

# Gujarat Technological University

## COURSE NAME: FUNDAMENTALS OF ELECTRICAL ENGINEERING

1. **RATIONALE:** In the era of globalization, it has become essential to possess the knowledge of various engineering disciplines. The aim of introducing this course is to impart knowledge of basic concepts of electrical engineering to the students of other branches.

2. **SCHEME OF TEACHING :**

TOPIC NO.	NAME OF TOPIC	NO. OF HOURS		
		LECT	PRACT	TOTAL
1.	FUNDAMENTALS OF ELECTRIC AND MAGNETIC CIRCUITS	4	-	4
2.	ELECTROMAGNETIC INDUCTION	3	-	3
3.	A.C. FUNDAMENTALS	5	-	5
4	A.C. CIRCUITS	6	8	14
5	TRANSFORMER	5	2	7
6	ELECTRICAL MACHINES	8	8	16
7	ELECTRICAL MEASURING INSTRUMENTS	4	4	8
8	PROTECTION AND UTILIZATION OF ELECTRICAL POWER	4	4	8
9	BASIC ELECTRONICS	3	2	5
TOTAL		42	28	70

3. **OBJECTIVES :-**

- (1) Understand fundamentals of electric and magnetic circuits
- (2) Understand AC circuits
- (3) Understand principle, classification and applications of transformers
- (4) Understand rotating electrical machines
- (5) Understand domestic wiring and various protective devices
- (6) Understand electrical measuring instruments

(7) Understand basic concepts of electronics

**4. COMMUNICATION SKILLS :**

- (1) Deliver a talk on a topic fluently and confidently for five minutes (or more).
- (2) Describe an object, process or procedure.
- (3) Write assignments (Classroom, library, home)
- (4) Write report on experiments conducted in laboratories.

**5. TOPICS AND SUB-TOPICS**

**1. FUNDAMENTALS OF ELECTRIC AND MAGNETIC CIRCUITS**

- 1.1 Definitions of EMF, Current, Potential Difference, Power and Energy.
- 1.1 Study of terms: - M.M.F, magnetic force, permeability, hysteresis loop, reluctance, leakage factor etc.
- 1.2 Comparison of magnetic and electric circuit.

**2. ELECTROMAGNETIC INDUCTION**

- 2.1 State Faraday's laws of electro magnetic induction.
- 2.2 Dynamically induced emf.
- 2.3 Statically induced emf.-(a) Self induced emf (b) Mutually induced emf.
- 2.4 Definitions & equations of self & mutual inductance.

**3. A.C. FUNDAMENTALS**

- 3.1 Define cycle, frequency, periodic time, amplitude, angular velocity or Frequency with reference to alternating emf & current.
- 3.2 Definitions of RMS value, average value, form factor & peak factor.
- 3.3 Vector representation of an alternating emf and current.
- 3.4 Mathematical representation of an alternating emf and current by a Symbolic notation, operator "j".

**4. A.C. CIRCUITS**

- 4.1 A.C. through pure a) resistors, b) inductors and c) capacitors.
- 4.2 A.C. through R-L series, R-C series, and R-L-C series circuit and simple problems of series R-L circuit.
- 4.3 Definitions of impedance, phase angle, and power factor.
- 4.4 Power in A. C. Circuits. Concept of power triangle.
- 4.5 Voltage and Current relationship in Star and Delta connections.

**5. TRANSFORMER**

- 5.1 General construction and principle of transformers.
- 5.2 Emf equation and transformation ratio of transformers.
- 5.3 List various losses in transformers and equation of efficiency.
- 5.4 Applications of Transformers.
- 5.5 Construction and uses of auto transformers.

**6. ELECTRICAL MACHINES**

- 6.1 Construction, working principle, types and applications of D.C. generator.
- 6.2 Construction, working principle, types and applications of D.C. motor.
- 6.3 Back EMF and torque equation of D.C. Motor (without derivation)
- 6.4 Speed Control of D.C. shunt motor.

6.5 Construction, working principle, types and applications of single phase and three phase Induction motor.

6.6 Necessity of Starter (DOL and Star-Delta)

## **7. ELECTRICAL MEASURING INSTRUMENTS**

7.1 List of various measuring instruments (Voltmeter, Ammeter, Wattmeter, Megger, Clip-on meter, Energymeter, Luxmeter and Multimeter)

7.2 Methods of connecting various indicating instruments.

7.3 C.R.O and its applications.

## **8. PROTECTION AND UTILIZATION OF ELECTRICAL POWER**

8.1 Domestic wiring (a) Lamp Control from one place (b) Staircase Wiring

8.2 Different protective devices such as fuse, M.C.B. and ELCB.

8.3 Electrical safety and earthing.

8.4 Causes of low power factor and advantages of power factor improvement.

## **9. BASIC ELECTRONICS**

9.1 Conductors, insulators and semi conductors and their energy bands.

9.2 P & N type semi conductor.

9.3 Semiconductors devices such as diode, transistor and SCR, their general construction and applications.

### **Reference Books:**

1. A text book of Electrical Technology vol.1 by B.L.Theraja
2. A text book of Electrical Technology vol.2 by B.L.Theraja
3. Principles of Electrical Machine by V.K. Mehta
4. Principles of Power System by V.K. Mehta
5. Electrical and electronic measurement and instrumentation by A.K. Sawhney

### **List of Laboratory Experiments:**

1. To measure voltage ,current & power in 1-phase circuit.(with resistive load)
2. To measure voltage, current & power in R-L series circuit.
3. Relation between line & phase values in Star & Delta connection.
4. Measurement of transformation ratio K of 1-phase transformer.
5. Study of DC machine parts & their identification.
6. Speed control of DC shunt motor.
7. Study of 1-phase Induction Motor (a) Capacitor Start & Capacitor Run Motor (b) Shaded pole Motor (3) Universal Motor.
8. Study of DOL & Star-Delta Starter.
9. Use of Digital Multi-meter for the measurement of voltage, current, & resistance.
10. Measurement of D.C. Voltage, A.C. Voltage & Frequency using CRO.
11. Wiring Diagram of (a) Lamp Control from one place (b) Lamp Control from two places
12. Demonstration of MCB & ELCB.
13. Demonstration of Half Wave & Full Wave Rectifier.

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