

3.1 FUNDAMENTALS OF ELECTRICAL ENGINEERING

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RATIONALE

For a diploma holder in electrical engineering, it becomes imperative to know the fundamentals of the subject in order to grasp the knowledge of the field. This subject will provide acquaintance with various terms knowledge of fundamental concepts of electricity, magnetism and various principles related to it.

LEARNING OUTCOME

After undergoing the subject, students will be able to:

- Verify the laws related to basics of electrical engineering
- Solve electrical and electronics networks by applying various network theorems
- Use various batteries and their care, maintenance
- Develop a relation between electric current and magnetism and vice-versa
- Convert mechanical energy to electrical energy
- Apply electromagnetic induction principles in various electrical equipment and machines
- Describe alternating voltage and current generation
- Connect AC circuits

DETAILED CONTENTS

1. Introduction (04 hrs)
 - 1.1 Application and Advantages of Electrical Energy
 - Different forms of energy
 - Advantages of electrical energy
 - Uses of electrical energy
 - 1.2 Basic Electrical Quantities
 - Basic concept of charge, current, voltage, resistance, power, energy and their units
 - Conversion of units of work, power and energy from one form to another
2. DC Circuits (11 hrs)
 - 2.1 Ohm's law, resistances in series and parallel
 - 2.2 Kirchoff's laws and their applications in solving electrical network problems

- 2.3 Network theorems such as Thevenin's theorem, superposition theorem
Maximum power and transfer theorem and Norton's theorem
- 2.4 Star-delta transformation
- 3. Batteries (06 hrs)
 - 3.1 Basic idea about primary and secondary cells
 - 3.2 Working principle, construction and applications of Lead acid, Nickel
Cadmium and Silver Oxide Cells
 - 3.3 Charging methods used for lead acid accumulator
 - 3.4 Care and maintenance of a lead acid battery
 - 3.5 Grouping of cells in series and parallel (simple numerical problems).
- 4. Magnetism and Electromagnetism: (08 hrs)
 - 4.1 Introduction to electromagnetism, Magnetic field around a straight current
carrying conductor and a solenoid and methods to find its direction, force
between two parallel current carrying conductors.
 - 4.2 Force on a conductor placed in the magnetic field
 - 4.3 Series magnetic circuits, simple problems
 - 4.4 Concept of hysteresis, loop and hysteresis loss.
- 5. Electromagnetic Induction: (09 hrs)
 - 5.1. Faraday's Laws of electromagnetic induction
 - 5.2. Lenz's law
 - 5.3. Fleming's Right and Left Hand Rule
 - 5.4. Principle of self and mutual induction
 - 5.5. Principle of self and mutually induced e.m.f. and simple problems
 - 5.6. Inductances in series and parallel
 - 5.7. Energy stored in a magnetic field
 - 5.8. Concept of eddy currents, eddy current loss

6. AC Fundamentals (10 hrs)
- 6.1. Concept of A.C. generation (single phase and three phase)
 - 6.2. Difference between A.C and D.C
 - 6.3. Concept of alternating current and voltage, equation of instantaneous values, average value, r.m.s value, form factor, power factor etc.
 - 6.4. Concept of phasor and phase difference.
 - 6.5. Representation of alternating sinusoidal quantities by vectors
 - 6.6. Phasor algebra (addition, subtraction, multiplication and division of complex quantities)
7. AC Circuits (16 hrs)
- 7.1. AC through pure resistance, inductance and capacitance
 - 7.2. Alternating voltage applied to RL,RC and RLC series and parallel circuits (impedance triangle, phasor diagram and their solutions)
 - 7.3. Introduction to susceptance, conductance and admittance
 - 7.4. Power in pure resistance, inductance, capacitance, RL, RC, RLC circuits
 - 7.5. Active and reactive components of current and their significance
 - 7.6. Power factor and its practical significance

