

3.1 MANUFACTURING PROCESSES-I

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RATIOANELE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various manufacturing processes is required to be imparted. Hence the subject of workshop technology.

DETAILED CONTENTS

1. Welding (18 hrs)

1.1 Welding Process

Principle of welding, Classification of welding processes, Advantages and limitations of welding, Industrial applications of welding, Welding positions and techniques, symbols.

1.2 Gas Welding

Principle of operation, Types of gas welding flames and their applications, Gas welding equipment - Gas welding torch, Oxy acetylene cutting torch, Blow pipe, Pressure regulators, Filler rods and fluxes

1.3 Arc Welding

Principle of operation, Arc welding machines and equipment, A.C. and D.C. arc welding, Effect of polarity, current regulation and voltage regulation

1.4 Other Welding Processes

- Resistance welding, introduction to spot and seam welding
- Modern welding methods – TIG, MIG, ultrasonic welding, laser beam welding, robotic welding

1.5 Welding Defects

Types of welding defects, methods of controlling welding defects, inspection of welding defects

2. Pattern Making (04 hrs)

Types of pattern, Pattern material, Pattern allowances, Pattern codes as per B.I.S., Introduction to cores, core boxes and core materials, Core making procedure, Core prints, positioning of cores

3. Moulding and Casting (16 hrs)

3.1 Moulding Sand

Properties of moulding sand, their impact and control of properties. Various types of moulding sand.

3.2 Mould Making

Types of moulds, molding boxes, hand tools used for mould making, molding processes, molding machines: squeeze machine, jolt squeeze machine and sand slinger.

3.3 Casting Processes

Charging a furnace, melting and pouring both ferrous and non ferrous metals, cleaning of castings, Principle,

3.4 Gating and Riser System

Elements of gating system, Pouring basin, sprue, runner, gates, Types of risers, location of risers, Directional solidification

3.5 Melting Furnaces

Construction and working of Pit furnace, Cupola furnace, Crucible furnace – tilting type, Electric furnace

3.6 Casting Defects

Different types of casting defects, Testing of defects through magnetic particle inspection.

4. Metal Forming Processes (10 hrs)

4.1 Press Working - Types of presses, type of dies, selection of press die, die material. Press Operations-Shearing, piercing, trimming, punching, notching, shaving, gearing, embossing, stamping

4.2 Forging, Rolling, Extrusion and drawing

LIST OF PRACTICALS

General introduction to hand tools used in foundry, welding and pattern making and smithy shop.

Welding Shop

- Job 1. Preparing gas welding joint in vertical position joining M.S. Plates
- Job 2. Exercise on gas cutting of mild steel plate with oxy-acetylene gas torch.
- Job 3. Exercise on gas welding of cast iron and brass part or component.
- Job 4. Exercise on preparation of T Joint by arc welding
- Job 5. Exercise on spot welding/seam welding
- Job 6. Exercise on MIG and TIG welding

Pattern making

- Job 1. Preparation of solid/single piece pattern.
- Job 2. Preparation of two piece/split pattern
- Job 3. Preparation of a pattern on wooden lathe
- Job 4. Preparation of a self cored pattern
- Job 5. Preparation of a core box.

Foundry Shop

- Job 1. Preparation of mould with solid pattern on floor.
- Job 2. Preparation of floor mould of solid pattern using cope.
- Job 3. Preparation of floor mould of split pattern in cope and drag of moulding box.
- Job 4. Moulding and casting of a solid pattern of aluminum
- Job 5. Preparing a mould of step pulley and also preparing core for the same.
- Job 6. A visit to cast iron foundry should be arranged to have first hand knowledge of cast iron melting pouring and casting.
- Job 7. Testing of moisture contents and strength of moulding sand.

Forging Shop/Fitting Shop/Sheet Metal Shop

- Job 1. Preparation of single ended spanner by hand/machine forging.
- Job 2. Preparation of simple die
- Job 3. Demonstration of spinning process on lathe and spinning a bowl on a lathe machine.

- Job 4. Demonstration of grinding process on lathe machine and grinding a job on a lathe machine
- Job 5. Preparation of utility item out of G.I. sheet.
- Job 6. Preparation of drilling Jig.

