3.1 ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS

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RATIONALE

A diploma holder will be involved in maintenance, repair and production of electrical equipment and systems. In addition, he may be required to procure, inspect and test electrical and electronic engineering materials. Knowledge of various types of materials will be needed in order to execute the above mentioned functions. He may also have to decide for an alternative when a particular material is either not readily available in the market or its cost becomes prohibitive.

DETAILED CONTENTS

1. Classification: (3 Hrs)
   Classification of materials into conducting, semi conducting and insulating materials through a brief reference to their atomic structure and energy bands
2. Conducting Materials (12 Hrs)
   - 2.1 Introduction
   - 2.2 Resistance and factors affecting it such as alloying and temperature etc
   - 2.3 Classification of conducting material as low resistivity and high resistivity materials, Low resistance materials
     - 2.3.1 Copper:
       General properties as conductor: Resistivity, temperature coefficient, density, mechanical properties of hard-drawn and annealed copper, corrosion, contact resistance. Application in the field of electrical engineering.
     - 2.3.2 Aluminium:
       General properties as conductor: Rresistivity, temperature coefficient, density, mechanical properties of hard and annealed aluminium, solderability, contact resistance. Applications in the field of electrical engineering.
     - 2.3.3 Steel:
       General properties as conductor: Resistivity, corrosion, temperature coefficient, density, mechanical properties, solderability, Applications in the field of electrical engineering.
     - 2.3.4. Introduction to bundle conductors and its applications.
       Low resistivity copper alloys: Brass, Bronze (cadmium and Beryllium), their practical applications with reasons for the same
   - 2.4 Applications of special metals e.g. Silver, Gold, and Platinum
   - 2.5 High resistivity materials and their applications e.g, manganin, constantan, Nichrome, mercury, platinum, carbon and tungsten
   - 2.6 Superconductors and their applications
3. Review of Semi-conducting Materials (2 Hrs)

Semi-conductors and their properties, Materials used for electronic components like resistors, capacitors, diodes, transistors and inductors etc.

4. Insulating materials; General Properties: (12 Hrs)

4.1 Electrical Properties:
Volume resistivity, surface resistance, dielectric loss, dielectric strength (breakdown voltage) dielectric constant

4.2 Physical Properties:
Hygroscopicity, tensile and compressive strength, abrasive resistance, brittleness

4.3 Thermal Properties:
Heat resistance, classification according to permissible temperature rise. Effect of overloading on the life of an electrical appliance, increase in rating with the use of insulating materials having higher thermal stability, Thermal conductivity, Electro-thermal breakdown in solid dielectrics

4.4 Chemical Properties:
Solubility, chemical resistance, weatherability

4.5 Mechanical properties, mechanical structure, tensile structure

5. Insulating Materials and their applications: (16 Hrs)

5.1 Plastics

5.1.1 Definition and classification

5.1.2 Thermosetting materials:
Phenol-formaldehyde resins (i.e. Bakelite) amino resins (urea formaldehyde and Malamine-formaldehyde), epoxy resins - their important properties and applications

5.1.3 Thermo-plastic materials:
Polyvinyl chloride (PVC), polyethelene, silicons, their important properties and applications

5.2 Natural insulating materials, properties and their applications

- Mica and Mica products
- Asbestos and asbestos products
- Ceramic materials (porcelain and steatite)
- Glass and glass products
- Cotton
- Silk
- Jute
- Paper (dry and impregnated)
- Rubber, Bitumen
- Mineral and insulating oil for transformers switchgear capacitors, high voltage insulated cables, insulating varnishes for coating and impregnation

- Enamels for winding wires
- Glass fibre sleeves

5.3 Gaseous materials; Air, Hydrogen, Nitrogen, SF_6 their properties and applications

6. Magnetic Materials: (11 Hrs)

6.1 Introduction - ferromagnetic materials, permeability, B-H curve, magnetic saturation, hysteresis loop including coercive force and residual magnetism, concept of eddy current and hysteresis loss, curie temperature, magnetostriction effect.