LIST OF PRACTICALS

1. Determination of voltage-current relationship in a dc circuit under specific physical conditions and to draw conclusions (to verify ohm's law)
2. Filament lamp
 - Measure the resistance of a cold lamp filament with the help of calculations.
 - Measure the current drawn by the lamp at different voltages from zero to 220 volts and the resistance of lamp at different voltages, plot a graph between current and voltage
3. (a) To verify that $R_t = R_1 + R_2 + \dots$ where R_1, R_2 etc. are resistances connected in series

(b) To verify
$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_m}$$

Where R_1, R_2 etc. are resistances connected in parallel

4. Verification of Kirchhoff's current and voltage laws applied to DC circuits
 - a) to construct a circuit arrangement consisting of resistances in series, parallel combination
 - b) identification of node points in the circuit
 - c) to see that algebraic sum of currents at node point is zero
 - d) to see that algebraic sum of emfs and voltage drops in a closed loop is zero
5. To find ratio of inductance values of a coil having air /iron core respectively and to see the effect of introduction of a magnetic core on coil inductance
6. To construct an RL and RC circuit and to measure
 - a) their impedance
 - b) phase angle between voltage and current
 - c) construct impedance triangle
7. Measurement of power and power factor of a single phase RLC circuit. To calculate KVA and KVAR
8. Testing a battery for its charged condition and to charge it

Note: The results should be verified analytically also.

INSTRUCTIONAL STRATEGY

Basic electrical engineering being a fundamental subject need to be handled very carefully and in a manner such that students develop clear understanding of principles and concepts and develop skill in their application in solving related problems. Teacher may lay emphasis on laboratory experiments and give lot of tutorial work to students in order to give them an opportunity in mastering the basics in solving related problems

RECOMMENDED BOOKS

1. Fundamentals of Electrical Engineering by Sahdev, Uneek Publication, Jalandhar
2. Basic Electrical Engineering by PS Dhogal, Tata McGraw Hill Education Pvt. Ltd., New Delhi
3. Electrical Science by VK Mehta, S Chand and Co., New Delhi
4. Electrical Engineering by DR Arora, Ishan Publications, Ambala
5. Electrical Technology by JB Gupta, SK Kataria and Sons, New Delhi
6. Electrical Technology by BL Theraja, S Chand & Co., New Delhi
7. Electrical Science by S. Chandhni, R Chakrabarti and PK Chattopadhyay. Narosa Publishing House Pvt. Ltd., New Delhi
8. Basic Electrical Engineering by Mool Singh, Galgotia Publication Pvt. Ltd., New Delhi
9. Principles of Electrical Engineering by BR Gupta, S Chand & Co., New Delhi
10. Handbook of Electrical Engineering by SL Bhatia, Khanna Publishers, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (hrs)	Marks Allocation (%)
1.	04	06
2.	11	17
3.	06	09
4.	08	12
5.	09	14
6.	10	17
7.	16	25
Total	64	100

3.2 ANALOG ELECTRONICS

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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 Diodes, Bipolar transistors, rectifiers, single stage and multistage amplifiers and field effect transistors have been included.

LEARNING OUTCOME

After undergoing the subject, students will be able to:

- Use P.N. junction as rectifier
- Use Zener diode as voltage stabilizer
- Use bi-polar transistors and its application as an amplifier and as a switch
- Analyse amplifier and enhance the gain of amplifier
- Use unipolar transistors as amplifier
- Identify and testing of various active and passive components such as resistor, inductor, capacitor, diode and transistor

DETAILED CONTENTS

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|-----|--|----------|
| 1. | Semiconductor Diodes | (12 hrs) |
| 1.1 | PN Junction, mechanism of current flow in PN junction, drift and diffusion currents, depletion layer, potential barrier, effect of forward and reverse biasing in a PN junction. Concept of junction capacitance in forward and reverse biased conditions. Breakdown mechanism | |
| 1.2 | Ideal diode, Semiconductor diode characteristics, static and dynamic resistance | |
| 1.3 | 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 | |
| 1.4 | Concept of ripples, filter circuits – shunt capacitor, series inductor, and pie (π) filters and their applications | |
| 1.5 | Diode ratings/specifications | |

