**19EEE131 - BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**

|  |  |  |  |
| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **3** | **1** | **3** | **5.5** |

**Preamble:** 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**

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

**Unit I (10L + 6P)**

**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**

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

* state Ohms law and Kirchhoff’s Laws **(L1)**
* identify and analyze series and parallel connections in a circuit **(L1)**
* predict the behavior of an electrical circuit **(L2)**
* determine the current, voltage and power in the given electrical circuit **(L4)**
* apply various techniques to analyze an electric circuit **(L3)**

**Unit II (10L + 6P)**

**DC Machines:** Constructional features, induced EMF and torque expressions, different types of excitation, performance characteristics of different types of dc machines, Starters: 2-point, 3-point starters, losses and efficiency, efficiency by direct loading.

**Learning Outcomes**

*Upon successful completion of the course, 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 + 9P)**

**Transformers:** Constructional details, EMF equation, voltage regulation, losses and efficiency, open/short- circuit tests and determination of efficiency. **Three Phase Induction Motors**: Construction, working principle of three phase induction motor, Torque and Torque-Slip characteristics.

**Learning Outcomes**

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

* describe the constructional details of transformers **(L1)**
* demonstrate voltage regulation of transformer **(L3)**
* discuss about open and short- circuit tests of transformer **(L2)**
* explain the working principle of three phase induction motor **(L5)**
* describe torque and torque slip characteristics **(L1)**
* estimate losses and efficiency of three Phase Induction Motors **(L2)**

**Unit IV (12L + 9P)**

**Semiconductor Devices:** p-n Junction diode **-** Basic operating principle, current-voltage characteristics, rectifier circuits (half-wave, full-wave, rectifier with filter capacitor), Zener diode as Voltage Regulator; Metal oxide semiconductor field effect transistor (MOSFET): Operation of NMOS and PMOS FETs, MOSFET as an amplifier and switch.

**Learning Outcomes**

*Upon successful completion of the course, 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 **(L5)**
* describe the construction and operation of *n*-channel and *p*-channel MOSFETs **(L1)**
* explain the use of MOSFET as an amplifier and bidirectional switch **(L5)**

**Unit V** (**10L + 6P)**

**Operational Amplifiers:** The Ideal Op Amp, The Inverting Configuration, The closed loop gain, Effect of Finite open-loop gain, The Noninverting Configuration, The closed loop gain, Characteristics of Non Inverting Configuration, Effect of finite open loop gain, the voltage follower, Difference amplifiers, A Single Op-amp difference amplifier.

**Learning Outcomes**

*Upon successful completion of the course, 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)**

**Text Books:**

1. D.P.Kothari, I.J.Nagrath, Basic Electrical and Electronics Engineering, 1stedition, McGraw Hill Education (India) Private Limited, 2017.
2. B.L.Theraja, Fundamentals of Electrical Engineering and Electronics, 1stedition,S.Chand Publishing, New Delhi, 2006.
3. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits 6th edition, 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. R.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)**
* demonistrate the operation and applications of various electronic devices **(L2)**
* construct Inverting and Noninverting configurations of Op-Amp **(L5)**