INSTRUCTIONAL STRATEGY

1. Teachers should lay special emphasis in making the students conversant with concepts, principles, procedures and practices related to various manufacturing processes.
2. Focus should be laid in preparing jobs using various machines/equipment in the workshop.
3. Use of audio-visual aids/video films should be made to show specialized operations.

LIST OF RECOMMENDED BOOKS

1. Workshop Technology by BS Raghuvanshi : Dhanpat Rai and Sons Delhi
2. Elements of Workshop Technology by SK Choudhry and Hajra : Asia Publishing House
3. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi
4. Foundry Technology by KP Sinha and DB Goel; Roorkee Publishing House, Roorkee.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	18	34
2	04	12
3	16	34
4	10	20
Total	48	100

3.2 MECHANICAL ENGINEERING FUNDAMENTALS

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Rationale

A diploma holder in this course is required to make use of different materials for various applications, basic concepts of thermodynamics and various materials. This subject aims at developing knowledge about the fundamentals of Mechanical Engineering.

Detailed Contents

1. Introduction to Engineering Materials (10 hrs.)
Material, Different engineering materials and applications, classification of materials, Thermal, chemical, electrical, mechanical properties of various materials.
2. Concept of Stress and Strain (12 hrs)
 - 2.1 Tensile, compressive and shear stresses and strains.
 - 2.2 Concept of elasticity, elastic limit and limit of proportionality.
 - 2.2.1 Hook's Law
 - 2.2.2 Young's Modulus of elasticity
 - 2.2.3 Nominal Stress
 - 2.2.4 Stress- Strain Diagram
 - 2.2.5 Yield point, plastic stage
 - 2.2.6 Ultimate strength and breaking stress
 - 2.2.7 Percentage elongation
 - 2.2.8 Proof Stress and working stress
 - 2.2.9 Factor of safety
 - 2.2.10 Poisson's ratio
 - 2.2.11 Shear modulus
3. Fundamental Concepts of Thermodynamics (16 hrs)
 - 3.1 Thermodynamic state and system, boundary, surrounding, universe
 - 3.2 Thermodynamic Systems- Closed, open, isolated, adiabatic, homogeneous and heterogeneous, macroscopic and microscopic
 - 3.3 Properties of systems- Intensive and extensive, Concept of enthalpy, internal energy
 - 3.4 Quasi-static process, reversible and irreversible processes

4. Laws of Thermodynamics (10 hrs)
- 4.1 Law of conservation of energy
 - 4.2 First law of thermodynamics (Joule’s experiment) and its applications
 - 4.3 Second law of thermodynamics:- Kelvin Plank’s statement, Classius statement
 - 4.4 Zeroth law of thermodynamics
 - 4.5 Introduction to third law of thermodynamics, concept of irreversibility, entropy
5. IC engine (16 hrs)
- 5.1 Introduction
 - 5.2 Working principle of two stroke and four stroke cycle, SI engine and CI engine, Otto cycle, diesel cycle and dual cycle
 - 5.3 Location and function of various parts of IC engine and materials used
 - 5.4 IC engine terms - bore, stroke, dead centre, crank throw, compression ratio, piston displacement, piston speed.

INSTRUCTIONAL STRATEGY

1. Expose the students to real life problems
2. Plan assignments so as to promote problem solving abilities

RECOMMENDED BOOKS

1. Engineering thermodynamics by P.K.Nag; Tata McGraw Hill, Delhi
2. Thermal Engineering by R.K Rajput; Laxmi Publication, New Delhi
3. Strength of Materials by R.S. Khurmi; S.Chand & Company, New Delhi
4. Text book of Material Science by R.K. Rajput, Katson Publication, Ludhiana

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted in (hrs)	Marks Allotted in (%)
1	10	15
2	12	20
3	16	25
4	10	15
5	16	25
Total	64	100

3.3 ELECTRICAL ENGINEERING FUNDAMENTALS

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RATIONALE

This course will enable the students to understand the basic concepts and principles of d.c and a.c fundamental, a.c circuits, batteries, electromagnetic induction etc. including constant voltage and current sources. A diploma holder may be involved in various jobs ranging from preventive maintenance of electrical installation to fault location etc. In addition, he may be working in testing laboratories where he uses measuring instruments. To carry out these and similar jobs effectively, knowledge of basic concepts, principles and their applications is very essential.