- 1.6 Various types of diodes such as zener diode, varactor diode, schottky diode, light emitting diode, tunnel diode, photo diode; their working characteristics and applications
 - 1.7 Zener diode and its characteristics
 - 1.8 Use of zener diode for voltage stabilization
2. Bi-polar Transistors (08 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 (12 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
 - 3.3 Concept of h-parameters of a transistor
 - 3.4 Use of data book to know the parameters of a given transistor
4. Single-Stage Transistor Amplifiers (12 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 Concept of DC and AC load line
 - 4.4 Voltage gain of single stage transistor amplifier using characteristics of the device
 - 4.5 Concept of input and output impedance
 - 4.6 AC equivalent circuit of single stage transistor amplifiers
 - 4.7 Calculation of voltage gain using AC equivalent circuit
 - 4.8 Frequency response of a single stage transistor amplifier
5. Multi-Stage Transistor Amplifiers (10 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 Loading effect in multistage amplifiers
 - 5.5 Elementary idea about direct coupled amplifier, its limitations and applications
 - 5.6 Transformer coupled amplifiers, its frequency response. Effect of coefficient of coupling on frequency response. Applications of transformer coupled amplifiers
6. Field Effect Transistor (FET) (08 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

LIST OF PRACTICALS

1.
 - a) Identification and testing of electronic components such as resistor, inductor, capacitor, diode, transistor and different types of switches used in Electronic circuits
 - b) Measurement of resistances using multimeter and their comparison with colour code values
2. To plot V-I characteristics of a Semiconductor diode and to calculate its static and dynamic resistance
3.
 - a) To plot V-I characteristics of a zenor diode and finding its reverse breakdown voltage
 - b) Fabrication of a zenor diode voltage stabilizer circuit using PCB
4. Observation of input and output wave shapes of a half-wave rectifier and verification of relationship between dc output and ac input voltage
5. Observation of input and output wave shapes of a full wave rectifier and verification of relationship between dc and ac input voltage
6. Observation of input and output wave shapes of a full wave rectifier with (i) shunt capacitor (ii) series inductor (iii) Π filter circuits
7. Plotting input and output characteristics of a transistor in CB configuration
8. Plotting input and output characteristics of a transistor in CE configuration
9. Measurement of operating point in case of (i) fixed biased circuit (ii) potential divider biasing circuit and to observe the effect of temperature variation on the operating point.

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 etc must be told to students.

RECOMMENDED BOOKS

1. Basic Electronics and Linear Circuit by NN Bhargava, Kulshreshtha 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. Electronics Devices and Circuits by Millman and Halkias; McGraw Hill.
7. Principles of Electronics by Albert Paul Malvino; Tata McGraw Hill Education Pvt Ltd, New Delhi.
8. Basic Electronics – Problems and Solutions by Albert Malvino and David J. Bates; Tata McGraw Hill Education Pvt Ltd, New Delhi.
9. Basic Electronics by J.S. Katre, Sandeep Bajaj, Tech. Max. Publications, Pune.
10. Analog Electronics by DR Arora, Ishan Publications, Ambala City.
11. Analog Electronics by JC Karhara, King India Publication, New Delhi
12. Electrical Devices and Circuits by Rama Reddy, Narosa Pulishing House Pvt. Ltd., New Delhi
13. Electronic Devices and Circuits by Dharma Raj Cheruku and Battula Tirumala Krishna: Pearson Education (Singapore) Pvt Ltd., Indian Branch, 482 F.I.E Patparganj, Delhi- 92
14. Basic Electronics by JB Gupta, SK Kataria and Sons, New Delhi
15. Grob's Basic Electronics- A text Lab Manual (Special Indian Edition) by Schultz, Tata McGraw Hill Education Pvt Ltd, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allocation (%)
1	14	23
2	08	12
3	12	18
4	12	18
5	10	15
6	08	14
Total	64	100

3.3 ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS

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RATIONALE

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

LEARNING OUTCOME

After undergoing the subject, students will be able to:

