3.1 ANALOG ELECTRONICS - II

L T P

3 - 3

RATIONALE

Having attained basic knowledge of electronic devices like diodes, transistors, and elementary circuits, in second semester, this course will enable the students to learn about the use of transistors in analog circuits like power amplifier, multistage amplifier, oscillators, wave shaping circuits and in multivibrators etc. It also gives information about timer, operational amplifier, voltage regulator, ICs and their applications for effective functioning in the field of electronic service industry.

DETAILED CONTENTS

1. Multistage Amplifiers (06 hrs)

a) Need for multistage amplifier

b) Gain of multistage amplifier

c) Different types of multistage amplifier like RC coupled, transformer coupled, direct coupled, and their frequency response and bandwidth

2. Large Signal Amplifier (06 hrs)

a) Difference between voltage and power amplifiers

b) Importance of impedance matching in amplifiers

c) Class A, Class B, Class AB, and Class C amplifiers, collector efficiency and Distortion in class A,B,C

d) Single ended power amplifiers, Graphical method of calculation (without derivation) of output power; heat dissipation curve and importance of heat sinks. Push-pull amplifier, and complementary symmetry push-pull amplifier

3. Feedback in Amplifiers (06 hrs)

a) Basic principles and types of feedback.

b) Derivation of expression for gain of an amplifier employing feedback.

c) Effect of feedback (negative) on gain, stability, distortion and bandwidth of an amplifier.

d) RC coupled amplifier without emitter bypass capacitor.

e) Emitter follower amplifier and its application.

4. Sinusoidal Oscillators (06 hrs)

a) Use of positive feedback

b) Barkhausen criterion for oscillations

c) Different oscillator circuits-tuned collector, Hartley, Colpitts, phase shift, Wien's bridge, and crystal oscillator. Their working principles (no mathematical derivation but only simple numerical problems)

5. Tuned Voltage Amplifiers (04 hrs)

a) Series and parallel resonant circuits and bandwidth of resonant circuits

b) Single and double tuned voltage amplifiers and their frequency response characteristics

6. Wave Shaping Circuits (06 hrs)

a) General idea about different wave shapers

b) RC and RL integrating and differentiating circuits with their applications

c) Diode clipping and clamping circuits and simple numerical problems on these circuits

7. Multivibrator Circuits (06 hrs)

a) Working principle of transistor as switch

b) Concept of multi-vibrator: astable, monostable, and bistable and their applications

c) Block diagram of IC 555 and its working and applications

d) IC 555 as monostable and astable multi-vibrator

8. Operational Amplifiers (06 hrs)

a) Characteristics of an ideal operational amplifier and its block diagram

b) Definition of differential voltage gain, CMRR, PSRR, slew rate and input offset current

c) Operational amplifier as an inverter, scale changer, adder, subtractor, differentiator, and integrator

d) Concept of Schmitt trigger circuit and sample/hold circuit using operational amplifier and their application

9. Regulated DC Power supply (02 Hrs.)

a) Concept of d.c. Power supply.

b) Line and load regulation.

c) Concept of fixed Voltage, IC regulators like 78xx, 79xx

d) Working principle and block diagram of SMPS.

LIST OF PRACTICALS

(1) Plot the frequency response of two stage RC coupled amplifier and calculate the bandwidth and compare it with single stage amplifier

(2) To measure the gain of push-pull amplifier at 1KHz

(3) To measure the voltage gain of emitter follower circuit and plot its frequency response

(4) Plot the frequency response curve of Hartley and Colpitts Oscillator

(5) Plot the frequency response curve of phase shift and Wein bridge Oscillator

(6) To observe the output waveforms of series and shunt clipping circuits

(7) To observe the output for clamping circuits

(8) Use of IC 555 as Monostable multivibrator and observe the output for different values of RC

(9) Use of IC 555 as A stable multivibrator and observe the output at different duty cycles

(10) To use IC 741 (op-amplifier) as

i) Inverter, ii) Adder, iii) Subtracter iv) Integrator

(11) To realize positive and negative fixed voltage DC power supply using 7805/ 7905

INSTRUCTIONAL STRATEGY

This subject being of fundamental importance for diploma holders in electronics engineering and related fields, emphasis on conceptual understanding may be given by taking the help of charts, simulation packages etc. Sufficient exercises may be given to the students in single stage and multi-stage amplifier circuits in addition to simple exercises in fabricating and testing of various simple d.c circuits. The students may be encouraged to perform some additional practical exercises apart from the list provided.