DETAILED CONTENTS

1. Voltage and Current Sources (01 hrs)
 - 1.1 Concept of voltage sources- symbol, graphical representation and characteristics of constant/ ideal and practical sources.
 - 1.2 Concept of current sources- symbol, graphical representation and characteristics of constant/ideal and practical current sources.
2. DC Circuit Theorems (04 hrs)
 - 2.1. Thevenin's theorem, Norton's theorem, super position theorem, maximum power transfer theorem.
 - 2.2 Application of network theorems in solving d. c circuit problems.
3. Electro Magnetic Induction (08 hrs)
 - 3.1. Concepts of magnetic field produced by flow of current, Magnetic circuit, concept of magneto-motive force (MMF), flux, reluctance, permeability, analogy between electric and magnetic circuit.
 - 3.2. Faraday's laws of electro-magnetic induction, principles of self and mutual induction, self and mutually induced e.m.f, simple numerical problems.
 - 3.3. Concept of current growth, decay and time constant in an inductive (RL) circuit.
 - 3.4. Energy stored in an inductor, series and parallel combination of inductors.
4. AC Fundamentals (12 hrs)
 - 4.1 Concept of alternating voltage and current
 - 4.2 Difference between AC and DC

- 4.3 Concept of cycle, frequency, time period, amplitude, instantaneous value, average value, r.m.s. value, maximum value, form factor and peak factor.
 - 4.4 Representation of sinusoidal quantities by phasor diagrams.
 - 4.5 Equation of sinusoidal wave form (with derivation)
 - 4.6 Effect of alternating voltage applied to a pure resistance, pure inductance and Pure capacitance.
5. AC Circuits (10 hrs)
- 5.1. Concept of Inductive reactance, Capacitive reactance and impedance
 - 5.2. Alternating voltage applied to resistance and inductance in series.
 - 5.3 Alternating voltage applied to resistance and capacitance in series.
 - 5.4. Impedance triangle and phase angle
 - 5.5. Solutions and phasor diagrams for simple RLC circuits (series and parallel).
 - 5.6. Series and parallel resonance conditions (with derivation)
 - 5.7 Power in pure resistance, inductance and capacitance, power in combined RLC circuits. Power factor, active and reactive power and their significance, importance of power factor.
 - 5.8. Definition of conductance, susceptance and admittance
6. Transformers (10 hrs.)
- 6.1 Introduction
 - 6.2 Constructional features of a transformer and parts of transformer
 - 6.3 Working principle of a transformer
 - 6.4 EMF equation
 - 6.5 Transformer on no-load and its phasor diagram
 - 6.6 Transformer – neglecting voltage drop in the windings – Ampere turn balance – its phasor diagram
 - 6.7 Mutual and leakage fluxes, leakage reactance
 - 6.8 Transformer on load, voltage drops and its phasor diagram
 - 6.9 Equivalent circuit
 - 6.10 Relation between induced emf and terminal voltage, regulation of a transformer- mathematical relation
 - 6.11 Losses in a transformer
 - 6.12 Open circuit and short circuit test. Calculation of efficiency, condition for maximum efficiency-maintenance of Transformer, scheduled Maintenance
 - 6.13 Auto transformer construction, saving of copper, working and applications
 - 6.14 Construction of 3- phase transformer
 - 6.15 Types of 3- phase transformer i.e. delta-delta, delta-star, star-delta and star-star
7. Various Types of Power Plants (03 hrs)
- 7.1. Principle of power generation in thermal, hydro and nuclear power stations and their comparative study.
 - 7.2. Elementary block diagram of thermal, hydro and nuclear power stations.

LIST OF PRACTICALS

1. Familiarization of measuring instruments viz voltmeter, ammeter, CRO, Wattmeter and multi-meter and other accessories
2. Verification of ohm's law
3. To measure (very low) resistance of an ammeter and (very high) resistance of a voltmeter
4. To verify in d.c circuits:
 - a.. Thevenin's theorem,
 - b. Norton's theorem,
 - c. Super position theorem,
 - d. Maximum power transfer theorem,
5. To observe change in resistance of a bulb in hot and cold conditions, using voltmeter and ammeter.
6. Verification of Kirchhoff's Current Law and Kirchhoff's Voltage Law in a dc circuit
7. To find the ratio of inductance of a coil having air-core and iron-core respectively and to observe the effect of introduction of a magnetic core on coil inductance
8. To find the voltage current relationship in a single phase R-L and R-C Series circuits, draw their impedance triangles and determine the power factor in each case .
9. To test a lead - acid storage battery and measure its specific gravity.
10. Measurement of power and power factor in a single phase R.L.C. circuit and to calculate active and reactive power.
11. To perform open circuit and short circuit test for determining: (i) equivalent circuit (ii) the regulation and (iii) efficiency of a transformer from the data obtained from open circuit and short circuit test at full load
12. To find the efficiency and regulation of single phase transformer by actually loading it.
13. Visit to a nearby power station(s).

