Introduction to Electrical Engineering		Semester	I/II
Course Code	1BESC104B/204B	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40 Hours	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	**Theory**		

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

1. Explain the generation of power and the laws used in DC circuits.
2. Analyse single-phase and three-phase circuits.
3. Describe the construction, operation and applications of DC machines.
4. Describe the construction, operation and applications of transformers and induction motors.
5. Explain electricity billing and safety measures

Module-1

Power Generation: Conventional and nonconventional energy sources. Single-line diagram of power supply system showing power station, transmission system and distribution system. Definition of power grid.

DC circuits: Ohm's law and Kirchhoff's laws, analysis of series, parallel and series-parallel circuits. Power and energy.Problems.

Number of Hours: 08

Module-2

Single-Phase Circuits: Generation of single-phase system. Equation of AC voltage and current, average value, RMS value, form factor, peak factor and their relation [No derivations]. Voltage and current relationships in R, L and C circuits, concept of power, reactive power, apparent power and power factor, analysis of R-L, R-C and R-L-C series circuits, parallel circuits, illustrative examples.

Three-Phase Circuits: Generation of three-phase systems, star and delta (mesh) connections, relation between phase and line values of voltages and of currents of star and delta connections. Definition of balanced and unbalanced source and load. Power, reactive power and power factor. Problems with balanced loads.

Number of Hours: 08

Module-3

DC Generator: Principle of operation, constructional details, induced emf expression, types of generators. Relation between induced emf and terminal voltage. Simple problems.

DC Motor: Principle of operation, back emf and its significance. Torque equation, types of motors, characteristics and speed control of DC shunt motor. Applications of DC motors. Simple problems.

Number of Hours:08

Module-4

Transformers: Introduction to transformers, necessity of transformer, principles of operation, constructional features of single phase transformers. EMF equation, losses, variation of losses with respect to load. Calculation of efficiency at different loads.

Three-phase induction Motors: Definition of rotating magnetic field (without derivation), Principle of operation. Constructional features of squirrel cage type and wound rotor type induction motor. Slip and its significance, problems. Applications.

Number of Hours: 08

Module-5

Domestic Wiring: Two-way and three-way control of loads.
Electricity Bill: Definition of "unit" used for consumption of electrical energy, power rating of common household appliances. Two-part electricity tariff.
Equipment Safety measures: Working principle of fuse and miniature circuit breaker (MCB), merits and demerits.
Personal safety measures: Electric shock, safety precautions to avoid shock. Earthing and types: Plate earthing and pipe earthing.

Number of Hours: 08

Suggested Learning Resources

Textbooks:

1. A text book of Electrical Technology by B.L. Theraja, S Chand and Company, reprint edition 2014.
2. Principles of Electrical Engineering & Electronics by V. K. Mehta, Rohit Mehta, S. Chand and Company Publications, 2nd edition, 2015.

Reference books

1.Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Tata McGraw Hill 4th edition, 2019.0
2.Fundamentals of Electrical Engineering by Rajendra Prasad, PHI, 3rd edition, 2014.
3.Electrical Technology by E. Hughes, Pearson, 12th Edition, 2016.
4.Basic Electrical and Electronics Engineering, K.Vijayarekha, et al, Cengage. Reprint 2023.
5. Handbook of Electrical Engineering formulae, Harish C Rai, CBS Publications, 2018.

Web links and Video Lectures (e-Resources): www.nptel.ac.in

(1)Principle of Electrical Sciences, Prof Sanjay Agrawal, Indira Gandhi National Open University.
(2)Electricity and Electrical Wiring, Dr. Antara Mahanta Barua, Krishna Kanta Handiqui State Open University, Guwahati.

Teaching-Learning Process (Innovative Delivery Methods):

The following are sample strategies that educators may adopt to enhance the effectiveness of the teaching-learning process and facilitate the achievement of course outcomes.

1. Technology Integration, 2. Collaborative Learning, 3. Flipped Classroom, 4. Visual Based Learning

Assessment Structure:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage.

- To qualify and become eligible to appear for SEE, in the **CIE**, a student must score at least **40% of 50 marks**, i.e., **20 marks**.
- To pass the **SEE**, a student must score at least **35% of 50 marks**, i.e., **18 marks**.
- Not- withstanding the above, a student is considered to have **passed the course,** provided the combined total of **CIE and SEE is at least 40 out of 100 marks**.