6.2 Soft Magnetic Materials:

6.2.1 Alloyed steels with silicon: High silicon, alloy steel for transformers, low silicon alloy steel for electric rotating machines

6.2.2 Cold rolled grain oriented steels for transformer, Non-oriented steels for rotating machine

6.2.3 Nickel-iron alloys

6.2.4 Soft Ferrites

6.3 Hard magnetic materials

Tungsten steel, chrome steel, hard ferrites and cobalt steel, their applications

7. Special Materials (4 hrs)

Thermocouple, bimetals, leads soldering and fuses material, mention their applications

8. Introduction of various engineering materials necessary for fabrication of electrical machines such as motors, generators, transformers etc (4 hrs)

INSTRUCTIONAL STRATEGY

The teacher should bring different materials, electronic components and devices in the class while taking lectures and explain and make students familiar with them. Also he may give emphasis on practical applications of these devices and components in the field. In addition, the students should be given exercises on identification of materials used in various electronic gadgets etc .and be encouraged to do practical work independently and confidently.

RECOMMENDED BOOKS

1. Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi
2. Electronic Components and Materials by Grover and Jamwal, Dhanpat Rai and Co., New Delhi
3. Electrical Engineering Materials by Sahdev, Unique International Publications
4. Electronic Components and Materials by SM Dhir, Tata Mc Graw Hill, New Delhi
5. Electrical Engineering Materials by PL Kapoor, Khanna Publishers, New Delhi
6. Electrical and Electronics Engineering Materials BR Sharma and Others, Satya Parkashan, New Delhi
7. Electrical and Electronics Engineering Materials DR Arora, Ishan Publications, Ambala City
8. Electrical Engineering Materials by Rakesh Dogra, SK Kataria and Sons, NEW Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPERSETTER

Sr. No	Topic	Time Allotted (Hrs)	Marks Allocation (%)
1	Classification	3	5
2	Conducting Materials	12	20
3	Review of Semi-conducting Materials	2	5
4	Insulating materials; General Properties:	12	20
5	Insulating Materials and their Applications	16	25
6	Magnetic Materials:	11	15
7	Special Materials	4	5
8	Introduction of various Engineering Materials	4	5
	Total	**64**	**100**

3.2 ELECTRONICS - II

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RATIONALE

At present, electronic gadgets are being extensively used in various manufacturing processes in industries, power system operations, communication systems, computers etc. Even for an electrical diploma holder, it is absolutely necessary to have a basic understanding of electronic components, their function and applications. This understanding should facilitate in operation and maintenance equipment, which are electronically controlled. . In this course topic like Amplifiers, Oscillators and Wave Shape Circuits have been dealt with.

DETAILED CONTENTS

1. Transistor Audio Power Amplifier (12 hrs)

    1.1 Difference between voltage and power amplifier
    1.2 Important terms in Power Amplifier, collector efficiency, distortion and dissipation capability
    1.3 Classification of power amplifier class A, B and C
    1.4 Class A single-ended power amplifier, its working and collector efficiency
    1.5 Impedance matching in a power amplifier using transformer
    1.6 Heat sinks in power amplifiers
    1.7 Push-pull amplifier: circuit details, working and advantages (no mathematical derivations)
    1.8 Principles of the working of complementary symmetry push-pull amplifier

2. Tuned Voltage Amplifier (8 hrs)
    2.1 Introduction
    2.2 Series and parallel resonance (No mathematical derivation)
    2.3 Single and double tuned voltage amplifiers
    2.4 Frequency response of tuned voltage amplifiers
    2.5 Applications of tuned voltage amplifiers

3. Feedback in Amplifiers (8 hrs)
    3.1 Feedback and its importance, positive and negative feedback and their need
    3.2 Voltage gain of an amplifier with negative feedback $A_f = \frac{A}{1+\beta A}$
    3.3 Effect of negative feedback on voltage gain, stability, distortion, band width, output and input impedance of an amplifier (No mathematical derivation)
    3.4 Typical feedback circuits
    3.5 Effect of removing the emitter by-pass capacitor on a CE transistor amplifier
    3.6 Emitter follower and its applications

