
11	Hacksaw 20-25cm (adjustable)	01
12	Junior saw 20cm	01
13	File flat 20cm 2nd cut	01
14	Soldering iron 25 Watt	10
15	Temperature controlled soldering station 15 Watt	01
16	De-soldering pump	10
17	Wire gauge set	01
18	Tweezers 10 Cms	10
19	Adjustable spanner/slide wrench (15-20cis)	01
20	Wire stripper	10
21	Electric drill machine 10mm	01
22	Digital multimeter	10
23	Analog multimeter	10
24	Voltmeters 0-1V / 0-10V / 0-50V / 0-100V	02 Each
25	Ammeters 0-10 mA / 0-100 mA / 0-500 mA / 0 – 1 A	02 Each
26	Watt meter 5/250V	01
27	Regulated power supply 30V/1A	10
28	Oscilloscopes 20 MHZ	04
29	Digital Storage CRO	01
30	Digital frequency counters / Meters	02
31	Function Generator	01
32	Digital LCR meters	02
33	Digital trainers	02
34	Digital IC Tester	01
35	Logic Probes	05
36	Dimmerstat, 2 Amps	02
37	Servo Motor	01
38	DC Motor	02
39	Tachometer	01
40	Different types of displays	02 each
41	Work table/Bench	01
42	Microprocessor kit (8085)	10
43	Invertors	01
44	UPS	01
45	Battery Charger	01
46	Pulse Generator	01
47	Different Types of Sensors	01
48	DOL Starter	01
49	DOL Starter with forward/reverse control	01
50	On delay Timers, off delay timers	01
51	Earth Leakage circuit breakers	01
52	Counters	01
53	Temp. Controllers	01
54	Smoke Detector	01
55	Emergency tube light	01
56	Single phase Preventer	01
57	Strain Gauge, L V D T	01 each
58	Three phase motor speed controller /Trainer	01

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