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 and fundamental concepts of electricity, magnetism and various principles related to it.

LEARNING OUTCOMES

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
- Connect measuring instruments in AC circuits

DETAILED CONTENTS

1. Introduction (04 Periods)

   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 Periods)

   2.1 Ohm's law, resistances in series and parallel

   2.2 Kirchhoff's laws and their applications in solving electrical network problems

2.3 Network theorems such as Thevenin's theorem, superposition theorem Maximum power transfer theorem and Norton's theorem

2.4 Star-delta transformation

3. Batteries (06 Periods)

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 Periods)

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 Periods)

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 Periods)

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 phase 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 (12 Periods)

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

8. Poly-Phase Systems (04 periods)

8.1. Advantages of 3Ø over 1- Ø system

8.2. Star & delta connections (derive relationship b/w phase Voltage(Vph) Line Voltage (V_L) and Phase Currrent (Iph) Line Current ($I_{L)}$ in star delta connections

8.3. 3-phase balanced and unbalanced circuits

8.4. Power in 3-phase circuits

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

   a) Measure the resistance of a cold lamp filament with the help of calculations.

   b) 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 $R_t = R_1+R_2+\ldots$ Rn where R_1, R_2 Rn etc. are resistances connected in series

   (b) To verify $\frac{1}{Rt} = \frac{1}{R_1} + \frac{1}{R_2} + \text{-------} + \frac{1}{R_m}$

   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 needs 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 giver them an opportunity in mastering the basics in solving related problems

MEANS OF ASSESSMENT

* Assignments and quiz/class tests
* Mid-term and end-term written tests
* Laboratory and practical work
* Viva-Voce

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 Engineering by DR Arora, Ishan Publications, Ambala
4. Electrical Technology by JB Gupta, SK Kataria and Sons, New Delhi
5. Electrical Technology by BL Theraja, S Chand & Co., New Delhi
6. Handbook of Electrical Engineering by SL Bhatia, Khanna Publishers, New.Delhi
7. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allocation (%)
1.	04	06
2.	11	17
3.	06	09
4.	08	12
5.	09	14
6.	10	17
7.	12	20
8	04	05
Total	**64**	**100**

3.2 COMPUTER APPLICATIONS IN ELECTRICAL INSTALLATIONS

L	T	P
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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, this course offers exposure to various engineering applications of computers in electrical engineering. The practical exercises and demonstration of application software in the field of electrical engineering during the course of study will help the students in getting the employment.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Use MATLAB and LABVIEW for solving problems and designing electrical systems
- Explain the utility of software – LABVIEW, EPLAN software

DETAILED CONTENTS

PRACTICAL EXERCISES:

1. MATLAB and SCILAB

   - Introduction to MATLAB, MATLAB Programming – input/output, types of graphs, functions, loops, structures, MATLAB Simulink.

2. LABVIEW

   Graphical Programming using LabVIEW including creation of VIs, subVIs, structures, arrays, clusters, charts and graphs, strings, File I/Os. Practice on NI ELVIS and other DAQ hardware

3. EPAN

   - Utility of EPLAN software

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making

- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce
- Software installation, operation, development and viva-voce

RECOMMENDED BOOKS

1. MATLAB and SIMULINK for Engineers, Agam Kumar Tyagi, Oxford, 2011.
2. MATLAB 7 by RudraPratap, Oxford University Press.
3. MATLAB Programming for Engineers by Stephen J. Chapman
4. MATLAB and Its Applications In Engineering by R.K. Bansal, A.K. Goel
5. Virtual Instrumentation Using LabVIEWKindle Edition by Jovitha Jerome, PHI, 2010
6. Introduction to Multisim for Electric Circuits, James W. Nilsson and Susan Riedel, 2014.
7. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in
http://nptel.ac.in
www.nittrchd.ac.in>hctel

3.3 ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS

L	T	P
4	-	-

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 materials/component
- Select proper conducting material for a particular application
- Select a proper insulating material for a particular application
- Suggest an 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 Periods)

   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 Periods)

   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 Periods)

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

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

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 Periods)