4. Sinusoidal Oscillators (8 hrs)
   - 4.1. Sinusoidal Oscillators – positive feedback in amplifiers
   - 4.2. Difference between an oscillator and an alternator
   - 4.3. Essentials of an oscillator
   - 4.4. Circuit details and working of LC oscillators viz. Tuned Collector, Hartley and Colpitt's oscillators
   - 4.5. R-C oscillator circuits, phase shift and Wein bridge oscillator circuits
   - 4.6. Introduction to piezoelectric crystal and crystal oscillator circuit

5. Wave-Shaping and Switching Circuits (15 hrs)
   - 5.1 Concept of Wave-shaping
   - 5.2 Wave-shaping circuits
     a. R-C differentiating and integrating circuits
     b. Diode clipping circuits
     c. Diode clamping circuits
     d. Applications of wave-shaping circuits
   - 5.3 Transistor as a switch (explanation using CE transistor characteristics)
   - 5.4 Collector coupled astable, monostable, bistable multivibrator circuits (explanation using wave shapes). Brief mention of uses of multivibrators
   - 5.5 Working and applications of transistor inverter circuit using power transistors

6. Power supplies: (5 hrs)
   Working Principles of different types of power supplies viz. CVTs, UPS, Stabilizers, SMPS, IC voltage regulator (78 XX,79XX)

7. Operational Amplifier (8 hrs)
   - 7.1. The basic operational amplifier. The differential amplifier. The emitter coupled differential amplifier. Offset even voltages and currents
   - 7.2. Basic operational amplifier applications, analog integrator and differentiator
   - 7.3. Familiarization with specifications and pin configuration of IC 741
   - 7.4. Block diagram and operation of 555 IC timer

LIST OF PRACTICALS

1. To measure (a) optimum load (b) output power and (c) signal handling capacity of a push-pull amplifier
2. To observe the effect of negative current feedback on the voltage gain of a single stage transistor amplifier by removing emitter by-pass capacitor.
3. To measure (a) voltage gain and (b) input and output impedance for an emitter follower circuit.
4. To measure frequency of (a) Hartley (b) R-C Phase Shift oscillator output signal.
5. To observe the differentiated and integrated square wave on a CRO for different values of R-C time constant

6. Clipping of both portion of sine-wave using:
    a) diode and dc source
    b) zener diodes

   Clamping a sine-wave to:
    a) Negative dc voltage
    b) Positive dc voltage
7. To generate square-wave using an astable multivibrator and to observe the wave form on a CRO
8. To observe triggering and working of a bistable multivibrator circuit and observe its output wave form on a CRO
9. To use the op-Amp (IC 741) as inverting and non-inverting amplifiers, adder, comparator, integrator and differentiator
10. To study the pin configuration and working of IC 555 and its use as monostable and astable multivibrator
11. To realize the regulated power supply by using three terminal voltage regulator ICs such as 7805, 7905, 7915 etc.

INSTRUCTIONAL STRATEGY

The teacher should bring electronic components and devices in the class while taking lectures and explain and make students familiar with them. Also he/she may give emphasis on practical applications of these devices and components in the field. In addition, the students should be encouraged to do practical work independently and confidently.

