

Unit 1

Introduction

OBJECTIVE OF THE COURSE

The objective of Basic Electrical Engineering (BEE) is to provide a foundational understanding of the electrical domain, which is essential for all engineering students, irrespective of their specialization.

Key Objectives

1. *Fundamental Understanding:*
To develop a basic but deep understanding of electrical principles, laws, circuits, and machines.
2. *Core Knowledge of Electrical Elements:*
Introduce basic electrical components like resistors, inductors, capacitors, voltage and current sources.
3. *Network Theorems and Circuit Analysis:*
Develop an ability to analyse both AC and DC circuits using laws like Ohm's Law, Kirchhoff's Laws, and theorems like Thevenin's, Norton's, and Superposition.
4. *Electric Machines and Transformers:*
Gain knowledge of the construction, principle of working, and applications of DC machines, transformers, and basic AC machines.
5. *Measurement and Instruments:*
Introduce basic electrical measurement techniques and working of common electrical measuring instruments like ammeter, voltmeter, wattmeter, and energy meter.
6. *Practical Application:*
To bridge the gap between theory and real-world electrical systems used in daily life, industries, and engineering.
7. *Interdisciplinary Role:*
Prepare students from non-electrical branches to understand and work with electrical systems in their respective domains.

SCOPE OF THE COURSE

The scope of Basic Electrical Engineering extends beyond a single subject—it is an essential discipline that contributes to mechanical, civil, computer science, electronics, and IT fields.

Key Areas of Scope

1. *Universal Application:*
Electrical engineering concepts are widely applicable in all branches of engineering. From wiring a building to running industrial machines, electrical principles are foundational.
2. *Foundation for Advanced Studies:*
It lays the base for advanced studies in power systems, electrical drives, power electronics, instrumentation, and control systems.
3. *Relevance to Modern Technology:*
Essential for understanding robotics, IoT devices, automation systems, smart grids, renewable energy systems (solar, wind), and electric vehicles.

4. *Industrial Relevance:*
Industries require engineers to handle electrical maintenance, installations, and troubleshooting. This course prepares you for those challenges.
5. *Design and Simulation Tools:*
Learning concepts such as circuit analysis also introduces you to software tools like MATLAB, Multisim, and PSICE for designing and simulating circuits.
6. *Government Exams & Jobs:*
Basic electrical concepts are part of competitive exams like GATE, SSC JE, RRB JE, ISRO, DRDO, etc.
7. *Multidisciplinary Integration:*
Integrates with mechanical engineering (e.g., motors in mechanical systems), civil (building electrical layout), and IT (hardware and embedded systems).

OUTCOMES OF THE COURSE

After completing this course, students will be able to:

Practical Outcomes

1. *Understand and analyse simple electrical circuits*
Students will gain confidence in solving DC and AC circuits.
2. *Calculate electrical parameters*
Learn how to compute voltage, current, resistance, power, and energy in both DC and AC conditions.
3. *Apply network theorems*
Use theorems such as Thevenin, Norton, Superposition in practical circuit simplifications.
4. *Understand electric machines and transformers*
Explain working of DC generator/motor and transformer with efficiency and loss calculations.
5. *Operate measuring instruments*
Know how to use voltmeters, ammeters, wattmeter's and multimeters accurately.
6. *Improve problem-solving skills*
Develop logical and analytical abilities through numerical and circuit design tasks.
7. *Hands-on Experimentation Skills*
Learn practical aspects of electrical circuits via labs – connecting, testing, and troubleshooting.
8. *Safety Practices*
Understand safety protocols while working with electrical circuits and installations.
9. *Interpreting Electrical Drawings*
Understand and read basic electrical layouts, symbols, and machine diagrams.
10. *Appreciation for Future Learning*
Encouragement to dive deeper into specialized topics like embedded systems, control systems, power electronics, etc.

Real-Life Application Examples

- *Transformer at home* – Adapters you use to charge phones work on transformer principles.
- *Electric Motors* – Used in fans, washing machines, mixers, and electric vehicles.
- *Measuring Instruments* – Every electricity bill is measured using an energy meter.
- *Power Generation* – Concepts used in hydro, thermal, and solar power plants.