For Electrical & Electronics Engg. branch only

Course Name **Basics of Electrical Engineering**		Semester	I
Course Code	1BEE105/205	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours	40Hours Theory	Total Marks	100
Credits	3 Credits	Exam Hours	3 Hours
Examination type (SEE)	**Theory**		

Course Objectives:

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.

Pre- requisite: Students should have the knowledge of
1. Ohms Law Kirchhoff's Current and Voltage Law.
2. Fundamentals of AC and DC Circuits.
3. Basic of Magnetism.

Module-1	**Hours:08**
DC circuits: Ohm's law and Kirchhoff's laws, analysis of series, parallel and series-parallel circuits. Power and energy. Problems on series and parallel circuits. **Electromagnetic Induction:** definition of magnetic field, mmf, Flux Density and relative Faraday's law of electromagnetic induction, Lenz's law, dynamically and statically induced emf, Fleming's right-hand rule . Inductance and mutual inductance, coefficient of coupling, Simple problems .	

Module-2	**Hours:08**
Single-phase Circuits: Generation of sinusoidal 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. **Three- phase Circuits:** Generation of three-phase system, 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. Measurement of 3-phase power by 2-wattmeter method. Effect of low power factor on watt meter readings. Comparison between single phase and	

three-phase systems.	
Module-3 **Transformer:** Introduction to transformers, principles of operation, Constructional features of single phase transformers. EMF equation. Problems. **Three-phase induction Motors:** Concept of rotating magnetic field, Principle of operation. Constructional features of squirrel cage type and wound rotor type induction motor. Slip and its significance, problems.	**Hours:08**
Module-4 **DC machines:** Introduction,construction and working principle of DC generator,EMF equation. Working principle of DC motor, Significance of Back EMF in DC motor problems **Alternator:** Introduction,construction and working principle of alternator ,EMF equation considering pitch factor and winding factor types of alternators and their constructional features , problems on EMF equation.	**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, 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. Importance of earthing, types of earthing: Pipe and plate.	**Hours:08**
Semester End Examination (SEE): Theory SEE will be conducted by Institute as per the scheduled timetable, with common question papers for the course 1. The question paper will have ten questions. Each question is set for 20 marks. 2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.	

3. The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources: Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year):

Textbooks:

1. A textbook of Electrical Technology byB.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. 2 nd edition,2017.

Course outcome (Course Skill Set): At the end of the course the student will be able to:

CO1	Understand the DC Electric circuits and principles of Electromagnetism.		
CO2	Analyze the single phase and three phase AC circuits.		
CO3	Discuss the construction and operation of various AC Electrical Machines.		
CO4	Discuss the construction and operation of various DC Electrical Machines.		
CO5	Explain the concepts electricity billing, circuit protective devices and personal safety measures.		

Course Name:	**Basic Electrical Lab Semester I/II**	Semester	1
Course Code:	**1BBEEL107/207**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	70
Total Hours	2	Total Marks	100
Credits	1 Credits	Exam Hours	03
Examination type (SEE)	**Practical**		

Course outcome (Course Skill Set)

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

(1)Conduct standard electrical experiments to verify theoretical principles.

(2)Measure key electrical parameters such as resistance, inductance, impedance, power, and power factor with standard methods.

(3)Design and perform experiments to solve practical open-ended electrical problems.

(4)Analyse experimental data from non-routine method to arrive at a solution.

Note:

(i)The laboratory syllabus consists of PART-A and PART-B. While PART-A has 6 conventional experiments, PART-B has 6 typical open-ended experiments. The maximum mark for laboratory course is 100.

(ii) Both PART-A and PART-B are considered for CIE and SEE.

(iii) Students have to answer 1(one) question from PART-A and 1(one) question from PART-B.

(iv a) The questions set for SEE shall be from amongst the experiments under PART-A. It is evaluated for 70 marks out of the maximum 100 marks.

(iv b)The open-ended question set for SEE shall be any other open-ended question and not selected from the experiments under PART-A. It shall be evaluated for 30 marks.

(v) For continuous internal evaluation, during the semester classwork, the typical open-ended questions may be selected from PART-B or there may be any other similar question to enhance the skill of the students.

PART – A **CONVENTIONAL EXPERIMENTS**	
(1) Verification of Ohm's law and Kirchhoff's laws. (2) Measurement of low range resistance using voltmeter-ammeter method. Verification of resistance value using multimeter/LCR meter. (3) Measurement of earth's resistance by 3-electrode method. (4) Measurement of resistance, inductance, impedance and power factor using voltmeter, ammeter and watt meter in single-phase AC circuits. (5) Measurement of three-phase power of a delta connected by 2-wattmeter method, when the load is delta connected. Calculation of resistance, reactance, impedance and power factor. (6) Wiring an appropriate electric circuit, understanding the basic principle used for 2-way and 3-way control of load.	

