

Electronics and Communication Engineering

(For Punjab State)

VARIOUS SUBJECTS IN SECOND YEAR

Sr.No.	Subjects	Page No(s)
Semester– III		85-108
3.1.	Electronic Instruments and Measurements	86
3.2	Principles of Communication Engineering	89
3.3	Digital Electronics	93
3.4	Electronic Devices and Circuits	98
3.5	Electrical Machines	102
3.6	Computer Programming and Applications	106
Semester– IV		109-129
4.1	Network Filters and Transmission Lines	110
4.2	Communication Systems-I	114
4.3	Power Electronics	117
4.4	Microprocessor	120
4.5	Electronic Design and Fabrication Techniques	123
4.6	Generic Skills and Entrepreneurship Development	126
<i>Entrepreneurial Awareness Camp</i>		129

3.1 ELECTRONIC INSTRUMENTS AND MEASUREMENT

L T P
4 - 2

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 (06 hrs)
Measurement, method of measurement, types of instruments
Specifications of instruments: Accuracy, precision, sensitivity, resolution, range, errors in measurement, sources of errors, limiting errors, loading effect, importance and applications of standards and calibration
2. Voltage, Current and Resistance Measurement (12 hrs)
 - Principles of measurement of dc voltage, dc current, ac voltage, ac current, Principles of operation and construction of permanent magnet moving coil (PMMC) instruments
 - Moving iron type instruments, measurement of d.c voltage and current, measurement of ac voltage and current, milli-volt measurement
 - Block diagram of multimeter and measurement of voltage, current and resistance using multimeter
 - Specifications of multimeter and their applications
 - Limitations with regard to frequency and input impedance
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 current, voltage, 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 (08 hrs)
- Explanation of block diagram specifications of low frequency and RF generators, pulse generator, function generator
 - Distortion factor meter; wave analyser and spectrum analyser
5. Impedance Bridges and Q Meters (14 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 (14 hrs)
- Comparison of analog and digital instruments
 - Working principle of ramp, dual slope and integration type digital voltmeter
 - Block diagram and working of a digital multimeter
 - Measurement of time interval, time period and frequency using universal counter/frequency counter
 - Working principle of logic probe, logic pulser, logic analyzer, logic comparator, signature analyzer and logic analyzer

LIST OF PRACTICALS

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance
2. To observe the limitations of a multimeter for measuring high frequency voltage
3. Measurement of voltage, frequency, time period and phase using CRO
4. Measurement of rise time and fall time using CRO
5. Measurement of Q of a coil and its dependence on frequency
6. Measurement of voltage, frequency, time and phase using DSO
7. Measurement of resistance and inductance of coil using RLC Bridge
8. Measurement of distortion of RF signal generator using distortion factor meter
9. Use of logic pulser and logic probe

10. Measurement of time period, frequency, average period using universal counter/ frequency counter

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 Rajiv Sapra, Ishan Publications, Ambala
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	6	5
2.	Voltage, Current and Resistance Measurement	12	20
3.	Cathode Ray Oscilloscope	10	15
4.	Signal Generators and Analysis Instruments	8	10
5.	Impedance Bridges and Q Meters	14	25
6.	Digital Instruments	14	25
Total		64	100

3.2 PRINCIPLES OF COMMUNICATION ENGINEERING

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4 - 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, frequency translation and demodulation in communication systems
 - b) Basic scheme of a modern communication system.
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 Bessel function) Modulation index, maximum frequency deviation and deviation ratio, BW and FM signals, Carson's rule.
 - b) Effect of noise on FM carrier. Noise triangle, Role of limiter, Need for pre-emphasis and de-emphasis, capture effect.
 - c) Comparison of FM and AM in communication systems
4. Phase modulation (06 hrs)

Derivation of expression for phase modulated wave, modulation index, comparison with frequency modulation.
5. Principles of Modulators (10 hrs)

Working principles and typical application as:

- Square Law Modulator
- Switching Modulator
- Collector modulator
- Base Modulator
- Balanced Modulator
- Ring Modulator

6. Principles of FM Modulators (06 hrs)

Working principles and applications of reactance modulator, varactor diode modulator, VCO and Armstrong phase modulator. Stabilization of carrier for using AFC Block diagram approach).

7. Demodulation of AM Waves (06 hrs)

- a) Principles of demodulation of AM wave using diode detector circuit; concept of Clipping and formula for RC time constant for minimum distortion (no derivation)
- b) Principle of demodulation of AM Wave using synchronous detection.