LIST OF RECOMMENDED BOOKS

(1) Basic Electronics and Linear Circuits by NN Bhargava, Tata McGraw Hills, New Delhi

(2) Electronic Principles by Sahdev, Dhanpat Rai and Sons, New Delhi.

(3) Electronics Principles by Malvino, Tata McGraw Hills, New Delhi

(4) Electronic Circuit Theory by Boylstead

(5) Electronic Devices and Circuits by BL Theraja, S Chand and Co Ltd. New Delhi

(6) Analog Electronics-II by D.R. Arora, North Publication , Jalandehar

(7) Operational Amplifiers and Linear Integrated Circuits by Ramakant A. Gaykwad

(8) Electronics Devices and Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi

(9) Electronics Devices and Circuits-II by Rajesh Kumar, Eagle Prakashan, Jalandhar

(10) Principles of Electrical and Electronics Engineering by VK Mehta; S Chand and Co., New Delhi

(11) Electronic Components and Materials by SM Dhir, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi.

(12) Principles of Electronics by SK Bhattacharya and Renu Vig, SK Kataria and Sons, Delhi

(13) Basic Electronics 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.	Multistage Amplifiers	06	12
2.	Large Signal Amplifier	06	16
3.	Feedback in Amplifier	06	14
4.	Sinusoidal Oscillators	06	16
5.	Tuned Voltage Amplifiers	04	06
6.	Wave Shaping Circuits	06	10
7.	Multivibrator Circuits	06	10
8.	Operational amplifiers	06	12
9.	Regulated DC power Supply	02	04
Total		**48**	**100**

3.2 COMPUTER PROGRAMMING AND APPLICATIONS

L T P
2 - 4

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 various application software in the field of 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 (04 hrs)

   a) Steps in development of a program
   b) Flow-charts, algorithm development
   c) Approaches Towards Programming
   d) Introduction to various computer languages high level language(HLL), machine language (ML) and Assembly Language
   e) Introduction to Translators: Assembler, Compiler, Interpreter

2. Fundamentals of C Programming (24 hrs)

   a) Overview of C:
   History of 'C', Features and Characteristics, Structure of C, Header Files

   b) I/O statements
   Input output statements, Assignment statements, Variables, Constants, Data Types Operators & Expressions with their precedence, Standard Formatted and Unformatted I/O Functions.

   c) Control Structures
   Decision and Loop Statements: if-else, while, do- while, for loops, breaks, switch statements

   d) Functions:
   Introduction to Functions, Function declaration and definition, parameter passing- Call by value-Call By Reference, storage class Specifies, Local and Global Variables, standard library functions, Recursion

   e) Arrays:
   Introduction to Array, Array Declaration and Initialization, Single and multi dimensional Arrays, character arrays

f) Pointers:
Introduction to Pointers, Declaration and Initialization, Address Operators & Pointers To various data types, pointers in parameters passing, pointers to function

g) Structures:
Declaration & Definition of a structure, pointer to structure, union and array of structure, Self Referential Structures

h) Strings:
String processing, functions and standard library function

i) 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 Electronics Engineering (04 hrs)

Computer application overview through various applications software related to Electronics Engineering branch viz: ORCAD, PSPICE, OPTSIM, KEIL, Circuit Maker, MATLAB, 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 such as MATLAB, PSPICE, OPTSIM etc.

INSTRUCTIONAL STRATEGY

This course is a highly practical and self- study oriented courses. The teachers are expected to explain the theoretical part and ensure that the students to execute and debug different programs. The PC needed to have Turbo C & MATLAB software.

RECOMMENDED BOOKS

1. Programming in C by Balagurusamy, Tata McGraw Hill Education Pvt Ltd, New Delhi
2. Programming in C by Gottfried, Tata McGraw Hill Education Pvt Ltd, New Delhi
3. Let us C- Yashwant Kanetkar, BPB Publications, New Delhi
4. Computer Programming and Applications by Preeti Chhabra, Ishan Publication.
5. Programming in C by R Subburaj, Vikas Publishhing House Pvt. Ltd., Jangpura, New Delhi
6. Programming in C by Kris A Jansa, Galgotia Publications Pvt. Ltd., Daryaganj, New Delhi
7. Programming in C by BP Mahapatra, Khanna Publishers, New Delhi
8. Pointers in C by Yashwant Kanetkar, BPB Publishers New Delhi
9. Programming in Applications by Chandershekhar, Unique International Publications, Jalandhar

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**

3.3 PRINCIPLES OF COMMUNICATION ENGINEERING

L T P
3 - 2

RATIONALE

The study of principles of communication systems leads to further specialized study of audio and video systems, line communications and microwave communication systems. Thus the diploma-holder in Electronics and Communication Engineering shall find employment in areas of R and D, production, servicing and maintenance of various communication systems. The students should understand the advantage and limitations of various analog and digital modulation systems on a comparative a scale and relate to them while studying practical communication systems.

