Name of Faculty	:	Faculty of Engineering & Technology
Name of Program	:	Bachelor of Technology (B. Tech)
Course Code	:	2BEE01
Course Title	:	Fundamentals of Electrical Engineering
Type of Course	:	Basic Engineering (BE)
Year of Introduction	:	2023-24

Prerequisite	:	-
Course Objective	:	The primary energy source for both emerging and industrialised nations has been electricity. A nation's power usage per person can be used as a gauge of its level of development. All engineering graduates must thus be familiar with the fundamentals of electrical engineering. This topic covers the concepts of AC and DC, fundamental circuit analysis techniques, and an introduction to electrical machinery.
Course Outcomes	:	At the end of this course, students will be able to:
	CO1	To determine the equivalent resistance, current, voltage, power, MMF, magnetic flux density, field intensity, reluctance of a given electric and magnetic circuits
	CO2	To analyse single phase & three phase ac circuits.
	CO3	To apply concepts of electric network topology, nodes, branches, and loops to solve circuit problems, including the use of computer simulation and analyse different thermos to given electrical circuits
	CO4	To understand the construction working principle, application and characteristics of static and rotating machine

Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
				Theory Marks		Practical Marks		Total
L	T	P	C	SEE	CIA	SEE	CIA	Marks
3	0	2	4	70	30	30	20	150

*Legends: **L**-Lecture; **T**–Tutorial/Teacher Guided Theory Practice; **P** – Practical, **C** – Credit, **SEE** – Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.))*

Course Content

Unit No.	Topics	Teaching Hours	Weightage	Mapping with CO
1	**DC Circuits:** Electric Charge, Current, Electromotive force, potential and voltage. Resistors, Capacitors, Inductors brief review & terminal V-I relations. Ohm's law, Kirchhoff's voltage and current laws, Nodes-Branches and loops, Series elements and Voltage Division, Parallel elements and Current Division, Star-Delta transformation, Independent sources and Dependent sources, source transformation, Magneto motive force, flux, reluctance, permeability comparison of electric and magnetic circuits analysis of series and parallel magnetic circuits, energy stored in magnetic circuits, magnetic circuits with air-gaps, Electromagnetic Induction – Faraday's laws, Lenz's law tors, Inductors brief review & terminal V-I relations.	10	20%	CO1
2	**AC Circuits:** Sinusoidal waveforms (voltage & current), their mathematical and graphical representation, concept of cycle period, frequency, instantaneous, peak, average, RMS values, peak factor, and form factor. Study & Analysis of single-phase AC circuits with R, L, C, RL, RC, RLC combinations, corresponding waveforms & Phasor Diagrams. Generation of three phase voltages- advantages of three phase systems, star and delta connection, three wire and four wire systems, relation between line and phase voltages, line and phase currents.	10	20%	CO1
3	**Circuit Analysis:** Mesh and Nodal analysis, star to delta and delta to star transformations, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer Theorem. Concept of Resonance, Analysis of series and parallel Resonance.	07	15%	CO1 CO2
4	**Transformers:** Operating principle, classification, construction, emf equation, Ideal & practical transformer, phasor diagrams, equivalent circuit model, losses & efficiency, voltage regulation, Direct Loading rest, no load and short circuit test, back-to-back (Sumpner's test), autotransformers. Construction of polyphase transformer, Various connections and vector groups, Applications, Parallel operation and its conditions	08	20%	CO4

5	**Electrical Machines:** Principle and operation of DC Motor, Construction of DC machine. Concept of Back EMF, Types of DC motor, losses and Torque equation. DC generator construction, working principle and its EMF equation. concept of armature reaction . Types of dc generators, efficiency of dc generator, problems on Emf equation. Applications. Principle and operation of 3-phase induction motor, slip, Torque-Equation, Torque-slip characteristics. Problems on Torque equation. Applications of induction motors. Principle and operation of 3-phase alternator – Construction, working principle, Emf equation of Alternator-Pitch factor and Distribution factor, characteristics of alternator	10	25%	CO4

Suggested Distribution of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyse	Evaluate	Create
Weightage	**40**	**20**	**20**	**20**	**0**	**0**

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

Suggested List of Experiments/Tutorials

Sr. No.	Name of Experiment/Tutorial	Teaching Hours
1	To study various measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Resistors, Capacitors and Inductors.	2
2	To verify Ohm's law.	2
3	Verification of Kirchoff's voltage law & Kirchoff's current law.	2
4	To verify Superposition Theorem.	2
5	To verify Thevenin's & Norton's theorem.	2
6	Sketch B-H curve for magnetic circuit of a given material and observe no-load current waveform on an oscilloscope. (non-sinusoidal wave-shape).	2
7	To verify the current and voltage relationships in three phase star and delta connections.	2
8	Verification of phasor quantities of series R-L-C circuit.	2
9	Analysis of Torque Speed Characteristic of separately excited dc motor.	2
10	Analysis of Torque-Slip Characteristic of an induction motor.	2

Major Equipment/ Instruments and Software Required

Sr. No.	Name of Major Equipment/ Instruments and Software
1	Ammeters, Voltmeters, Wattmeters
2	Resistors, Capacitors and Inductors of appropriate rating.
3	Multimeters, Digital storage oscilloscope
4	Cut section models/charts of various machines, Demo units
5	Kit as per list of experiment
6	Induction Motor

Suggested Learning Websites

Sr. No.	Name of Website
1	www.vlabs.co.in
2	www.nptel.ac.in
3	www.circuitlab.com
4	www.electronics.stackexchange.com

Reference Books

Sr. No.	Name of Reference Books
1	Basic Electrical Engineering - Nagsarkar and Sukhija, Oxford University Press
2	L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
3	D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
4	D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
5	B. L. Theraja, "Electrical Technology – Part I and II", S. Chand and Co. 2012