Course Code	Course Name	L	T	P	C
EST 122B	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	3	0	2	4

(Effective from the academic year 2023-24 admissions)

This course introduces the student, to the fundamental principles and building blocks of electrical and electronics engineering. The first three units cover the electric circuit laws, theorems, and principles of electrical machines. The last two units cover semiconductor devices and their applications.

Course Objectives

- To familiarize the basic DC and AC networks used in electrical and electronic circuits.
- To explain the concepts of electrical machines and their characteristics.
- To introduce the importance of transformers in transmission and distribution of electric power.
- To impart the knowledge about the characteristics, working principles and applications of semiconductor diodes, metal Oxide semiconductor field effect transistors (MOSFETs).
- To expose basic concepts and applications of Operational Amplifier and configurations.

UNIT I **10L**

Basic laws and Theorems: Ohms law, Kirchoff's Laws, series and parallel circuits, source transformations, delta- wye conversion. Mesh analysis, nodal analysis. Linearity and superposition theorem, Thevenin's and Norton's theorem with simple examples, maximum power transfer theorem with simple examples.

Learning Outcomes:

After completion of this unit, the student will be able to

- State Ohms law and Kirchhoff's Laws(L1)
- Identify and analyze series and parallel connections in a circuit (L4)
- Predict the behavior of an electrical circuit(L2)
- Determine the current, voltage and power in the given electrical circuit (L3)
- Apply various techniques to analyze an electric circuit(L3)

UNIT II **08L**

DC Machines: Constructional features, induced EMF and torque expressions, different types of excitations, performance characteristics of different types of dc machines,, losses and efficiency of the DC machines. Starters and their necessity

Learning Outcomes:

After completion of this unit, the student will be able to

- Describe the constructional features of DC machines (L1)
- Analyze EMF and torque expressions of DC machine (L4)
- Demonstrate the performance characteristics of different types of dc machines (L3)
- Explain types of starters used for starting of dc motors(L2)

- Estimate losses and efficiency of electrical machine(L2)

UNIT III **12L**

Transformers: Constructional details, EMF equation, voltage regulation, losses and efficiency, open/short-circuit tests and determination of efficiency.

Learning Outcomes:

After completion of this unit, the student will be able to

- Describe the constructional details of transformers(L1)
- Demonstrate voltage regulation of transformer(L2)
- Discuss about open and short- circuit tests of transformer (L2)
- Explain the working principle of three phase induction motor (L5)
- Describe torque and power factor (L1)
- Estimate losses and efficiency of Induction Motors (L2)

UNIT IV **14L**

Semiconductor Devices: p-n Junction diode - Basic operating principle, current-voltage characteristics, applications as switch and rectifier. Zener diode as Voltage Regulator;
Metal oxide semiconductor field effect transistor (MOSFET): Operation MOSFET as an amplifier and switch.

Learning Outcomes:

After completion of this unit, the student will be able to

- Describe the device structure and physical operation of a diode (L1)
- Discuss V-I characteristics of diodes(L2)
- Explain the use of diode as switch and in electronic circuits (L2)
- Describe the construction and operation of n-channel and p-channel MOSFETs (L1)
- Explain the use of MOSFET as an amplifier and bidirectional switch (L2)

UNIT V **10L**

OPERATIONAL AMPLIFIER FUNDAMENTALS: Operational Amplifier, Basic Op-Amp Configuration, An Op-Amp with Negative Feedback, Voltage Series and Voltage Shunt Configurations, Voltage Follower, Difference Amplifiers, Specification of an Op-Amp, Offset Voltages and Currents, CMRR, Slew Rate, PSRR, Input Bias and Offset Currents.

Learning Outcomes:

After completion of this unit, the student will be able to

- List the characteristics of an ideal Op Amp(L1)
- Explain the Inverting and Noninverting configurations of Op-Amp (L2)
- Construct a single Op-amp difference amplifier(L3)

Basic Electrical and Electronics Engineering Laboratory

1. Verification of Kirchhoff's Laws KVL and KCL.

2. Verification of DC Superposition Theorem.
3. Verification of Thevenin's Theorem and Norton's Theorem.
4. OCC and External characteristics of separately excited DC generators.
5. Swinburne's test on a DC shunt motor.
6. OC and SC Tests on single phase transformer.
7. Brake Test on DC shunt motor.
8. Current Voltage Characteristics of a p-n Junction Diode/LED.
9. Diode Rectifier Circuits.
10. Voltage Regulation with Zener Diodes.
11. Design of a MOSTFET amplifier and MOSFET inverter/2-input gates
12. Inverting and Non-Inverting Amplifier Design with Op-amps.
13. Simulation experiments using PSPICE
    a. Diode and Transistor Circuit Analysis.
    b. MOSFET Amplifier design.
    c. Inverting and Noninverting Amplifier Design with Op-amps.

Textbook (s):

1. D.P. Kothari, I.J. Nagrath, Basic Electrical and Electronics Engineering, 1/e, McGraw Hill Education (India) Private Limited, 2017.
2. B. L. Theraja, Fundamentals of Electrical Engineering and Electronics, 1/e, S. Chand Publishing, New Delhi, 2006.
3. Adel S. Sedra and Kenneth C.Smith, Microelectronic Circuits, 6/e, Oxford University Press, 2014.

References:

1. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson Education, 2011.
2. Dharma Raj Cheruku, B T Krishna, Electronic Devices and Circuits, 2/e, Pearson Education, 2008.
3. K.Rajput, Basic Electrical and Electronics Engineering, University Science Press, New Delhi, 2012.

Course Outcomes

Upon successful completion of the course, the student will be able to:

- Predict and analyze the behavior of an electrical circuit(L3)
- Analyze the performance quantities such as losses, efficiency and identify applications of DC machines(L4)
- Explain the use of transformers in transmission and distribution of electric power and other applications (L2)
- Demonstrate the operation and applications of various electronic devices (L2)
- Construct Inverting and Noninverting configurations of Op-Amp (L3)