RECOMMENDED BOOKS

1. Electrical Technology, Fifth Edition by Edward Hughes, Longman Publishers
2. Electrical Technology by BL Theraja, S Chand and Co, New Delhi
3. Basic Electrical and Electronics Engineering by SK Sahdev; Dhanpat Rai and Sons, New Delhi
4. Experiments in Basic Electrical Engineering by SK Bhattacharya, KM Rastogi; New Age International (P) Ltd.; Publishers New Delhi
5. Principles of Electrical Engineering by BR Gupta, S Chand and Co, New Delhi
6. Electrical Engineering by DR Arora; Ishan Publications, Ambala
7. Basic Electrical Engineering by PS Dhogal, Tata Mc Graw Hill, New Delhi
8. Basic Electrical Engineering by JB Gupta; SK Kataria and Sons, New Delhi
9. Experiments in Basic Electrical Engineering by GP Chhalhotra, Khanna Publishers, New Delhi
10. Basic Electrical Engineering by T.S. Anand, North Publications, Jalandhar.

INSTRUCTIONAL STRATEGY

Electrical machines being a core subject of electrical diploma curriculum, where a student will deal with various types of electrical machines which are employed in industry, power stations, domestic and commercial appliances etc. After studying this subject, an electrical diploma holder must be competent to repair and maintain these machines and give suggestions to improve their performance. Special care has to be taken on conceptual understanding of concepts and principles in the subject. For this purpose exposure to industry, work places, and utilization of various types of electrical machine for different applications may be emphasized. Explanation of practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications.

SUGGESTED DISTRIBUTION OF MARKS

S.No	Time Allotted(Hrs.)	Marks Allotted(%)
1	01	05
2	04	10
3	08	15
4	12	20
5	10	20
6	10	20
7	03	10
Total	48	100

3.4 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 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

3.5 ANALOG ELECTRONIC DEVICES

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RATIONALE

At present, electronics 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, topics like semi-conductor physics, semi-conductor Diodes, Bipolar transistors, rectifiers, single stage and multistage amplifiers, field effect transistors, operational amplifiers and timers.

DETAILED CONTENTS

1. Semiconductor diodes and its applications (08 hrs)
 - 1.1 Ideal diode, Semiconductor diode characteristics, static and dynamic resistance
 - 1.2 Use of diode as half wave and full wave rectifiers (centre tapped and bridge type), relation between DC output and AC input voltage, rectifier efficiency
 - 1.3 Concept of ripples, filter circuits – shunt capacitor, series inductor, and pie () filters and their applications
 - 1.4 Various types of diodes such as zener diode, varactor diode, schottky diode, light emitting diode, tunnel diode, photo diode; their working characteristics and applications
 - 1.5 Zener diode and its characteristics, Use of zener diode for voltage stabilization

2. Bi-polar Transistors (07 hrs)
 - 2.1 Concept of junction transistor, PNP and NPN transistors, their symbols and mechanism of current flow
 - 2.2 Transistor configurations: common base (CB), common emitter (CE) and common collector (CC), current relation and their input/output characteristics; comparison of the three configurations

3. Transistor Biasing and Stabilization (06 hrs)
 - 3.1 Transistor biasing, its need, operating point, effect of temperature on the operating point of a transistor and need of stabilization of operating point.