- Identify electrical and electronics engineering material
- Select proper conducting material for a particular application
- Select a proper insulating material for a particular application
- Select a proper semiconductor material for a particular application
- Make use of alternate material if proper material is not available
- Procure various electrical and electronics engineering material available in the market
- Select proper magnetic material for a particular application
- Make use of engineering material used for fabrication of particular electrical machine
- Select gaseous material for particular application

DETAILED CONTENTS

1. Classification: (03 hrs)

Classification of materials into conducting, semi conducting and insulating materials through a brief reference to their atomic structure and energy bands

2. Conducting Materials (12 hrs)

2.1 Introduction

2.2 Resistance and factors affecting it such as alloying and temperature etc

2.3 Classification of conducting material as low resistivity and high resistivity materials, low resistance materials

2.3.1 Copper:

General properties as conductor: Resistivity, temperature coefficient, density, mechanical properties of hard-drawn and

annealed copper, corrosion, contact resistance. Application in the field of electrical engineering.

2.3.2 Aluminium:

General properties as conductor: resistivity, temperature coefficient, density, mechanical properties of hard and annealed aluminium, solderability, contact resistance. Applications in the field of electrical engineering.

2.3.3 Steel:

Mechanical properties of steel, applications in the field of electrical engineering.

2.3.4 Introduction to bundle conductors and its applications.

2.3.5 Low resistivity copper alloys: Brass, Bronze (cadmium and Beryllium), their practical applications with reasons for the same

2.4 Applications of special metals e.g. Silver, Gold, Platinum etc.

2.5 High resistivity materials and their applications e.g., manganin, constantan, Nichrome, mercury, platinum, carbon and tungsten

2.6 Superconductors and their applications

3. Review of Semi-conducting Materials (02 hrs)

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

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

4.1 Electrical Properties:

Volume resistivity, surface resistance, dielectric loss, dielectric strength (breakdown voltage) dielectric constant

4.2 Physical Properties:

Hygroscopicity, tensile and compressive strength, abrasive resistance, brittleness

4.3 Thermal Properties:

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

4.4 Chemical Properties:

Solubility, chemical resistance, weatherability

4.5 Mechanical properties, mechanical structure, tensile structure

5. Insulating Materials and their applications: (16 hrs)
- 5.1 Plastics
- 5.1.1 Definition and classification
- 5.1.2 Thermosetting materials:
Phenol-formaldehyde resins (i.e. Bakelite) amino resins (urea formaldehyde and Melamine-formaldehyde), epoxy resins - their important properties and applications
- 5.1.3 Thermo-plastic materials:
Polyvinyl chloride (PVC), polyethelene, silicones, their important properties and applications
- 5.2 Natural insulating materials, properties and their applications
- Mica and Mica products
 - Asbestos and asbestos products
 - Ceramic materials (porcelain and steatite)
 - Glass and glass products
 - Cotton
 - Silk
 - Jute
 - Paper (dry and impregnated)
 - Rubber, Bitumen
 - Mineral and insulating oil for transformers switchgear capacitors, high voltage insulated cables, insulating varnishes for coating and impregnation
 - Enamels for winding wires
 - Glass fibre sleeves
- 5.3 Gaseous materials; Air, Hydrogen, Nitrogen, SF their properties and applications
6. Magnetic Materials: (11 hrs)
- 6.1 Introduction - ferromagnetic materials, permeability, B-H curve, magnetic saturation, hysteresis loop including coercive force and residual magnetism, concept of eddy current and hysteresis loss, curie temperature, magnetostriction effect.
- 6.2 Soft Magnetic Materials:
- 6.2.1 Alloyed steels with silicon: High silicon, alloy steel for transformers, low silicon alloy steel for electric rotating machines
- 6.2.2 Cold rolled grain oriented steels for transformer, Non-oriented steels for rotating machine
- 6.2.3 Nickel-iron alloys
- 6.2.4 Soft Ferrites

- 6.3 Hard magnetic materials
Tungsten steel, chrome steel, hard ferrites and cobalt steel, their applications
7. Special Materials (04 hrs)
Thermocouple, bimetals, leads soldering and fuses material and their applications
8. Introduction of various engineering materials necessary for fabrication of electrical machines such as motors, generators, transformers etc (04 hrs)