8. Demodulation of FM Waves (06 hrs)

- a) Basic principles of FM detection using slope detector
- b) Principle of working of the following FM demodulators
 - Foster-Seeley discriminator
 - Ratio detector
 - Quadrature detector
 - Phase locked Loop (PLL) FM demodulators

9. Pulse Modulation (14 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) PAM, PPM, PWM

- d) Pulse code Modulation (PCM) Basic scheme of PCM system. Quantisation, quantisation error, companding, block diagram of TDM-PCM communication system and function of each block. Advantages of PCM systems. Concepts of differential PCM (DPCM)
- e) Delta Modulation (DM)
Basic principle of delta modulation system, advantages of delta modulation system over PCM system. Limitations of delta modulation, concept of adaptive delta modulation (ADM)

LIST OF PRACTICALS

1.
 - a) To observe an AM wave on CRO produced by a standard signal generator using internal and external modulation
 - b) To measure the modulation index of the wave obtained in above practical
2.
 - a) To obtain an AM wave from a square law modulator circuit and observe waveforms
 - b) To measure the modulation index of the obtained wave form.
3. To obtain an FM wave and measure the frequency deviation for different modulating signals.
4. To obtain modulating signal from an AM detector circuit and observe the pattern for different RC time constants and obtain its optimum value for least distortion.
5. To obtain modulating signal from a FM detector .
6. 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.
7. To observe and note the pulse amplitude modulated signal (PAM) and compare them with the corresponding analog input signal
8. To observe PPM and PWM signal and compare it with the analog input signal
9. To feed an analog signal to a PCM modulator and compare the demodulated signal with the analog input. Also note the effect of low pass filter at the demodulated output.
10. To study the process of delta modulation/demodulation

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 DR Arora, Ishan Publications, Ambala
- (7) Communication Engineering by A Kumar
- (8) Principles of Communication Engineering by Manoj Kumar, Satya Prakashan, New Delhi
- (9) Principles of Communication Engineering by Anokh Singh, S.Chand and Co., New Delhi
- (10) 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	4	5
2.	Amplitude modulation	6	10
3.	Frequency modulation	6	10
4.	Phase modulation	6	10
5.	Principles of Modulators	10	15
6.	Principles of FM Modulators	6	10
7.	Demodulation of AM Waves	6	10
8.	Demodulation of FM Waves	6	10
9	Pulse Modulation	14	20
Total		64	100

3.3 DIGITAL ELECTRONICS

(Common in Electronics (μ P), Computer Engg, I.T and ECE)

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4 - 3

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)
- 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
 - Karnaugh map (upto 4 variables) and simple application in developing combinational logic circuits
6. Arithmetic circuits (06 hrs)
- Half adder and Full adder circuit, design and implementation.
 - Half and Full subtractor circuit, design and implementation.
 - 4 bit adder/subtractor.
 - Adder and Subtractor IC (7484)
7. Decoders, Multiplexeres and De Multiplexeres (06 hrs)
- Four bit decoder circuits for 7 segment display and decoder/driver ICs.
 - Multiplexers and De-Multiplexers
 - Basic functions and block diagram of MUX and DEMUX. Different types and ICs
8. Latches and flip flops (06 hrs)
- Concept and types of latch with their working and applications
 - Operation using waveforms and truth tables of RS, T, D, Master/Slave JK flip flops.
 - Difference between a latch and a flip flop
 - Flip flop ICs
9. Counters (8 hrs)
- Introduction to Asynchronous and Synchronous counters
 - Binary counters
 - Divide by N ripple counters, Decade counter.
 - Pre settable and programmable counters
 - Up/down counter
 - Ring counter with timing diagram
 - Counter ICs
10. Shift Register (07 hrs)
- 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
 - Buffer register, Tristate Buffer register
 - 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, Multiplexers and Demultiplexers	6	10
8.	Latches and Flip flops	6	10
9.	Counters	8	10
10.	Shift Registers	7	10
11.	A/D and D/A Converter	8	10
Total		64	100

3.4 ELECTRONIC DEVICES AND CIRCUITS

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4 - 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 (08 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 (08 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 (08 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 with emitter bypass capacitor
 - e) Emitter follower amplifier and its application
4. Sinusoidal Oscillators (08 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 (04 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 (08 hrs)
 - a) Working principle of transistor as switch
 - b) Concept of multi-vibrator: astable, monostable, and bistable and their applications
 - c) Block diagram of IC555 and its working and applications
 - d) IC555 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 Supplies (04 hrs)
 - a) Concept of DC power supply. Line and load regulation
 - b) Concept of fixed voltage, IC regulators (like 7805, 7905), and variable voltage regulator like (IC 723)
10. Opto Electric Devices (04 hrs)