Continuous Comprehensive Assessments (CCA):

CCA will be conducted for a total of 25 marks. It is recommended to include a maximum of two learning activities aimed at enhancing the holistic development of students. These activities should align with course objectives and promote higher-order thinking and application-based learning.
Learning Activity -1: (Marks- 15)
Learning Activity -2 (optional): (Marks-10)

Rubrics for Learning Activity 1, Maximum marks:15 (Based on the nature of learning activity, design the rubrics for each activity)						
Activity type	**Performance Indicator**	**Excellent**	**Very Good**	**Good**	**Fair**	**Needs Improvement**
Any one of the actives mentioned in Activity -1						
Industrial Visit Report Writing (15)	**PO10.2:** Submit a comprehensive report. (15)	Submits a clear, concise, well-structured, report with relevant attachments. (15-12)	Submits a clear and structured report with sufficient attachments. (11-9)	Submits a moderate report without many attachments. (8-6)	Submits a moderate report devoid of attachments. (5-3)	Submits a report not following a sequence of events that a report generally demands. (2-1)
Case Study / Problem-Based Learning (15)	**PO2.2**: Analyse problems using first principles. (5)	Applies first principles thoroughly to produce logical, and innovative solution. (5)	Applies first principles effectively with minor mistakes. (4)	Applies first principles adequately for regular problems (3)	Applies first principles to only simple problems. (2)	Applies first principles in an inappropriate way. (1)
	PO3.1: Produce appropriate solutions (5)	Produces creative, technically sound, and sustainable solutions to almost all problems. (5)	Produces acceptable solutions to many problems. (4)	Produces satisfactory solutions only to standard problems (3)	Produces incomplete Solutions. (2)	Produces no relevant solutions. (1)
	PO11.1: Understand impact of engineering solutions in societal context (5)	Provides comprehensive solutions covering societal, health, safety, environmental and cost effective issues. (5)	Provides appreciable solutions covering only few societal issues. (4)	Recognizes basic societal impacts. Provides satisfactory solutions covering only some of the societal issues. (3)	Limited understanding of societal impacts. Provides an abridged solutions. (2)	Very limited consideration of societal impacts. Provides solutions that do not have much relevance to the context. (1)

Rubrics for Learning Activity – 2, Maximum Marks:10 (Based on the nature of learning activity, design the rubrics for each activity)						
Activity type	**Performance Indicator**	**Excellent**	**Very Good**	**Good**	**Fair**	**Needs Improvement**
Any one of the actives mentioned in Activity -2						
Assignment (10)	**PO1.1**: Apply knowledge of mathematics, science, and engineering. (5)	Applies concepts flawlessly to all the problems. (5)	Applies concepts correctly to most of the problems with minor mistakes. (4)	Applies concepts only to few problems with acceptable approach. (3)	Applies concepts only to few problems with minor mistakes. (2)	Applies concepts to few problems committing mistakes. (1)
	PO2.1: Analyse and solve engineering problems. (5)	Analyse to provide innovative solutions for all the problems. (5)	Analyse to provide correct solutions for most of the problems. (4)	Analyse to provide solutions to some of the problems. (3)	Partially analyse to give solution in few cases. (2)	Struggles to analyse problems. Offers incomplete or incorrect solution. (1)
Presentation/ Seminar (10)	**PO10.1**: Communicate effectively both in written and oral form. (5)	Presents ideas confidently, clearly, and engagingly with excellent audience interaction. (5)	Presents clearly the topic contents but falters while delivering the content. (4)	Presents the contents properly but struggles to deliver. (3)	Presents imprecise contents and finds difficulty in delivery.(2)	Presents imprecise contents and fails to deliver. (1)
	PO8.1: Demonstrate professional and ethical behaviour. (5)	Adheres to high ethical standards, shows strong professional conduct. (5)	Mostly adheres to ethical standards with minor lapses. (4)	Understands ethics but inconsistently applies them. (3)	Shows limited awareness of ethical standards (2)	Shows disregard to ethics and professionalism (1)