INSTRUCTIONAL STRATEGY

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

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No	Time Allotted (Hrs)	Marks Allocation (%)
1.	03	05
2.	12	20
3.	02	05
4.	12	20
5.	16	25
6.	11	15
7.	04	05
8.	04	05
Total	64	100

3.4 GENERIC SKILLS AND ENTREPRENEURSHIP DEVELOPMENT

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RATIONALE

Generic Skills and Entrepreneurship Development is one of the courses from “Human Science” subject area. Generic skills have emerged as an important component of employability skills, which enable an individual to become and remain employable over lifetime and to lead happy and prosperous life. Entrepreneurship development aims at developing conceptual understanding for setting-up one’s own business venture/enterprise. This aspect of Human Resource Development has become equally important in the era, when wage employment prospects have become meager. Both the subject areas are supplementary to each other and soft skills are required to be developed in diploma pass-outs for enhancing their employability and self confidence.

LEARNING OUTCOME

After undergoing the subject, the student will be able to:

- Explain the importance of generic skills
- Demonstrate self development
- Manage himself/herself physically, intellectually and psychologically
- Work effectively as a team member
- Manage tasks effectively
- Apply knowledge to solve problems
- Develop an entrepreneurial mindset.
- Identify entrepreneurial support system for new ventures and small businesses.
- Recognize a business opportunity.
- Prepare project report
- **Demonstrate how to launch an individual's entrepreneurial career**

DETAILED CONTENTS

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|----|---|----------|
| 1. | Introduction to Generic Skills | (04 hrs) |
| | 1.1 Importance of Generic Skill Development | |
| | 1.2 Global and Local Scenario of Generic Skill Development | |
| | 1.3 Life Long Learning and associated importance of Generic Skill Development | |

2. Managing Self (08 hrs)
- 2.1 Knowing Self for Self Development
- Self-concept, personality, traits, multiple intelligence such as language intelligence, numerical intelligence, psychological intelligence etc.
- 2.2 Managing Self - Physical
- Personal grooming, Health, Hygiene, Time Management
- 2.3 Managing Self – Intellectual development
- Information Search: Sources of information
 - Writing Skills – Official & business correspondence, Job application covering letter and resume
 - Speaking Skills – Mock interview, Preparing for meeting, Group discussion
- 2.4 Managing Self – Psychological
- Stress, Emotions, Anxiety-concepts and significance
 - Techniques to manage stress
3. Managing in Team (06 hrs)
- 3.1 Team - definition, team dynamics
- 3.2 Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background
4. Task Management (03 hrs)
- 4.1 Task Initiation, planning, execution, close out
- 4.2 Exercises/case studies on task planning towards development of skills for task management
5. Problem Solving (05 hrs)
- 5.1 Prerequisites of problem solving- meaningful learning, ability to apply knowledge in problem solving
- 5.2 Different approaches for problem solving.
- 5.3 Steps followed in problem solving.
- 5.4 Exercises/case studies on problem solving.
6. Entrepreneurship (22 hrs)
- 6.1 Introduction
- Concept/Meaning and its need
 - Qualities of an entrepreneur
 - Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries

Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level.

- 6.2 Market Survey and Opportunity Identification (Business Planning)
 - How to start a small scale industry
 - Procedures for registration of small-scale industry
 - Assessment of demand and supply in potential areas of growth.
 - Understanding business opportunity
 - Considerations in product selection
- 6.3 Project Report Preparation
 - Preliminary Project Report
 - Techno-Economic Feasibility Report
 - Preparation of Detailed Project Report

INSTRUCTIONAL STRATEGY

This subject will require a blend of different teaching and learning methods beginning with lecture method. Some of the topics may be taught using question answer, assignment, case studies or seminar. In addition, expert lectures may be arranged from within the institution or from management organizations. Conceptual understanding of Entrepreneurship, inputs by teachers and outside experts will expose the students so as to facilitate in starting ones own business venture/enterprise. The teacher will discuss success stories and case studies with students, which in turn, will develop managerial qualities in the students. There may be guest lectures by successful diploma holding entrepreneurs and field visits also. The students may also be provided relevant text material and handouts.