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 Periods)

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 Periods)

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 Periods)

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.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making

- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce

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
9. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No	Time Allotted (Periods)	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 ELECTRONICS - II

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RATIONALE

The purpose of the introduction of electronics in the electrical engineering diploma course has been already explained in the rationale of the subject Basic Electronics in this course topic like Amplifiers, Oscillators and Wave Shape Circuits have been dealt with.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Differentiate the voltage and power amplifier
- Analyze amplifier and enhance the gain of amplifier
- Design a wave shaping circuit
- Realize regulated power supply circuit using voltage regulator IC
- Use Op-Amp as amplifiers, adder, comparator, integrator and differentiator

DETAILED CONTENTS

1. Transistor Audio Power Amplifier (09 periods)

    1.1 Difference between voltage and power amplifier

    1.2 Important terms in Power Amplifier, collector efficiency, distortion and dissipation capability

    1.3 Classification of power amplifier class A, B and C

    1.4 Class A single-ended power amplifier, its working and collector efficiency

    1.5 Impedance matching in a power amplifier using transformer

    1.6 Heat sinks in power amplifiers

    1.7 Push-pull amplifier: circuit details, working and advantages (no mathematical derivations)

    1.8 Principles of the working of complementary symmetry push-pull amplifier

2. Tuned Voltage Amplifier (06 periods)

    2.1 Introduction

    2.2 Series and parallel resonance (No mathematical derivation)

    2.3 Single and double tuned voltage amplifiers

2.4 Frequency response of tuned voltage amplifiers

2.5 Applications of tuned voltage amplifiers

3. Feedback in Amplifiers (06 periods)

3.1 Feedback and its importance, positive and negative feedback and their need

3.2 Voltage gain of an amplifier with negative feedback $A = \frac{A}{1+\beta A}$

3.3 Effect of negative feedback on voltage gain, stability, distortion, band width, output and input impedance of an amplifier (No mathematical derivation)

3.4 Typical feedback circuits

3.5 Effect of removing the emitter by-pass capacitor on a CE transistor amplifier

3.6 Emitter follower and its applications

4. Sinusoidal Oscillators (06 periods)

4.1. Sinusoidal Oscillators – positive feedback in amplifiers

4.2. Difference between an oscillator and an alternator

4.3. Essentials of an oscillator

4.4. Circuit details and working of LC oscillators viz. Tuned Collector, Hartley and Colpitt's oscillators

4.5. R-C oscillator circuits, phase shift and Wein bridge oscillator circuits

4.6. Introduction to piezoelectric crystal and crystal oscillator circuit

5. Wave-Shaping and Switching Circuits (11 periods)

5.1 Concept of Wave-shaping

5.2 Wave-shaping circuits

a. R-C differentiating and integrating circuits

b. Diode clipping circuits

c. Diode clamping circuits

d. Applications of wave-shaping circuits

5.3 Transistor as a switch (explanation using CE transistor characteristics)

5.4 Collector coupled astable, monostable, bistable multivibrator circuits (explanation using wave shapes). Brief mention of uses of multivibrators

5.5 Working and applications of transistor inverter circuit using power transistors

6. Power supplies: (04 periods)

Working Principles of different types of power supplies viz. CVTs, IC voltage regulator (78 XX,79XX)

7. Operational Amplifier (06 periods)

7.1. The basic operational amplifier. The differential amplifier. The emitter coupled differential amplifier. Offset even voltages and currents

7.2. Basic operational amplifier applications, integrator and differentiator, summer, subtractor

7.3. Familiarization with specifications and pin configuration of IC 741

7.4. Block diagram and operation of 555 IC timer

LIST OF PRACTICALS

1. To 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
2. To measure (a) optimum load (b) output power (c) signal handling capacity of a push-pull amplifier
3. To measure (a) voltage gain (b) input and output impedance for an emitter follower circuit