- 3.2 Different biasing circuits, limitations, simple problems to calculate operating point in different biasing circuits. Use of Thevenin's theorem to determine operating point
- 4. Single-Stage Transistor Amplifiers (08 hrs)
 - 4.1 Single stage transistor amplifier circuit in CE configuration, function of each component
 - 4.2 Working of single stage transistor amplifier, physical and graphical explanation, phase reversal
 - 4.3 Frequency response of a single stage transistor amplifier
- 5. Multi-Stage Transistor Amplifiers (08 hrs)
 - 5.1 Need of multi-stage transistor amplifiers – different types of couplings, their purpose and applications.
 - 5.2 Knowledge of various terms such as voltage gain, current gain, power gain, frequency response, decibel gain and band width
 - 5.3 RC coupled two-stage amplifiers, circuit details, working, frequency response, applications
 - 5.4 Elementary idea about direct coupled amplifier, its limitations and applications
- 6. Field Effect Transistor (FET) (07 hrs)
 - 6.1 Construction, operation, characteristics and applications of a N channel JFET and P channel JFET
 - 6.2 JFET as an amplifier
 - 6.3 Types, construction, operation, characteristics and applications of a MOSFET
 - 6.4 Comparison between BJT, JFET and MOSFET
- 7. Feedback in Amplifiers (06 hrs)
 - 7.1 Basic principles and types of Feedback
 - 7.2 Derivation of expression for gain of an amplifier employing feedback
 - 7.3 Effect of feedback (negative) on gain, stability, distortion and bandwidth of an amplifier
- 8. Multivibrator Circuits (08 hrs)
 - 8.1 Concept of multi-vibrator: astable, monostable and bistable and their applications
 - 8.2 Block diagram of IC555 and its working and applications
 - 8.3 IC555 as monostable and astable multi-vibrator

9. Operational Amplifiers (06 hrs.)
- 9.1 Characteristics of an ideal operational amplifier and its block diagram
 - 9.2 Definition of differential voltage gain, CMRR, PSRR, slew rate and input offset current
 - 9.3 Operational amplifier as an inverter, scale changer, adder, subtractor, differentiator and integrator

LIST OF PRACTICALS

1. V-I characteristics of a semiconductor diode and to calculate its static and dynamic resistance
2. V-I characteristics of a zener diode and finding its reverse breakdown voltage
3. Observation of input and output wave shapes of a half-wave rectifier and verification of relationship between dc output and ac input voltage
4. Observation of input and output wave shapes of a full wave rectifier and verification and relationship between dc and ac input voltage
5. Plotting input and output characteristics of a transistor in CE configuration
6. To measure the voltage gain and band width by plotting frequency response curve of a single stage amplifier using CE configuration at different loads
7. To study the effect of coupling capacitor on lower cut off frequency and upper cut off frequency by plotting frequency response curve of a two stage RC coupled amplifier
8. To plot V-I characteristics of a FET
9. Use of IC555 as monostable and astable multivibrator and observe the output for different values of RC.
10. To use IC741(OP- AMP) as (i) Inverter (ii) Adder (iii) Subtractor (iv) Integrator

INSTRUCTIONAL STRATEGY

This subject gives the knowledge of fundamental concepts of basic electronics. The teacher should give emphasis on understanding of concepts and various term used in the subject. The students be made familiar with diodes, transistors, resistors, capacitors, inductors etc. and electrical measuring instruments etc. Practical exercises will reinforce various concepts. Application of Semiconductor Diodes, Transistors, Field Effect Transistors, operational amplifier and multivibrators must be told to students.

RECOMMENDED BOOKS

1. Basic Electronics and Linear Circuit by NN Bhargava, Kulshreshta and SC Gupta, Tata McGraw Hill Education Pvt Ltd, New Delhi.
2. Electronic Principles by SK Sahdev, Dhanpat Rai & Co., New Delhi
3. Principles of Electrical and Electronics Engineering by VK Mehta; S Chand and Co., New Delhi

4. Electronic Components and Materials by SM Dhir, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi.
5. Principles of Electronics by SK Bhattacharya and Renu Vig, SK Kataria and Sons, Delhi
6. Principles of Electronics by Albert Paul Malvino; Tata McGraw Hill Education Pvt Ltd, New Delhi.
7. Analog Electronics by DR Arora, Ishan Publications, Ambala City.
8. Analog Electronics by JC Karhara, King India Publication, New Delhi
9. 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	Semiconductor Diodes and its applications	08	12
2	Bi-polar Transistors	07	10
3	Transistor Biasing and Stabilization	06	10
4	Single-Stage Transistor Amplifiers	08	12
5	Multi-Stage Transistor Amplifiers	08	12
6	Field Effect Transistor	07	10
7	Feedback in amplifiers	06	10
8	Multivibrator circuits	08	12
9	Operational Amplifiers	06	12
	Total	64	100