RECOMMENDED BOOKS

1. Soft Skills for Interpersonal Communication by S. Balasubramanian Published by Orient Black Swan, New Delhi.
2. Generic skill Development Manual, MSBTE, Mumbai.
3. Lifelong learning, Policy Brief (www.oecd.org)
4. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
5. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
6. Handbook of Small Scale Industry by PM Bhandari

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	04	05
2.	08	15
3.	06	10
4.	03	10
5.	05	10
6.	22	50
Total	48	100

3.5 ELECTRICAL ENGINEERING DESIGN AND DRAWING

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RATIONALE

A student of electrical engineering is supposed to have ability to :

- i) Read, understand and interpret engineering drawings
- ii) Communicate and co-relate through sketches and drawings
- iii) Prepare working drawings of panels, transmission and distribution

The contents of this subject has been designed to develop requisite knowledge and skills of electrical drawings in the students of diploma in electrical engineering.

LEARNING OUTCOME

After undergoing the subject, students will be able to:

- Recognise various electrical devices and their symbols
- Recognise various electrical devices placed on the panels/distribution boards and to design the panels
- Recognise the internal details of various electrical machines and devices
- Read schematic and wiring diagrams of electrical devices
- Read and interpret electrical installation plan
- Communicate about circuits and devices through sketches and drawings

DETAILED CONTENTS (To make 16 Sheets)

1. Symbols and Signs Conventions **(3 Sheets)**
 Various Electrical Symbols used in Domestic and Industrial Installation and Power System as per BIS Code.
2. Panels/Distribution Boards **3 Sheets)**
 Design and Drawing of panels/Distribution board using MCBS, ELCB main switches and change over switches for domestic installation, industrial and commercial installation.
3. Orthographic projections of Simple Electrical Parts **(4 Sheets)**
 - Bus bar post/ Kit Kat

- Pin type and shackle type insulator (Pin Type 11kV/66kV)
 - Bobbins of a small transformer / choke
 - Stay insulators/Suspension type insulators
4. Orthographic Projection of Machine Parts **(4 Sheets)**
- Rotor of a squirrel cage induction motor
 - Motor body (induction motor) as per IS Specifications (using outside dimensions)
 - Slip rings of 3-phase induction Motor.
 - Stator of 3 phase Induction motor (Sectional View)
5. Contactor Control Circuits: Schematic and wiring diagram **(6 Sheets)**
- DOL Starter of 3-phase induction Motor.
 - Forwarding/reversing of 3-phase induction motor
 - Limit switch control of a 3-phase induction motor
 - Sequence operation of two motors using T.D.R.
 - Two speed motor control.
 - Automatic star-delta starter for 3-phase induction motor.

Note: At least 2 drawings are to be prepared using AutoCAD

INSTRUCTIONAL STRATEGY

Teacher should identify/prepare more exercises on the pattern shown above. The teacher should make the students confident in making drawing and layouts of electrical wiring installations and doing estimation and costing. This capability will lead the students to become a successful entrepreneur. Take the students to field/laboratory and show the material and equipment.

RECOMMENDED BOOKS

1. Electrical Engineering Design and Drawings by Surjeet Singh, Dhanpat Rai and Co, New Delhi
2. Electrical Engineering Design and Drawings by SK Bhattacharya, SK Kataria and Sons, New Delhi
3. Electrical Engineering Design and Drawings by Ubhi & Marwaha, IPH, New Delhi
4. Electrical Design and Drawing by SK Sahdev, Uneek Publications, Jalandhar
5. Electrical Engineering Drawing by Surjit Singh, SK Kataria and Sons, New Delhi

3.6 ELECTRICAL WORKSHOP PRACTICE - I

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RATIONALE

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

LEARNING OUTCOME

After undergoing the subject, students will be able to:

- Illustrate types of tools/equipment
- Describe domestic and industrial applications of electric circuits
- Detect and rectify faults in circuits
- Identify electrical hazards and its safety measures
- Assemble distribution and extension boards
- Construct alarm and indicating circuits using relays, bells, push buttons
- Install electrical wiring and test it using meggar