   To measure frequency generation in (a) Hartley (b) R-C Phase Shift oscillator
4. To observe the differentiated and integrated square wave on a CRO for different values of R-C time constant
5. Clipping of both portion of sine-wave using:
   a) diode and dc source

b) /*zener diodes

Clamping a sine-wave to:

a) Negative dc voltage

b) Positive dc voltage

6. To generate square-wave using an astable multivibrator and to observe the wave form on a CRO and verify the result using p-spice software
7. To observe triggering and working of a bistable multivibrator circuit and observe its output wave form on a CRO
8. To use the op-Amp (IC 741) as inverting one and non-inverting amplifiers, adder, comparator, integrator and differentiator and verify the result using p-spice software
9. To study the pin configuration and working of IC 555 and its use as monostable and astable multivibrator

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests

- Laboratory and practical work
- Model prototype making
- Viva—voce

RECOMMENDED BOOKS

1. A text book of Basic Electronics and Linear Circuits by NN Bhargava and others, Tata McGraw Hill, New Delhi

2. Electronics Principles by SK Sahdev, Dhanpat Rai and Co., New Delhi

3. Electronics Principles by Albert Paul Malina, Tata McGraw Hill, New Delhi

4. Operational Amplifiers and Linear Circuits by Rama Kant and A. Gayakwad, Prentice Hall of India, New Delhi

5. Electronic Devices Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi

6. Electronic Devices and Circuits by Millman and Halkias, McGraw Hill, New Delhi

7. Analog Electronics – II by DR Arora, Ishan Publication, Ambala

8. Electronic Devices and Circuits by JC Karhara, King India Publication, New Delh

9. Electronic Devices and Circuits-I, Eagle Prakashan, Jalandhar

10. Electronic Devices Circuits by JB Gupta, SK Kataria and Sons, New Delhi

11. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1	Transistor Audio Power Amplifier	09	20
2	Tuned Voltage Amplifier	06	12
3	Feedback in Amplifiers	06	12
4	Sinusoidal Oscillators	06	12
5	Wave-Shaping and Switching Circuits	11	24
6	Power Supplies	04	08
7	Operational Amplifier	06	12
	Total	**48**	**100**

3.5 ELECTRICAL ENGINEERING DESIGN AND DRAWING I

L	T	P
-	-	6

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 OUTCOMES

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 (2 Sheets)

   Various Electrical Symbols used in Domestic and Industrial Installation and Power System (Generation, Transmission and Distribution including Sub-stations) as per BIS Code.

2. Wiring Diagram

   2.1. Wiring diagram of light, fan, bell and alarm circuits. (6 Sheets)
   2.2. Staircase and godown wiring

3. Panels/Distribution Boards (6 Sheets)

   Design and Drawing of panels/Distribution board using MCB, ELCB main switches and change over switches for domestic installation, industrial and commercial installation.

4. Orthographic projections of Simple Electrical Parts (8 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
- 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.. Prepare wiring diagram and block diagrams for circuits/systems using any Engineering Graphic package (preferably CAD) (4 Sheets)

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.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Sketching
- Design and Drawing
- Workshop Job
- Model prototype making

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

6. Electrical Design and Drawing by Surjit Singh, North Publication, Jalandhar.

7. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

3. 6 ELECTRICAL WORKSHOP PRACTICE - I

L	T	P
-	-	6

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 I5A 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

10. Fault finding and repair of a tube light circuit

11. Wiring and testing of alarm and indicating circuits using relay, push buttons and bells (simple single phase circuits)

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

INSTRUCTIONAL STRATEGY

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce

3.7 ESTIMATING AND COSTING IN ELECTRICAL ENGINEERING

L	T	P
3	-	3

RATIONALE

A diploma holder in electrical engineering should be familiar to Indian Standards and relevant Electricity Rules. Preparation of good estimates is a professional's job, which requires knowledge of materials and methods to deal with economics. The contents of this subject have been designed keeping in view developing requisite knowledge and skills of estimation and costing in students of diploma in electrical engineering.