RECOMMENDED BOOKS

1. A text book of Basic Electronics and Linear Circuits by NN Bhargava and others, Tata McGraw Hill, New Delhi
2. Electronics Principles by SK Sahdev, Dhanpat Rai and Co., New Delhi
3. Electronics Principles by Albert Paul Malina, Tata McGraw Hill, New Delhi
4. Operational Amplifiers and Linear Circuits by Rama Kant and A. Gaykwad, Prentice Hall of India, New Delhi
5. Electronic Devices Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi
6. Electronic Devices and Circuits by Millman and Halkias, McGraw Hill, New Delhi
7. Analog Electronics – II by DR Arora, Ishan Publication, Ambala
8. Electronic Devices and Circuits by JC Karhara, King India Publication, New Delhi
9. Electronic Devices and Circuits-I, Eagle Prakashan, Jalandhar
10. Electronic Devices Circuits by JB Gupta, SK Kataria and Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1.	Transistor Audio Power Amplifier	12	20
2.	Tuned Voltage Amplifier	8	10
3.	Feedback in Amplifiers	8	10
4.	Sinusoidal Oscillators	8	10
5.	Wave-Shaping and Switching Circuits	15	30
6.	Power Supplies	5	10
7	Operational Amplifier	8	10
	Total	**64**	**100**

3.3 DIGITAL ELECTRONICS

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RATIONALE

This syllabus has been designed to make the students know about the fundamental principles of digital electronics and gain familiarity with the available IC chips. This subject aims to give a background in the broad field of digital systems design and microprocessors.

DETAILED CONTENTS

1. Introduction (02 hrs)

   a) Distinction between analog and digital signal.
   b) Applications and advantages of digital signals.

2. Number System (04 hrs)

   a) Binary, octal and hexadecimal number system: conversion from decimal and hexadecimal to binary and vice-versa.
   b) Binary addition, subtraction, multiplication and division including binary points. 1's and 2's complement method of addition/subtraction, sign magnitude method of representation, floating point representation

3. Codes and Parity (04 hrs)

   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. Logic Gates and Families (07 hrs)

   a) Concept of negative and positive logic
   b) Definition, symbols and truth tables of NOT, AND, OR, NAND, NOR, EXOR Gates, NAND and NOR as universal gates.
   (c) Logic family classification:
      - Definition of SSI, MSI, LSI, VLSI
      - TTL and C MOS families and their sub classification
      - Characteristics of TTL and C MOS digital gates. Delay, speed, noise margin, logic levels, power dissipation, fan-in, power supply requirement and comparison between TTL and C MOS families

5. Logic Simplification (06 hrs)

   a) Postulates of 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
   b) Karnaugh map (upto 4 variables) and simple application in developing combinational logic circuits

6. Arithmetic circuits (06 hrs)

a) Half adder and Full adder circuit, design and implementation.
b) Half and Full subtracter circuit, design and implementation.
c) 4 bit adder/subtracter.
d) Adder and Subtractor IC (7484)

7. Decoders, Multiplexeres and De Multiplexeres (06 hrs)

a) Four bit decoder circuits for 7 segment display and decoder/driver ICs.
b) Multiplexers and De-Multiplexers
c) Basic functions and block diagram of MUX and DEMUX. Different types and ICs

8. Latches and flip flops (06 hrs)

a) Concept and types of latch with their working and applications
b) Operation using waveforms and truth tables of RS, T, D, Master/Slave JK flip flops.
c) Difference between a latch and a flip flop
d) Flip flop ICs

9. Counters (8 hrs)

a) Introduction to Asynchronous and Synchronous counters
b) Binary counters
c) Divide by N ripple counters, Decade counter.
d) Pre settable and programmable counters
e) Up/down counter
f) Ring counter with timing diagram
g) Counter ICs

10. Shift Register (07 hrs)

Introduction and basic concepts including shift left and shift right.

a) Serial in parallel out, serial in serial out, parallel in serial out, parallel in parallel out.
b) Universal shift register
c) Buffer register, Tristate Buffer register
d) IC 7495

11. A/D and D/A Converters (08 hrs)

a) Working principle of A/D and D/A converters
b) Brief idea about different techniques A/D conversion and study of :
    - Stair step Ramp A/D converter
    - Dual Slope A/D converter
    - Successive Approximation A/D Converter
c) Detail study of :
    - Binary Weighted D/A converter
    - R/2R ladder D/A converter
d) Performance characteristics of A/D and D/A converter.
e) Applications of A/D and D/A converter.

