Basics of Electrical Engineering		Semester	I/II
Course Code	1BBEE105/205	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	**Theory**		

Course outcome

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

1. Apply the basic laws used in the analysis of DC circuits, Electrostatics and Electromagnetism.
2. Assess implications of electromagnetic induction.
3. Analyse the single phase circuits.
4. Analyse the three phase circuits and measure power.
5. Explain electricity billing, domestic wiring and safety measures against electricity.

Module-1

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

Electrostatics: Coulombs law, definitions of absolute and relative permittivity, electric field, electric flux, electric field strength, flux density. Capacitor: Expression of parallel plate capacitor, factors affecting capacitance, capacitors in series and capacitors in parallel, energy stored in an electrostatic field, problems.

Electromagnetism: Electromagnets-direction of flux produced, right-hand rule, definition-magnetic circuit, mmf, magnetic field strength, free space and relative permeability, reluctance, permeance, useful and leakage flux, simple series circuits and parallel circuit problems.

Number of Hours: 08

Module-2

Electromagnetic Induction: Faraday's law of electromagnetic induction, Lenz's law, dynamically and statically induced emf, Fleming's right-hand rule. Simple problems. Inductance and mutual inductance, coefficient of coupling, energy stored and its applications. Force experienced by a current-carrying conductor placed in the magnetic field. Fleming's left-hand rule. Force between conductors carrying current in the same and in the opposite directions.

Number of Hours: 08

Module-3

Single-phase Circuits: Generation of sinusoidal voltage, frequency of generated voltage, Expression of average value, RMS value, form factor and peak factor of sinusoidal voltage and current. Phasor representation of alternating quantities. Analysis of R, L and C circuits. Series and parallel R-L, R-C and R-L-C circuits with phasor diagrams, calculation of real power, reactive power, apparent power, and power factor, illustrative examples.

Number of Hours: 08

Module-4

Three- phase Circuits: Generation of three-phase system, definition of phase sequence, star and delta (mesh) connections, relation between phase and line values of voltages and of currents of star and delta connections, considering the phasor diagram. Definition of balanced and unbalanced source and load. Power, reactive power and power factor. Problems on balanced loads. Measurement of 3-phase power by 2-wattmeter method. Expression of power factor in terms wattmeter readings. Effect of power factor on wattmeter readings. Comparison between single phase and three-phase systems.

Number of Hours: 08

Module-5

Domestic Wiring: Service mains – overhead and underground. Types of wiring: Exposed to open space – wooden batten wiring and casing and capping. Concealed wiring: conduit wiring. Wiring for two-way and three-way control of load.

Domestic Electricity Bill: Power-rating of household connected loads. Sanctioned Load. Practical unit of measuring energy, energy expressed for commercial purposes - Unit, its definition.

Electricity bill [as per Electricity Supply Companies (escoms)]: Tariff method considered: two-part tariff. Particulars considered for billing: sanctioned load and units consumed. Calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principles of fuse and miniature circuit breaker (MCB), the merits and demerits of fuse and MCB.

Personal safety measures: Electric shock, possible effects of shocks. Safety precautions to avoid personal shock while dealing with electricity. Permanent measure: Earthing: Pipe and plate.

Number of Hours: 08

Suggested Learning Resources:

Textbooks:

1. A textbook of Electrical Technology by B.L. Theraja, Volume-1, S Chand and Company, Reprint Edition 2014. [Covers modules 1 to 4]
2. Basic Electrical Engineering, D.C. Kulshreshtha, McGraw Hill, 2nd Edition, 2024. [Covers all modules]

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, McGraw Hill 2nd edition, 3rd Reprint 2024.
2. Principles of Electrical Engineering & Electronics by V. K. Mehta, Rohit Mehta, S. Chand and Company Publications, 2nd edition, 2015.
3. Electrical Technology by E. Hughes, Pearson, 12th Edition, 2016.
4. Basic Electrical and Electronics Engineering, S.K Bhattacharya, et al, Pearson. 2nd edition, 2017.
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**.
- Notwithstanding 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 two actives mentioned below under 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 two actives mentioned below under 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)