DETAILED CONTENTS

1. Introduction (04 hrs)

   a) Need for modulation and demodulation in communication systems
   b) Basic scheme of a modern communication system.
   c) Noise and its different types (No mathematical derivation)

2. Amplitude modulation (06 hrs)

   a) Derivation of expression for an amplitude modulated wave. Carrier and side band components. Modulation index. Spectrum and BW of AM Wave. Relative power distribution in carrier and side bands.

   b) Elementary idea of DSB-SC, SSB-SC, ISB and VSB modulations, their comparison, and areas of applications

3. Frequency Modulation (06 hrs)

   a) Expression for frequency modulated wave and its frequency spectrum (without Proof and analysis of Bassel function) Modulation index, maximum frequency deviation and deviation ratio, BW of signals, Carson's rule.
   b) Comparison of FM and AM in communication systems
   c) Narrow band and Wide Band FM.

4. Phase Modulation (06 hrs)

   Expression for phase modulated wave, modulation index, comparison with frequency modulation.

5. Principles of AM Modulators (06 hrs)

   Circuit Diagram and working operation of:
   a) Collector and Base Modulator
   b) Square Law Modulator
      - Balanced Modulator
      - Ring Modulator

6. Demodulation of AM Waves (02 hrs)

Principles of demodulation of AM wave using diode detector circuit; concept of Clipping and formula for RC time constant for minimum distortion (no derivation)

7. Principles of FM Modulators (06 hrs)

Circuit Diagram and working of reactance modulator, varactor diode modulator, VCO and Armstrong phase modulator.

8. Demodulation of FM Waves (04 hrs)

a) Basic principles of FM detection using slope detector

b) Principle of working of the following FM demodulators

- Foster-Seeley discriminator
- Ratio detector

9. Pulse Modulation (08 hrs)

a) Statement of sampling theorem and elementary idea of sampling frequency for pulse modulation

b) Basic concepts of time division multiplexing (TDM) and frequency division multiplexing (FDM)

c) Types of pulse modulation-PAM, PPM, PWM (Generation and Detection) and their comparison

LIST OF PRACTICALS

1. To observe an AM wave on CRO produced by a standard signal generator.
2. To obtain an FM wave and measure the frequency deviation for different modulating signals.
3. To obtain demodulated modulating signal from an AM detector circuit.
4. To obtain demodulated signal from a FM detector.
5. To observe the sampled signal and compare it with the analog input signal. Note the effect of varying the sampling pulse width and frequency on the sampled output.
6. To observe and note the pulse amplitude modulated signal (PAM) and compare them with the corresponding analog input signal.
7. To observe PPM signal and compare it with the analog input signal.
8. To observe PWM signal and compare it with the analog input signal.

INSTRUCTIONAL STRATEGY

The subject requires both theory and practical emphasis simultaneously, so that the student can understand the practical significance of the various areas. Visits to instrumentation and communications industries must be carried out, so as to make the students can understand where and how the various instruments are used in the industry.

RECOMMENDED BOOKS

1. Electronics Communication System by Kennedy, Tata McGraw Hill Education Pvt Ltd, New Delhi
2. Fundamentals of Communication System by Fitz, Tata McGraw Hill Education Pvt Ltd, New Delhi
3. Principles of Communication Engineering by Taub, Tata McGraw Hill Education Pvt Ltd,
4. Electronics Communication by KS Jamwal, Dhanpat Rai and Co, New Delhi
5. Radio Engineering by GK Mittal, Khanna Publishers, New Delhi
6. Principles of Communication Engineering by Yash pal & Sanjeev Kumar North Publications, Ambala
7. Principles of Communication Engineering by Manoj Kumar, Satya Prakashan, New Delhi
8. Principles of Communication Engineering by Anokh Singh, S.Chand and Co., New Delhi
9. Principles of Communication Engineering by Roody , Coolin