LIST OF PRACTICALS

1. Verification and interpretation of truth tables for AND, OR, NOT NAND, NOR and Exclusive OR (EXOR) and Exclusive NOR(EXNOR) gates
2. - Realisation of logic functions with the help of NAND or NOR gates
   - Design of a NOR gate latch and verification of its operation
3. To design a half adder using XOR and NAND gates and verification of its operation

   Construction of a full adder circuit using XOR and NAND gates and verify its operation
4. 4 bit adder, 2's complement subtractor circuit using an 4 bit adder IC and an XOR IC and verify the operation of the circuit.
5. To design a NOR Gate Latch and verification of its operation
6. Verification of truth table for positive edge triggered, negative edge triggered, level triggered IC flip-flops (At least one IC each of D latch , D flip-flop, JK flip-flops).
7. Verification of truth table for encoder and decoder ICs, Mux and DeMux
8. To design a 4 bit SISO, SIPO, PISO, PIPO shift registers using JK/D flip flops and verification of their operation.
9. To design a 4 bit ring counter and verify its operation.
10. Asynchronous Counter ICs

    Verification of truth table for any one universal shift register IC

    Use of IC 7490 or equivalent TTL (a) divide by 2 (b) divide by 10 Counter **OR**

    Use of IC 7493 or equivalent TTL (a) divide by 2 (b) divide by 8 (c) divide by 16 counter

Note: Above experiments may preferably be done on Bread Boards.

INSTRUCTIONAL STRATEGY

The digital systems in microprocessors have significant importance in the area of electronics. Adequate competency needs to be developed by giving sufficient practical knowledge in microprocessors (programming as well as interfacing), A/D, D/A Converters and other topics. Help may be taken in the form of charts, simulation packages to develop clear concepts of the subject. Programming exercises other than the tested in circulation may be given to the students.

RECOMMENDED BOOKS

1. Digital Electronics and Applications by Malvino Leach, Tata McGraw Hill Education Pvt Ltd, New Delhi
2. Digital Logic Designs by Morris Mano, Prentice Hall of India, New Delhi
3. Digital Electronics by Soumitra Kumar Mandal, Tata McGraw Hill Education Pvt Ltd,
4. Digital Electronics by V K Sangar , Raj Publishers, Jalandhar

5. Digital Electronics by Tokheim, Tata McGraw Hill Education Pvt Ltd,
6. Digital Fundamentals by Thomas Floyds, Universal Book Stall
7. Digital Electronics by RP Jain, Tata McGraw Hill Education Pvt Ltd, New Delhi
8. Digital Electronics by KS Jamwal, Dhanpat Rai and Co., New Delhi
9. Digital Electronics by Rajiv Sapra, Ishan Publication, Ambala
10. Digital Electronics by BR Gupta, Dhanpat Rai & Co., New Delhi
11. Digital Systems: Principles and Applications by RJ Tocci, Prentice Hall of India, New Delhi
12. Digital Electronics by Rajaraman V., Prentice Hall of India, New Delhi
13. Fundamentals of Digital Electronics by Naresh Gupta, Jain Brothers, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Introduction	2	5
2.	Number System	4	5
3.	Codes and Parity	4	5
4.	Logic Gates and Families	7	15
5.	Logic Simplification	6	10
6.	Arithmetic Circuits	6	10
7.	Decoders, Multiplexeres and De Multiplexeres	6	10
8.	Latches and flip flops	6	10
9	Counters	8	10
10.	Shift Registers	7	10
11.	A/D and D/A Converters	8	10
	Total	**64**	**100**

3.4 ELECTRICAL AND ELECRONICS MEASURING INSTRUMENTS

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RATIONALE

Diploma holders in Electrical Engineering have to work on various jobs in the field as well as in testing laboratories and on control panels, where be performs the duties of installation, operation, maintenance and testing by measuring instruments. Persons working on control panels in power plants, substations and in industries, will come across the use of various types of instruments and have to take measurements.

