**1.4 PRINCIPLES OF ELECTRICAL ENGINEERING**

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**RATIONALE**

This is a basic technology subject. This subject will help the students to develop certain

technology related skill. This subject includes DC, magnetism, electromagnetism etc. This is one

of the important core engineering subjects for electrical engineers. The main objective of this

subject is to enhance the basic knowledge and skill. Learning of this course will also help the

students to understand the basics of electrical engineering i. e. basic concept in electrical &

magnetic circuits.

**COURSE OUTCOMES**

At the end of this subject, the student will be able to:

CO1: Acquire knowledge and understand the elements of electricity and DC circuits.

CO2: Remember the circuit elements and the laws governing the electrical circuits.

CO3: Comprehend the concept of Electrostatics and Magentostatics and apply the knowledge.

CO4: Acquire the concept of Electromagnetic Induction and its uses in engineering field.

CO5: Explain the various batteries as storage devices and be aware of safe disposal of batteries.

**DETAILED CONTENTS**

**UNIT I**

**Electrical Fundamentals**

1.1 Nature of Electricity, Charge, free electrons, Electric potential and potential

difference, Electric current, Electrical Energy, Electrical power and their unit.

1.2 Resistance: Definition, Unit, Laws of resistance, conductivity and resistivity, Effect of

temperature on resistance, Temperature coefficient of resistance, Types of resistance

& their applications, Color coding of resistance.

1.3 Rating and wattages of Electrical appliances, heating effect of Electrical current.

1.4 Introduction to Capacitors, capacitance, Variable capacitor, Factors affecting

capacitance of a capacitor.

1.5 Capacitance of parallel plate capacitor

1.6 Grouping of capacitors: capacitors in series, parallel, series-parallel.

1.7 Energy stored in capacitor, Charging and discharging of a capacitor.

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**UNIT II**

**DC Circuits**

2.1 Ohm's law with practical implementation.

2.2 Definition of DC circuit, types of DC circuits: series circuit, parallel circuit, seriesparallel

circuit.

2.3 Concept of voltage source & current source, connections and their conversions.

2.3 Wheatstone Bridge.

2.4 Kirchhoff’s Laws-KVL and KCL.

2.5 Star – Delta connections and their conversion.

**UNIT III**

**Electrostatics & Magnetostatics**

3.1 Concepts of Electrostatics, Coulomb’s law.

3.2 Concept of magnetism, Magnetic field, Magnetic lines of force

3.3 Definition of Electromagnetism, magnetic effect of electric current, direction of

magnetic field and current: right hand rule, right hand cork screw rule.

3.4 Magnetic field due to circular coil, solenoid,

3.5 Current carrying conductors in a magnetic field and methods to find its direction,

applications.

3.6 Force between two parallel current carrying conductors. Analogy between electric

and magnetic circuit. Definition of Magnetic circuit, terms related to magnetic

circuits: magneto-motive force (MMF), flux, magnetic flux density, reluctance,

permeability, field intensity, relation between magnetic flux density, permeability,

field intensity.

**UNIT IV**

**Electro-Magnetic Induction**

4.1 Determination of Ampere Turns, Series & parallel magnetic circuits, Concept of

magnetic leakage, useful flux & Air Gap.

4.2 Magnetic curve (B-H curve) - cause of Hysteresis, Hysteresis loss, significance of

Hysteresis loss, magnetic hysteresis loop for hard and soft magnetic materials.

4.3 Faraday’s laws of electro-magnetic induction.

4.4 Direction of Induced emf and current: Lenz’s law, Fleming’s right Hand rule

4.5 E.M.F induced in a conductor: Dynamically induced emf, Statically induced emf: Selfinduced

emf and Mutual induced emf, Expression for self-inductance, mutual

inductance.

4.6 Energy stored in an Inductor, Eddy currents, Eddy current losses.

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**UNIT V**

**Batteries**

5.1 Electrolysis, Faradays law of electrolysis, important terms related to electrolysis,

electroplating.

5.2 Concept of Cell: definition, emf of cell, internal resistance of cell, terminal potential of

cell, types of cell (primary and secondary cell), grouping of cell (series grouping, parallel

grouping, series-parallel grouping).

5.3 Concept of Battery: Definition, types of battery like Lead-Acid, Nickel-Cadmium,

Lithium ion batteries with their Construction, working principle and applications.

5.4 Charging methods of storage battery and charging indications.

5.5 Characteristics of battery: voltage, capacity, efficiency

5.6 Care and maintenance of battery

5.7 Introduction to maintenance free batteries.

5.8 Disposal of batteries

**PRACTICAL EXERCISES**

1. Familiarization of basic components/equipment like ammeter, voltmeter, watt meter,

resistance, capacitor, inductor, energy meter, power factor meter, CRO, multi-meter etc

and their operation, uses .

2. Determine the value of resistance using colour coding method.

3. Observation of change in resistance of a bulb in hot and cold conditions, using voltmeter

and ammeter.

4. To charge and discharge a capacitor and to show the graph on C.R.O.

5. Verification of laws of capacitors in series and parallel.

6. To verify ohm's law by drawing a graph between voltage and current.

7. Verification of Kirchhoff’s Current Law in a dc circuit.

8. Verification of Kirchhoff’s Voltage Laws in a dc circuit.

9. Measurement of current and voltage in series resistive circuit.

10. Measurement of current and voltage in parallel resistive circuit.

11. 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.

12. Verification of Faraday's law of electromagnetic induction.

13. To obtain BH curve of a magnetic material.

14. Demonstration of parts of a battery and find the specific gravity of battery.

15. Demonstration of charging and discharging of Battery and measure the terminal voltage

during charging and discharging condition.