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Introduction	04	5
2.	Amplitude Modulation	06	10
3.	Frequency Modulation	06	10
4.	Phase Modulation	06	10
5.	Principles of AM Modulators	06	15
6.	Demodulation of AM Waves	02	10
7.	Principles of FM Modulators	06	10
8.	Demodulation of FM Waves	04	10
9	Pulse Modulation	08	20
Total		**48**	**100**

3.4 DIGITAL ELECTRONICS - I

L	T	P
4	-	2

RATIONALE

The objective of this subject is to enable the students to know the basic concepts of digital electronics and gain familiarity with the available IC chips. The students will learn about number systems, logic gates, various codes, parities, Boolean algebra, Mux and Demux, filp-flop, counters, shift registers. This will form a broad base for studying digital system design, advanced microprocessors and further studies.

DETAILED CONTENT

1. Introduction (02 hrs)

   a) Define digital and analog signals and systems, difference between analog and digital signals

   b) Need of digitization and applications of digital systems

2. Number Systems (10 hrs)

   a) Decimal, binary, octal, hexadecimal number systems

   b) Conversion of number from one number system to another including decimal points

   c) Binary addition, subtraction, multiplication,1's and 2's complement method of subtraction

   d) BCD code numbers and their limitations, addition of BCD coded numbers, conversion of BCD to decimal and vice-versa

   e) Excess-3 code, gray code, binary to gray and gray to binary conversion

   f) Concept of parity, single and double parity, error detection and correction using parity

3. Logic Gates (04 hrs)

   a) 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

   b) NAND and NOR as universal logic gates

4. Logic Simplification (08 hrs)

   a) Rules and laws of Boolean algebra, logic expression, Demorgan's theorems, their proof

   b) Sum of products form (minterm), Product of sum form (MAXTERMS), simplification of Boolean expressions with the help of Rules and laws of Boolean algebra

   c) Karnaugh mapping techniques upto 4 variables and their applications for simplification of Boolean expression

5. Arithmetic Circuits (03 hrs)

   a) Half adder, full adder circuits and their operation

   b) Parallel binary adder, 2-bit and 4-bit binary full adder, block diagram, working

6. Multiplexer/Demultiplexer (04 hrs)

   a) Basic functions, symbols and logic diagrams of 4-inputs and 8-inputs multiplexers,

   b) Function/utility of 16 and 32 inputs multiplexers,

   c) Basic function, symbols and logic diagram of 4 outputs and 8 output DEMUX

   d) Realization of Boolean expression using multiplexer/demultiplexers

7. Decoders, Display Devices and Associated Circuits (04 hrs)

   a) Basic Binary decoder, 4-line to 16 line decoder circuit

   b) BCD to decimal decoder, BCD to 7-segment decoder/driver, LED/LCD display

8. Encoders and Comparators (04 hrs)

   a) Encoder, decimal to BCD encoder, decimal to BCD priority encoder, keyboard encoder

   b) Magnitude comparators, symbols and logic diagrams of 2-bit and 4-bit comparators

9. Latches and Flip-Flops (07 hrs)

   a) Latch, SR-latch, D-latch, Flip-flop, difference between latch and flip-flop

b) S-R, D flip-flop their operation using waveform and truth tables, race around condition

c) JK flip-flop, master slave and their operation using waveform and truth tables

10. Counters (10 hrs)

a) Asynchronous counter, 4-bit Asynchronous counter, Asynchronous decade counter

b) Synchronous counter, 4-bit synchronous binary counter.

c) Up/down Asynchronous counters 3 bit Asynchronous up/down counter.

d) Ring counter, cascaded counter, counter applications

11. Shift Registers (08 hrs)

a) Shift registers functions, serial-in-serial out, serial-in-parallel-out, parallel-in-serial-out, parallel-in-parallel out shift register

b) Universal shift register, shift register counter and applications of shift registers

LIST OF PRACTICALS

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
   a) multiplexer using an IC
   b) de-multiplexer using an IC
5. 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
6. Verify operation of SR, JK, D-flip-flop master slave JK filp-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. Testing of digital ICs using IC tester

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 Yashpal and Sanjeev Kumar North Publication, Jalandhar
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