Instruments used to read and observe the general electrical quantities like current, voltage, power, energy, frequency, resistance etc and their wave shapes, have been incorporated in this subject. So the technician will know the construction and use of various types of electrical instruments.

DETAILED CONTENTS

1. Introduction to Electrical Measuring Instruments: (10 hrs)

    1.1 Concept of measurement and instruments
    1.2 Concept of measurement of electrical quantities and instruments for their measurements
    1.3 Types of electrical measuring instruments – indicating, integrating and recording type instruments
    1.4 Essentials of indicating instruments – deflecting, controlling and damping torque

2. Ammeters and Voltmeters (Moving coil and moving iron type): (8 hrs)

    2.1 Concept of ammeters and voltmeters and difference between them
    2.2 Construction and working principles of moving Iron and moving coil instruments
    2.3 Merits and demerits, sources of error and application of these instruments

3. Wattmeters (Dynamometer Type) (4 hrs)

    Construction, working principle, merits and demerits of dynamometer type wattmeter, sources of error

4. Energy meter (Induction type): (6 hrs)

    Construction, working principle, merits and demerits of single-phase and three-phase energy meters

    4.1 Errors and their compensation
    4.2 Simple numerical problems
    4.3 Construction and working principle of maximum demand indicators

6 Miscellaneous Measuring Instruments: (12 hrs)

6.1 Construction, working principle and application of Meggar, Earth tester, Multimeter, Frequency meter (dynamometer type) single phase power factor meter (Electrodynamometer type). Working principle of synchroscope and phase sequence indicator, tong tester (Clamp-on meter)

6.2 Instrument Transformers: Construction, working and applications
a) CT
b) PT and their ratio and phase angle error

6. Electronic Instruments: (6 hrs)

6.1 Cathode Ray Oscilloscope: Block diagram, working principle of CRO and its various controls. Applications of CRO.
6.2 Digital multi-meter (only block diagram) and Applications

7. LCR meters. (4 hrs)
Study of LCR meters and their applications

8. Power Measurements in 3-phase circuits by (6 hrs)

(i) 2 wattmeter method in balanced and imbalanced circuits and simple problems
(ii) Three wattmeter method

9. Signal Generators- Explanation of block diagram and low frequency and RF Generator, pulse generator and function generator (4 hrs)

10. Impedance Bridge (4 hrs)
- Wheatstone Bridge
- A.C Bridge
- Maxwell's Induction Bridge, Hay's Bridge, De-Sauty's Schery and Anderson Bridge

LIST OF PRACTICALS

1. Use of analog and digital multimeter for measurement of voltage, current (a.c/d.c) and resistance
2. To calibrate 1-phase energy meter by direct loading method.
3. To measure the value of earth resistance using earth tester.
4. To measure power, power factor in a single-phase circuit, using wattmeter and power factor meter and to verify results with calculations.
5. Measurement of power and power factor of a three-phase balanced load by two wattmeter method.
6. Measurement of voltage and frequency of a sinusoidal signal using CRO and draw wave shape of signal.
7. Measurement of power in a 3 phase circuit using CT, PT and 3-phase wattmeter.
8. Use of LCR meter for measuring inductance, capacitance and resistance.

9. To record all electrical quantities from the meters installed in the institution premises.
10. To measure Energy at different Loads using Single phase Digital Energy meter.
11. Measurement of resistance and inductance of coil using RLC bridge

INSTRUCTIONAL STRATEGY

After making the students familiar with measuring instruments, they should be made conceptually clear about the constructional features and make them confident in making connection of various measuring instruments. Teacher should demonstrate the application of each measuring instrument in laboratory and encourage students to use them independently.