Working principles and characteristics of photo resistors, photo diodes, photo transistors, opto couplers.
11. VCO (IC 565) and PLL (IC 566) and their Applications (02hrs)

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 astable multivibrator and observe the output at different duty cycles
- (10) To use IC 741 (op-amplifier) as
 - i) Inverter,
 - ii) Adder,
 - iii) Subtractor
 - iv) Integrator
- (11) To realize positive and negative fixed voltage AC power supply using three terminal voltage regulator IC (7805, 7812, 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 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 Devices and Circuits by Millman and Halkias, McGraw Hills, New Delhi
- (5) Electronics Devices and Circuits by Bhupinderjit Kaur, modern Publishers, Jalandhar
- (6) Basic Electronics by Grob, Tata McGraw Hills, New Delhi
- (7) Art of Electronics by Horowitz
- (8) Electronic Circuit Theory by Boylestead
- (9) Electronic Devices and Circuits by BL Theraja, S Chand and Co Ltd. New Delhi
- (10) Operational Amplifiers and Linear Integrated Circuits by Ramakant A. Gaykwad
- (11) Electronics Devices and Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi
- (12) Electronics Devices and Circuits-II by Rajesh Kumar, Eagle Prakashan, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	<i>Topic</i>	Time Allotted (hrs)	Marks Allocation
1.	Multistage Amplifiers	08	15
2.	Large Signal Amplifier	08	15
3.	Feedback in Amplifier	08	15
4.	Sinusoidal Oscillators	08	10
5.	Tuned Voltage Amplifiers	04	5
6.	Wave Shaping Circuits	04	5
7.	Multivibrator Circuits	08	10
8.	Operational amplifiers	06	10
9.	Regulated power supplies	04	5
10.	Opto Electric Devices	04	5
11.	VCO & PLC and their Application	02	5
Total		64	100

3.5 ELECTRICAL MACHINES

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RATIONALE

Electrical machines is a subject where a student will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc. After studying this subject, diploma holder in Instrumentation and Control must be competent to repair and maintain these machines and give suggestions to improve their performance. Practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications

DETAILED CONTENTS

1. Three Phase Supply (6 hrs)
 - Advantage of three-phase system over single-phase system.
 - Star Delta connections
 - Relation between phase and line voltage and current in a three phase system
 - Power and power factor in three-phase system and their measurements by one, two and three wattmeter methods.

2. Transformers (10 hrs)

Principle of operation and constructional details of single phase and three-phase transformer, core type and shell type transformers, difference between single phase and three phase transformers and their applications.

 - Voltage Regulation of a transformer (No Derivation)
 - Losses in a transformer
 - Efficiency, condition for maximum efficiency and all day efficiency
 - Auto transformers and instrument transformer
 - CTs and PTs (Current transformer and potential transformer)
 - CVT (Constant Voltage Transformer)

3. Introduction to Rotating Electrical Machines (10 hrs)
 - E.M.F induced in a coil rotating in a magnetic field.
 - Definition of motor and generator
 - Basic principle of a generator and a motor
 - Torque due to alignment of two magnetic fields and the concept of Torque angle
 - Basic Electromagnetic laws (Faraday's laws of Electromagnetic Induction)

4. DC Machines (14 hrs)
- Principle of working of d.c motors and d.c generator, their constructional details
 - Function of the commutator for motoring and generating action
 - Factors determining the speed of a DC motor
 - Different types of excitation
 - Characteristics of different types of DC machines
 - Starting of DC motors and starters
 - Application of DC machines
5. A.C. Motors (12 hrs)
- Revolving magnetic field produced by poly phase supply
 - Brief introduction about three phase induction motors, its principle of operation
 - Types of induction motors and constructional features of squirrel cage and slip-ring motors
 - Starting and speed control
 - Star Delta and DOL (Direct-on-line) starters.
 - Reversal of direction of rotation of 3-phase induction motors
 - Applications of induction motors
 - Principle and working of Synchronous Machines
 - Application of Synchronous Machines
 -
6. Single Phase Fractional Kilowatt Motors (12 hrs)
- Introduction
 - Principle of operation of single phase motors
 - Types of single phase induction motors and their constructional details (i.e. split phase, capacitor start, capacitor start and run, shaded pole and reluctance start)
 - Single phase synchronous motors – reluctance motor (hysteresis motor)
 - Commutator type single-phase motors – Repulsion Induction motor, AC series motor and universal motors
 - Introduction to servo- motors and stepper motors
 - Concept of micro-motors.