DETAILED CONTENTS

1. Study of electrical safety measures as mentioned in the Indian Electricity Rules and shock treatment including first aid
2. Wire jointing
 - 2.1 Straight married joint
 - 2.2 Joint
 - 2.3 Western union joint
 - 2.4 Britania joint
 - 2.5 Twist sleeve joint
 - 2.6 Bolted type joint
3. Types of wiring and to make different light control circuits in the following types of wiring:
 - 3.1 Casing and capping (PVC) wiring.
 - 3.2 Conduit wiring (surface/concealed), Filling and crimping of thimbles

4. Wiring of main distribution board with four outgoing circuits for light and fan loads including main switch and fuses (only internal connection) Types of wiring and to make different light control circuits in the following types of wiring:
 - 4.1 Casing and Capping (PVC) wiring
 - 4.2 Conduit wiring (surface/concealed)
5. Construction/assembly of Distribution Board and Extension Board
 - 5.1 Construction of an extension board with two 5A sockets and one 15A Socket controlled by their respective switches, a fuse and indicator with series test lamp provision.
 - 5.2 Assembly of distribution board panel using MCB, main switch, change over switch and ELCB/RCCB.
 - 5.3 Wiring of main distribution board with four outgoing circuits for light and fan loads including main switch and fuses (only internal connection)
6. Simple light and Alarm Circuits (any four)
 - 6.1 One lamp controlled by two switches (staircase circuit)
 - 6.2 Two lamps controlled by three switches (double staircase circuit)
 - 6.3 Two ordinary bells (for day and night) used at a distant residence
 - 6.4 Bell response circuit using one bell and one relay
 - 6.5 Bell response circuit of an office (for three rooms)
 - 6.6 Traffic light control system for two roads crossing
 - 6.7 Wiring of a switch board containing at least two switches, one fan regulator and one 5/15A socket controlled by their respective switches using piano type switches and matching socket
7. Wiring of a series test lamp board and to use it for finding out simple faults
8. Testing of domestic wiring installation using meggar
9. Fault finding and repair of a tube light circuit
10. Wiring and testing of alarm and indicating circuits using relay, push buttons and bells (simple single phase circuits)
11. Assembly of distribution board/ panel using MCB, main switch, changeover switch and ELCB etc.

ENERGY CONSERVATION AWARENESS CAMP

A diploma holder must have knowledge of various tips of energy conservation. Energy conservation has attained priority as it is regarded as additional energy resource. Energy saved is energy produced. This camp covers the basic concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in household appliances and star rating. Lectures will be delivered on following broad topics. There will be no exam for this camp.

1. Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy
2. Introduction to energy management, energy conservation, energy efficiency and its need
3. Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance
4. Standards and Labeling
 - Concept of star rating and its importance
 - Types of product available for star rating
5. Salient Features of Punjab Energy Conservation Building Code (ECBC)
6. General Energy Saving Tips in:
 - Lighting System
 - Room Air Conditioners
 - Refrigerators
 - Water Heater
 - Computers
 - Fans, Heaters, Blowers and Washing Machines
 - Colour Television
 - Water Pumps
 - Kitchens
 - Transport

DRUGS USE AND ABUSE AWARENESS CAMP

Unit 1 Drugs Use and Abuse in Society

- a. Concept and overview
- b. Extent of the problem
- c. Drug use as a social problem
- d. Causes of Drug Use: Biological, Socio-cultural, psychological

Unit 2 Types of Dugs and identification of Abuse

- a. Familiar drugs: Tabacco, Caffeine, over the counter drugs
- b. Restricted Drugs: Opiates, Hallucinogens, Marijuana
- c. Reformance enhancing the drugs
- d. Uppers and Downers: Stimulants and Depressants

Unit 3 Impact of drug Abuse

- a. Individual level biological and psychological
- b. Family social, National

Unit 4 Management and prevention of Drug Abuse

- a. Medical and psychological
- b. Role of family School , Media and Legislation