RECOMMENDED BOOKS

1. Electrical Measurements and Measuring Instruments by Golding and Widdis; Wheeler Publishing House, New Delhi
1. Electrical Measurements and Measuring Instruments by SK Sahdev, Unique International Publications, Jalandhar
2. A Course in Electrical Measurement and Measuring Instruments by AK Sawhney and PL Bhatia; Dhanpat Rai and Sons, New Delhi
3. Electric Instruments by D. Cooper
4. Experiments in Basic Electrical Engineering by SK Bhattacharya and KM Rastogi, New Age International (P) Ltd., Publishers, New Delhi
5. Electronics Instrumentation by Umesh Sinha, Satya Publication, New Delhi
6. Basic Electrical Measurements by Melville B. Staut.
7. Electrical Measurement and Measuring Instruments by JB Gupta, SK Kataria and Sons, New Delhi
8. Electrical Measurement and Measuring Instruments by ML Anand, SK Kataria and Sons, New Delhi
9. Electronic instrumentation by JB Gupta, Satya Prakash, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1	Introduction to Electrical Measuring Instruments	10	15
2	Ammeters and Voltmeters	8	15
3	Watt Meter	4	5
4	Energy Meter	6	10
5	Miscellaneous Measuring Instruments:	12	20
6	Electronic Instruments:	6	10
7	LCR Meters	4	5
8	Power Measurements in 3-phase circuits	6	10
9	Signal Generators	4	5
10	Impedance Bridge	4	5
	Total	**64**	**100**

3.5 ELECTRICAL AND ELECTRONICS WORKSHOP PRACTICE

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RATIONALE

An electrical and electronics diploma holder will be required to inspect, test and modify the work done by skilled workers working under him. In addition, many a times, it will become necessary for him to demonstrate the correct method and procedure of doing a job. In order to carry out this function effectively in addition to conceptual understanding of the method or procedure he must possess appropriate manual skills. The subject aims at developing special skills required for repairing, fault finding, wiring in electrical and electronics appliances , apparatus , circuits and installations.

DETAILED CONTENTS

1. (a) To study and practice various Electrical and Electronics safety guidelines.

(b) To study various Electrical and Electronics Symbols.

2. To make use of various tools, equipments and instruments to be used in Electrical /Electronic Workshop such as Spanners, Screw Drivers, Files, Wire stripper, Soldering iron, Desoldering pump, Tweezers, Multimeter, CRO, Function Generator etc .

3. (a)To design a distribution board with four outgoing circuits for fan and light load along with main switch and fuses.

(b) Layout of complete house wiring with batten wiring or plastic casing and capping with light, tube and lamp.

4. Assembly of distribution board/panel using MCB, main switch, changeover switch and ELCB.

5. (a) Soldering electronic elements with the necessary switches, micro-switches and extension terminals.

(b) Wiring of series test lamp board and to use it for finding out circuit faults.

6. Testing and rectification of faults in common electrical appliances such as electric iron, electric kettle, ceiling fan and electric geyser.

7. To do the identification, study and testing of various electronic components viz various types of (a) Resistors (b) Capacitors (c) Inductors (d) Diodes (e) Transistors (f) Thyristors (g) ICs (Linear & Digital) etc..

8. To prepare design layout of PCBs using any software tool (e.g Proteous, Dip trace etc).

9. (a) To design and fabricate a PCB for a Regulated power supply.
(b) Assemble the Regulated power supply using PCB and test it.

10. (a) To design & fabricate a PCB for a LED Flasher circuit.
(b) Assemble the LED Flasher circuit using PCB and test it.

3.6 COMPUTER PROGRAMMING AND APPLICATIONS

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RATIONALE

Computer plays a very vital role in present day life, more so, in the professional life of Diploma engineers. In order to enable the students use the computers effectively in problem solving, this course offers the modern programming language C along with exposure to various engineering applications of computers. The knowledge of C language will be reinforced by the practical exercises and demonstration of application software in the field of Electrical and Electronics Engineering during the course of study. Introduction to data base management system is also a very significant field with vast employment potential.

