GUJARAT TECHNOLOGICAL UNIVERSITY

BASIC ELECTRICAL ENGINEERING
Subject Code: 3110005
1st Year

Type of course: Engineering Science

Prerequisite: NA

Rationale: Electricity has been the main source of energy for the developing and developed countries. Per capita consumption of electricity of a country can be considered as an indicator of the development of the country. In view of this, it is essential for all engineering graduates to know the basic aspects of electrical engineering. This subject deals with basic circuit solution methods, introduction to electrical machines and basics of domestic electrical installations.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE(E)	PA (M)	ESE (V)	PA(I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	***DC Circuits:*** Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.	**8**	**20**
2	***AC Circuits*** Representation of sinusoidal waveforms, peak and RMS values, Phasor representation of AC quantities, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), Series and parallel resonance. Three phase balanced circuits, voltage and current relations in star and delta connections, Power measurement in three phase circuits.	**10**	**25**
3	***Transformers*** Magnetic materials, BH characteristics. Construction and working principle of single phase and three phase transformers. Ideal and practical transformer. Auto-transformer and its applications**.**	**8**	**15**
4	***Electrical Machines*** Generation of rotating magnetic fields.	**8**	**20**

	Construction and working of following machines: • Three-phase induction motor • Single-phase induction motor. • Separately excited DC motor. • Synchronous generators.		
5	***Electrical Installations*** Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB. Types of Wires and Cables. Earthing – Types of earthing and its importance. Safety precautions for electrical appliances. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption. Basics of power factor improvement.	**8**	**20**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25	**25**	**10**	**5**	**5**	**0**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

(i) D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
(ii) Basic Electrical Engineering - Nagsarkar and Sukhija, Oxford University Press
(iii) B. L. Theraja, "Electrical Technology – Part I and II", S. Chand and Co. 2012
(iv) D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
(v) L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
(vi) E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
(vii) V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Course Outcomes

After learning the course the students should be able to:

- Understand and analyze basic circuits.
- Understand the working principles of electrical machines.
- Introduce the components of low voltage electrical installations.

List of Experiments:

(1) Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Resistors, Capacitors and Inductors.
(2) To verify the DC circuit currents and voltages by calculations and actual measurements.
(3) To verify the Kirchoff's current and voltage laws.
(4) To verify the Network theorems.

(5) To obtain sinusoidal steady state response of R-L and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage.
(6) Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a Digital Storage Oscilloscope).
(7) To verify the resonance in R-L-C circuits.
(8) To measure the power in three phase circuits using two wattmeter method.
(9) To verify the current and voltage relationships in three phase star and delta connections.
(10) Demonstration of cut-section models and charts of various machines.
(11) Demonstration of domestic installations like MCB, ELCB, MCCB etc.
(12) Understanding of various safety precautions for electrical installations.
(13) Demonstration of various types of wires and cables.
(14) Understanding of various electricity bills and calculations for energy consumption.
(15) To verify the power factor improvement in single phase AC circuit.

Major Equipment:

Ammeters, Voltmeters, Wattmeters, Resistors, Capacitors and Inductors of appropriate rating. Multimeters, Digital storage oscilloscope, Cut section models/charts of various machines, Demo units for MCB, ELCB, MCCB etc, Samples of wires and cables. Charts for earthing and safety precautions.

List of Open Source Software/learning website:

www.vlabs.co.in