PART – B
TYPICAL OPEN-ENDED EXPERIMENTS

Open-ended experiments are a type of laboratory activity where the outcome is not predetermined and students are given the freedom to explore, design, and conduct the experiment based on the problem statements as per the concepts defined by the course coordinator. It encourages creativity, critical thinking, and inquiry-based learning.

(1) Creation of short circuit to determine the time taken by a fuse of different length. Documenting the test data and
the conclusions.
(2) Trouble shooting experiments in simple DC circuits. The trouble may be due to loose connection, faulty component
leading to open circuits or short circuits. Detection of fault and the reasons for that and conclusion.
(3) Measurement of voltage between line and neutral, ground and line, ground and neutral in respect of heathy and
unhealthy 3-pin socket. Conclusions arrived for the faulty wiring. Allowable ground voltage.
(4) A 12 V battery is available. It is required to obtain 3 V from the battery to charge a mobile. Create a circuit to
obtain the required voltage. Specify all the ratings of the components used.
(5) Determine the efficiency of a given single phase transformer by direct loading using 2 low p.f wattmeters.
(6) To draw OCC characteristics of a given DC generator to estimate the critical resistance of the Field and emf induced due to residual flux.

Suggested Learning Resources:
Textbooks:
1. Manual prepared for the conventional experiments by EEE Departments.

Web links and Video Lectures (e-Resources):
(1) https://bes-iitr.vlabs.ac.in/List%20of%20experiments.html [Virtual Labs, an ministry of education (MOE) Govt.of India Initiative]

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.

(i)Demonstration with hands-on practice.
Perform the experiment step-by-step to reinforce understanding and skill after a demonstration.
(ii)Problem-based learning (PBL)
Students to work individually or in groups to analyse the situation, design solutions, and present their findings.

Assessment of CIE and SEE
The assessment of the practical course is for a maximum of 100 marks. Both CIE and SEE are evaluated

for 50 marks
each.

(a)CIE Assessment

(i)The CIE marks of 25 shall be based on the work carried out during the laboratory hours. The components considered
for assessment of marks shall be based on the experiment conducted under both PART-A and PART-B and the
laboratory record.

(ii)The rest 25 marks shall be for the test conducted under PART-A and PART-B.

(iii)The laboratory test (duration 03 hours) at the end of the last week of the semester /after completion of all the
experiments (whichever is early), shall be conducted for both PART-A and PART-B.

(iv)PART-A shall be evaluated for a maximum of 15 marks and PART-B for a maximum of 10 marks. Each student
has to conduct the PART-A experiment individually. The time allotted for this is 1.5 hours. The question under
PART-B may be attempted by an individual or a group of students. The time allotted for this is 1.5 hours.

(v)The evaluation process shall as per University notification.

(b)SEE Assessment

The maximum SEE mark for the final examination is 100 marks. While PART-A carries a maximum of 70 marks,
PART-B carries a maximum of 30 marks. The sum total of PART-A and PART-B should be scaled down to 50
marks.

The evaluation process shall as per University notification.

Passing Standard

(i)To become eligible to appear for SEE, the marks secured by a student in CIE must be a minimum of 40 % of
50 marks, i.e., 20 marks.

(ii)For a pass in SEE, the marks secured by a student must be a minimum of 35 % of 50 marks, i.e., 18 marks.

(iii) A student is deemed to have **successfully completed the course if the sum total of CIE and SEE is at least 40 out of 100 marks.■**

Rubrics for Practical assessment				
Performance Indicators	**Excellent**	**Very Good**	**Good**	**Needs Improvement**
Fundamental Knowledge (5) (PO1)	The student has an in depth knowledge of the topics related to the course. (5)	Student has ample knowledge of the topics related to course. (4)	Student has good amount of knowledge but not in detail. (3)	Student has some knowledge. (1-2)
Design of Experiment (5) (PO2 & PO3)	Student can conceive more than one design	Student is capable of discussing few designs	Student is capable of discussing one of the	Student is not capable of completing the design to its

	for the problem statement and capable of proving the best suitable design. (5)	for the problem statement but not certain about its suitability.(4)	designs and explain completely. (3)	logical end. (1-2)
Implementation (5) (PO3 & PO8)	Student is capable of implementing the design with ease to obtain optimal solution. (5)	Student is capable of implementing the design successfully, along with a solution and explanation. (4)	Student is capable of implementing the design with a solution and average explanation. (3)	Student is capable of implementing the design, but unable to justify the result. (1-2)
Result & analysis (5) (PO4)	Student is able to get the expected results with justifications. (5)	Student is able to get the expected results and able to justify only partially. (4)	Student is able to get the expected results and unable to justify (3)	Student is able to get the expected results but unable to justify (1-2)
Demonstration (10) (PO9)	The lab record is well-organized, with clear sections (e.g., introduction, Theory, Method, Results, Conclusions. (9-10)	The lab record is organized, with clear sections, but some sections are not well-defined. (7-8)	The lab record lacks clear organization or structure. Some sections are unclear or incomplete. (5-6)	The lab record is poorly organized, with missing or unclear sections. (3-4)