INSTRUCTIONAL STRATEGY

The Digital Electronic – 1 has significant importance in the field of Electronics. Adequate competency need to be developed by giving sufficient practical knowledge in microprocessor, A/D, D/A, convertors and other topics. Help may be taken in the form of charts, simulation packages to teach of the subject.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Introduction	02	06
2.	Number Systems	10	06
3.	Logic Gates	04	06
4.	Logic Simplification	08	12
5.	Arithmetic Circuits	03	10
6.	Multiplexer/Demultiplexer	04	10
7.	Decoders, Display Device and Associated Circuits	04	10
8.	Encoders and Comparators	04	10
9	Latches and Flip Flops	07	10
10.	Counters	10	10
11.	Shift Registers	08	10
Total		**64**	**100**

3.5 ELECTRONIC INSTRUMENTS AND MEASUREMENT

L	T	P
3	-	3

RATIONALE

In the real world of work the technician is required to handle wide variety of instruments while testing, trouble shooting, calibration etc. the study of this subject will help students to gain the knowledge of working principles and operation of different instruments. During practical sessions, he will acquire the requisite skills.

DETAILED CONTENTS

1. Basics of Measurements (04 hrs)

   Measurement, methods of measurement, types of instruments

   Specifications of instruments: Accuracy, precision, sensitivity, resolution, range, Errors in measurement, sources of errors, limiting errors, Loading effect, Importance and applications of standards and calibration

2. Voltage, Current and Resistance Measurement (12 hrs)

   - Principles of operation and construction of permanent magnet moving coil (PMMC) instruments.
   - Moving iron type instruments, measurement of D.C voltage and current, Block diagram, working principle, application and comparison of analog and digital Multimeter.
   - Specifications of multimeter and its applications.
   - Limitations with regard to frequency and input impedance.

3. Cathode Ray Oscilloscope (10 hrs)

   - Construction and working of Cathode Ray Tube(CRT)
   - Time base operation and need for blanking during flyback, synchronization
   - Block diagram, description of a basic CRO and triggered sweep oscilloscope, front panel controls.
   - Specifications of CRO and their explanation.
   - Measurement of voltage, current, frequency, time period and phase using CRO.
   - CRO probes, special features of dual beam, dual trace, delay sweep.
   - Digital storage oscilloscope (DSO) : block diagram and working principle.

4. Signal Generators and Analytical Instruments (06 hrs)

- Explanation of block diagram specifications of low frequency and RF generators, pulse generator, function generator
- Wave analyzer, distortion measurement and spectrum analyser

5. Impedance Bridges and Q Meters (10 hrs)

- Wheat stone bridge
- AC bridges: Maxwell's induction bridge, Hay's bridge, De-Sauty's bridge, Schering bridge and Anderson bridge
- Block diagram description of laboratory type RLC bridge, specifications of RLC bridge
- Block diagram and working principle of Q meter

6. Digital Instruments (06 hrs)

6.1 Comparison of analog and digital instruments

6.2 Working principle of ramp, dual slope and integration type digital voltmeter

6.3 Measurement of time interval, time period and frequency using universal counter/frequency counter

6.4 Working principle of logic probe, logic pulser, logic analyzer, logic comparator, signature analyzer

LIST OF PRACTICALS

1. Measurement of voltage, resistance, frequency, using digital multimeter
2. Measurement of voltage, frequency, time period and phase using CRO
3. Measurement of voltage, frequency, time and phase using DSO
4. Interfacing of DSO with printer.
5. Measurement of rise time and fall time using DSO
6. Measurement of Q of a coil and its dependence on frequency
7. Measurement of resistance and inductance of coil using RLC Bridge
8. Use of logic pulser and logic probe
9. Measurement of time period, frequency, average period using universal counter/ frequency counter
10. Measurement of Impedance using Maxwell Induction Bridge
11. To find the value of unknown resistance using Wheat Stone Bridge

INSTRUCTIONAL STRATEGY

The subject requires both theory and practical emphasis simultaneously, so that the student can understand the practical significance of the various areas. Visits to instrumentation and communications industries must be carried out, so as to make the students can understand where and how the various instruments are used in the industry.