DETAILED CONTENTS

1. Algorithm and Program Development (4 hrs)

- Steps in development of a program
- Flow-charts, algorithm development
- Introduction to various computer languages
- Concept of interpreter, compiler, high level language(HLL), machine language (ML) and Assembly Language

2. Program Structure (C Programming) (24 hrs)

History of 'C', data types, input output statements, arithmetic and logical operations, data assignments, precedence and associatively

I/O statements
Assignment, Variables, arithmetic operation- their precedence, data types standard I/O function, formulated I/O

Control Statements
Logical and relational operators; if-else, while, do- while, for loops, breaks, switch statements

Functions:
Function declaration, parameter passing- by value, storage classes (Local, Global and Static variables), standard library functions

Arrays:
Single and multi dimensional arrays, character arrays

Pointers:
To various data types, pointers in parameters passing, pointers to function

Structures:
Definition of a structure, pointer to structure, union and array of structure

Strings:
String processing, functions and standard library function

Data files
File handling and manipulation, file reading and writing, Binary and ASCII files, file records using standard function type mouse

3. Software Applications in Electrical Engineering (4 hrs)

Computer application overview through various applications software related to Electrical and Electronics Engineering branch viz: MATLAB, PSIM, PSPICE, ORCAD, PSPICE, OPTSIM, KEIL, Circuit Maker and Electronic Workbench

LIST OF PRACTICALS

1. Programming exercise on executing a C Programs.
2. Programming exercise on editing a C program.
3. Programming exercise on defining variables and assigning values to variables
4. Programming exercise on arithmetic and relation operators
5. Programming exercise on arithmetic expressions and their evaluation
6. Programming exercise on reading a character
7. Programming exercise on writing a character
8. Programming exercise on formatting input using print
9. Programming exercise on formatting output using scan
10. Programming exercise on simple IF statement
11. Programming exercise on IF… ELSE statement
12. Programming exercise on SWITCH statement
13. Programming exercise on GOTO statement
14. Programming exercise on DO-WHILE statement
15. Programming exercise on FOR statement
16. Programming exercise on one dimensional arrays
17. Programming exercise on two dimensional arrays
18. Demonstration of application software related to Electrical and Electronics Engineering branch such as: MATLAB, PSIM, MULTISIM, PSPICE, ORCAD, PSPICE, OPTSIM, KEIL, Circuit Maker and Electronic Workbench.

INSTRUCTIONAL STRATEGY

This course is a highly practical and self- study oriented courses. The teachers are expected to explain the theoretical part and make the students to execute and debug different programs. The PC needed to have Turbo C. In addition they must demonstrate various application software to students while explaining the capability of particular software.

RECOMMENDED BOOKS

1. Programming in C by Schaum series McGraw Hill Education Pvt Ltd. New Delhi.
2. Programming in C by Kerning Lan and Richie; Prentice Hall of India, New Delhi
3. Programming in C by Balagurusamy, Tata McGraw Hill,Education Pvt Ltd. New Delhi.
4. Let us C- Yashwant Kanetkar, BPB Publications, New Delhi
5. Vijay Mukhi Series for C and C++
6. Programming in C by R Subburaj, Vikas Publishhing House Pvt. Ltd., Jangpura, New Delhi
7. Programming in C by Kris A Jansa, Galgotia Publications Pvt. Ltd., Daryaganj, New Delhi
8. Programming in C by BP Mahapatra, Khanna Publishers, New Delhi
9. Elements of C by MH Lewin, Khanna Publishers, New Delhi
10. The Complete Reference to Visual Basic 6, by Noel Jerke, Tata McGraw Hill, New Delhi
11. Web site www.Beyondlogic.org
12. Pointers in C by Yashwant Kanetkar, BPB Publishers New Delhi
13. Programming in Applications by Chandershekhar, Uneek Publications, Jalandhar
14. The essentials of Computer Organizing and Architecture by Linda Null and Julia Labur, Narosa Publishing House Pvt. Ltd., New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Topic No.	Topic	Time Allotted (Hrs)	Marks Allocation
1.	Algorithm and Program Development	4	15
2.	Program Structure (C Programming)	24	70
3.	Software Applications	4	15
Total		**32**	**100**