Semester: I/II			
Course Title	Introduction to Electrical Engineering	**CIE Marks**	50
Course Code	BEEESC104/204B	**SEE Marks**	50
Course Type	Theory	**Total Marks**	100
Course Category	ESC	**SEE Duration**	03 hrs
Hours Per Week	2L : 2T : 0P	**SEE Type**	Written
Total Hours	40 hrs	**Credits**	03

Course Learning Objectives
This course will enable the students to
• Study the generation of various electric energy and laws used in the analysis of circuits.
• Explain different types of circuits in single-phase and three phase systems.
• Explain the construction and operation of A C & D C Generators and Motors.
• Study of electric safety measures, UPS and electricity billing.
Pre-Requisites
• Electrical energy, Resistance, Induced EMF, Faraday's Law, Fleming Rules, Lenz's Law, Fundamentals of Physics and Mathematics

Module-1: Introduction to Electrical Engineering	**(8 hrs)**
Introduction: General introduction to electric energy**,** Conventional and non-conventional energy resources, Single line diagram of electric power systems. **Power Generation:** Conventional Energy Resources: Hydel and Nuclear, Non-conventional Energy Resources: Solar & wind power generation, (Block Diagram approach). **D C Circuits:** Kirchhoff's Law: Statement and explanation, Analysis of Series, Parallel and Series-Parallel Circuits, Illustrative examples. **Self-Study Components:** Ohm's Law and its limitations, Resistance, D C source.	
Module-2 : A C Circuits	**(8 hrs)**
A C Fundamentals: Introduction to A C Fundamentals, Equation of alternating voltage and current, Average value, RMS value, Form factor, Peak factor and their relation. **A C Circuits:** Voltage and current relationship in R, L and C circuits, Concept of power and power factor, Analysis of R-L, R-C and R-L-C Series circuits, Phasor diagrams, 'j' operator, Illustrative examples. **Three Phase Circuits:** Generation of Three phase AC quantity, advantages and limitations, Relationship between line and phase quantities for Star and Delta connection, Measurement of three-phase power using two-wattmeter method, Illustrative examples. **Self-Study Components:** Generation of A C voltage, Real & Reactive Power, Phase sequence.	
Module-3 : D C Machines	**(8 hrs)**
D C Generator: Principle of operation, Constructional details and Types of generators, Relation between induced EMF and Terminal voltage, Expression for induced EMF, Illustrative examples. **D C Motor:** Principle of operation, back EMF and its significance and types of D C motors, Torque equation, Characteristics of shunt, series & compound motors, Applications of D C motors, Illustrative examples on shunt and series motors. **Self-Study Components:** Self & separately excited Generators, Applications of Generators.	

Module-4 : A C Machines	(8 hrs)
Transformers: Working principle and construction of single- phase Transformers, EMF equation, Losses, Variation of losses with respect to load, Efficiency, Illustrative examples. **Three Phase Induction Motors:** Concept of rotating magnetic field, Principle of operation and construction and types of Induction Motor, Slip and its significance, Frequency of rotor current, Illustrative examples. **Self-Study Components:** Variation of losses with respect to load.	
Module-5 : Electrical Billing, Safety and UPS	**(8 hrs)**
Electricity Bill: Two-Part Electricity Tariff, calculation of Electricity Bill for domestic consumers. **Equipment Safety Measures:** Working principle of Fuse and Miniature circuit breaker, Earth Leakage Circuit Breaker (ELCB). **Personal Safety Measures**: Electric Shock, Safety Precautions to avoid shock, Earthing and its types (plate & pipe). **Uninterruptible Power Supply**: Introduction to Uninterruptible Power Supply, Main Components of a UPS System, Types of UPS, Comparison of different types of UPS. **Self-Study Components:** Concept of power & energy, Power rating of household Appliances.	

Text Books:	
1.	"Basic Electrical Engineering" by D C Kulshreshtha, Tata McGraw Hill, First Edition 2019.
2.	"Principles of Electrical Engineering & Electronics" by V. K. Mehta, Rohit Mehta, S. Chand and Company Limited, Reprint, 2022.
3.	"A textbook of Electrical Technology" by B.L. Theraja, S Chand and Company, reprint edition 2014.
Reference Books/ e-Resources:	
1.	"Basic Electrical Engineering" by D. P. Kothari and I. J. Nagrath, Tata McGraw Hill, 4th edition, 2019.
2.	"Fundamentals of Electrical Engineering" by Rajendra Prasad, PHI, 3rd edition, 2014.
3.	"Principles of Power System" by V. K. Mehta, Rohit Mehta, S. Chand and Company Limited, Revised Edition, Reprint, 2022.
4.	"Generation and economic considerations" by J B Gupta, S K Kataria & Sons, 2nd Edition, 2012.
5.	"Hands on training on residential wiring and Safety devices" www.nptel.ac.in
6.	https://www.javatpoint.com/ups-uninterruptible-power-supply

Course Outcome Statements: Students are able to	
CO1	Explain the concept of energy sources, electric circuits.
CO2	Explain the safety measures, UPS and Electricity billing.
CO3	Apply the basic laws to solve electric circuits and devices.
CO4	Analyze electrical D C and A C machines.
CO5	Prepare a report on electrical wiring, load survey and improvement of power factor.

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	1
CO2	1	-	-	-	-	1	-	-	-	-	-	1
CO3	-	2	1	1	-	-	-	-	-	-	-	1
CO4	-	1	1	-	-	-	-	-	-	-	-	1
CO5	-	1	1	-	-	-	-	-	-	-	-	1
Avg.	**1.5**	**1.5**	**1**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1**

3: High, 2: Medium, 1: Low

Suggested Activity Based Assessment (ABA) Methods

Students shall select any one of the following and conduct a survey / experiment and prepare a detailed report.

- Residential Building Wiring.
- Simulation of Electric Circuits.
- Electrical Load Survey.
- Energy Conservation and Auditing.