LEARNING OUTCOME

After undergoing the subject, student will be able to:

- Determine various types of wiring systems and how they are being used
- Practice and execute any type of wiring
- Estimate and determine the cost of wiring installation
- Estimate the material required for HT and LT lines
- Prepare a tender document for a particular job
- Estimate the material required for pole-mounted sub-stations

DETAILED CONTENTS

1. Introduction (06 Periods)

   Purpose of estimating and costing, proforma for making estimates, preparation of materials schedule, costing, price list, preparation of tender document (with 2-3 exercises), net price list, market survey, overhead charges, labour charges, electrical point method and fixed percentage method, contingency, profit, purchase system, enquiries, comparative statements, orders for supply, payment of bills.

2. Types of Wiring (06 Periods)

   Cleat, batten, casing capping and conduit wiring, comparison of different wiring systems, selection and design of wiring schemes for particular situation (domestic and Industrial). Selection of wires and cables, wiring accessories and use of protective devices i.e. MCB, ELCB etc. Use of wire-gauge and tables (to be prepared/arranged)

3. Estimating and Costing: (24 Periods)

3.1 Domestic installations; standard practice as per IS and IE rules. Planning of circuits, sub-circuits and position of different accessories, electrical layout, preparing estimates including cost as per schedule rate pattern and actual market rate (single storey and multi-storey buildings having similar electrical load)

3.2 Industrial installations; relevant IE rules and IS standard practices, planning, designing and estimation of installation for single phase motors of different ratings, electrical circuit diagram, starters, preparation of list of materials, estimating and costing exercises on workshop with singe-phase, 3-phase motor load and the light load (3-phase supply system)

3.3 Service line connections estimate for domestic and industrial loads (over-head and under ground connections) from pole to energy meter.

4. Estimating Materials Required (16 Periods)

4.1 Transmission and distribution lines (overhead and underground) planning and designing of lines with different fixtures, earthing etc. based on unit cost calculations

4.2 Substation: Types of substations, substation schemes and components, estimate of 11/0.4 kV pole mounted substation up to 200 kVA rating, earthing of substations, Key Diagram of 66 kV/11 kV Substation.

4.3 Single line diagram, layout sketching of outdoor, indoor 11kV sub-station or 33kV sub-station

5. Preparation of Tender Documents (12 Periods)

At least 2-3 exercises, tender – constituents finalization, specimen tender

PRACTICALS

1. Framing of Tender and reply to tender to get job/project
2. Identification of wiring for different applications
3 Prepare an estimate for a Two room residential building as per given plan
4 Prepare an estimate for service connection for residential building having connected load ---- kW.
5 Visit a nearby substation and list the components with diagram

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 leading to preparation of small tender document.. This capability will lead the students to become a successful entrepreneur. Take the students to field/laboratory and show the material and equipment.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Drawing
- Viva—voce

RECOMMENDED BOOKS

1. Electrical Installation, Estimating and Costing by JB Gupta, SK Kataria and Sons, New Delhi
2. Estimating and Costing by SK Bhattacharya, Tata McGraw Hill, New Delhi
3. Estimating and Costing by Surjeet Singh, Dhanpat Rai & Co., New Delhi
4. Estimating and Costing by Praveen Kumar; North Publication, Jalandhar
5. Estimating and Costing by SL Uppal, Khanna Publishers, New Delhi
6. Electrical Estimating and Costing by N Alagappan and B Ekambaram, TMH, New Delhi
7. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allocation (%)
1	04	10
2	04	10
3	22	45
4	12	20
5	06	15
Total	**48**	**100**

3.8 SOFT SKILLS – I

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RATIONALE

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. The diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject is to prepare students for employability in job market.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Identify components of effective verbal communication
- Prepare a report
- Learn the techniques of enhancing memory
- Set goals for overall personality development
- Understand the concept of quality and its implementation in an organisation.

DETAILED CONTENTS

- Soft Skills - Concept and Importance
- Communication Skills- Improving verbal communication
- Report Writing
- Method to enhance memory and concentration
- Component of overall personality- Dressing sense/etiquettes/body language etc.

In addition, the students must participate in the following activities to be organized in the institute.

- Sports
- NCC/NSS
- Camp – Blood donation
- Cultural Event

Note : Extension Lectures by experts may be organized. There will be no examination for this subject.