LIST OF PRACTICALS

Demonstrate various instruments use viz Ammeter, Voltmeter, Wattmeter, p.f meter etc for their identification and connecting procedure in a circuit.

1. To measure power and power factors in 3 Phase load by two wattmeter method
2. To determine the efficiency of a single phase transformer from the data obtained through open circuit and short circuit test
3. To connect the primary and secondary windings of a three phase transformer in a suitable circuit and to verify line and phase current and voltage relationship respectively
4. To connect a dc shunt motor with supply through a 3 point starter and to run the motor at different speeds with the help of a field regulator
5. To run a 3 phase squirrel cage induction motor with the help of a star-delta starter. To change the direction of rotation of the motor.
6. To measure power and power factor of a single phase induction motor.
7. To run a synchronous motor with a.c supply and to measure speed to verify the relation $N=120 f/P$
8. To make connections of starting and running winding of a single phase capacitor motor and to run it with the help a DOL starter and to measure its speed
9. Study construction of a stepper and servomotor and to write their complete specifications.

INSTRUCTIONAL STRATEGY

A visit to a small factory (Preferably Transformer Factory) must 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 in groups of 10-20 (depending upon the size of the factory), where the instructor can give an idea of the working of the factory without much seeking assistance of the factory staff.

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	10
2.	Transformers	10	15
3.	Introduction to Rotating Electrical Machines	10	15
4.	DC Machines	14	20
5.	A.C. Motors	12	20
6.	Single Phase Fractional Kilowatt Motors	12	20
Total		64	100

3.6 COMPUTER PROGRAMMING AND APPLICATIONS (For Electronics Engineering)

L T P
2 - 3

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

2. Program Structure (C Programming) (24 hrs)
 - a) History of 'C', data types, input output statements, arithmetic and logical operations, data assignments, precedence and associativity
 - b) I/O statements
Assignment, Variables, arithmetic operation- their precedence, data types standard I/O function, formulated I/O
 - c) Control Statements
Logical and relational operators; if-else, while, do- while, for loops, breaks, switch statements
 - d) Functions:
Function declaration, parameter passing- by value, storage classes (Local, Global and Static variables), standard library functions
 - e) Arrays:
Single and multi dimensional arrays, character arrays
 - f) Pointers:
To various data types, pointers in parameters passing, pointers to function

- g) Structures:
Definition of a structure, pointer to structure, union and array of structure
 - 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 (4 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: MATLAB, OPTSIM, PSPICE 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.

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. Programming in C by Kerning Lan and Richie; Prentice Hall of India, 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. Programing 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 Education Pvt Ltd, New Delhi
11. Web site www.Beyondlogic.org
12. Pointers in C by Yashwant Kanetkar, BPB Publishers New Delhi
13. Programing in Applications by Chandershekhar, Unique International 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

ENVIRONMENTAL STUDIES

RATIONALE

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the eco system and controlling pollution by pollution control measures. He should also be aware of environmental laws related to the control of pollution.

Lectures will be delivered on following broad topics.

DETAILED CONTENTS		
1	Basics of ecology, eco system and sustainable development.	
2	Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table	
3	Sources of pollution - natural and man made, their effects on living and non-living organisms	
4	Pollution of water - causes, effects of domestic wastes and industrial effluent on living and non-living organisms	
5	Pollution of air-causes and effects of man, animal, vegetation and non-living organisms	
6	Sources of noise pollution and its effects	
7	Solid waste management; classification of refuse material, types, sources and properties of solid wastes, abatement methods	
8	Mining, blasting, deforestation and their effects	
9	Legislation to control environment	
10	Environmental Impact Assessment (EIA), Elements for preparing EIA statements	
11	Current issues in environmental pollution and its control, Global warming, Green house gases, non-conventional sources of energy, introduction to clean technology.	
12	Introduction to Green buildings, site selection, material efficiency, energy efficiency, water efficiency, building form.	
13	Role of non-conventional sources of energy in environmental protection	

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Marks Allotted (%)
1	5
2	7
3	7
4	10
5	10
6	6
7	10
8	6
9	6
10	8
11	10
12	5
13	10
Total	100