RECOMMENDED BOOKS

1. Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Sons, New Delhi
2. Electronics Measurement and Instrumentation by Oliver, Tata McGraw Hill Education Pvt Ltd, New Delhi
3. Electronics Instrumentation by Cooper, Prentice Hall of India, New Delhi
4. Electronics Test and Instrumentation by Yashpal and Sanjeev Kumar, North Publications, Jalandhar
5. Electronics Instrumentation by JB Gupta, Satya Prakashan, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation%
1.	Basics of Measurements	04	5
2.	Voltage, Current and Resistance Measurement	12	20
3.	Cathode Ray Oscilloscope	10	20
4.	Signal Generators and Analysis Instruments	06	15
5.	Impedance Bridges and Q Meters	10	20
6.	Digital Instruments	06	20
Total		**48**	**100**

3.6 ELECTRICAL MACHINES

L	T	P
3	-	3

RATIONALE

This subject deals with various types of electrical machines being employed in industry, power stations, domestic and commercial appliances etc. It is envisaged that after studying the subject, students will gain competence in operation, repair and maintenance of such machines and give suggestions for improvement in their performance. The students will study three phase supply, transformer, a.c. and d.c. motors. The practicals will enable students to perform various tests necessary for installation and commissioning of such machines.

DETAILED CONTENT

1. Three Phase Supply (06 hrs)

   a) Advantages of 3 phase system over single phase system

   b) Star delta connections

   c) Relation between phase voltage and line voltage, phase current and line current in a 3 phase system

   d) Power and power factor(p.f.) in 3 phase system and their measurements, importance of p.f. (simple problems)

2. Transformer (08 hrs)

   Principle of transformer, construction, voltage and current transformation. Methods of connection in 3 phase transformers, current and voltage relationship, auto transformer and its uses, instrument 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

3. DC Motor (08 hrs)

   Principle, significance of back emf, types of motors and their construction, 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)

4. Three Phase Induction Motors (08 hrs)

   Principle, construction, concept of slip, torque and characteristics, effect of motor resistance on torque (running and starting), rotor current, output power, different

methods of speed control. Starting methods and constructional and working of 3 point starter, applications (simple problems)

5. Synchronous Motors (06 hrs)

Principle, construction and working, effect of load and excitation on synchronous motor. Starting of motor and their applications

6. Single Phase Motors (06 hrs)

Principle, construction, working speed, control, starting and applications of the following motors:

a) Induction motor

c) Universal motor

7. Stepper Motor and Servo Motor (06 hrs)

Types, construction, working and their applications

(**Note**: No derivation of any formula)

LIST OF PRACTICALS

The students to perform following experiments in the lab:

1. DC machines

1.1 Speed control of dc shunt motor (i) Armature control method (ii) Field control method
1.2 Study of dc series motor with starter (to operate the motor on no load for a moment)

2. Transformers (single phase)

Open circuit and short circuit test for determining parameter of a transformer

3. Determining the regulation and efficiency from the data obtained from open circuit and short circuit test

4. Three-phase transformers

Checking the polarity of the windings of a three phase transformer and connecting the windings in various configurations

5. To measure power and power factors in 3 - phase load using two wattmeter method.

6. To connect a dc shunt motor with supply through 3 - phase starter and to run the motor at different speech with the help of a field regulator.

7. To run a 3 - phase squirrel cage Induction motor with the help of a star delta starter.

8. To change the direction of rotation of induction motor.

9. To run a synchronous motor with a.c. supply and to measure speed to verify the relation

$$N = \frac{120\,f}{p}$$

INSTRUCTIONAL STRATEGY

For conceptual understanding a field/industrial visit (preferably Transformer Factory) may be organised to give live exposure to students. For this the teacher should visit first to understand the assembly line-up which could be followed by a visit of the students, where the teacher can give an idea of the working of the factory without much seeking assistance of the factory staff. In addition, emphasis may be given on field applications and simple numerical problems.

RECOMMENDED BOOKS

1) Electrical Machine by SK Bhattacharya, Tata McGraw Hill Education Pvt Ltd, New Delhi

2) Electrical Machines by Nagrath and Kothari, Tata McGraw Hill Education Pvt Ltd, New Delhi

3) Experiments in Basic Electrical Engineering: by S.K. Bhattacharya, KM Rastogi: New Age International (P) Ltd. Publishers, New Delhi

4) Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar

5) Electrical Engineering by JB Gupta, SK Kataria & Sons, New Delhi

6) Electrical Machines by DR Arora, Ishan Publications, Ambala City.

7) Electrical Technology Vol. - I and II B.L. Thareja, S Chand and Co. New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Three phase Supply	6	12
2.	Transformers	8	20
3.	DC Motor	8	15
4.	3 Phase Induction Motors	8	20
5.	Synchronous Motors	6	10
6.	Single Phase Motors	6	13
7.	Stepper Motor and Servo Motor	6	10
Total		**48**	**100**