Basic Electrical and Electronics Engineering

EG2106CT

Year: II Total: 7 hours/week
Part: I Lecture: 3 hours/week
Tutorial: 1 hour/week
Practical: ... hours/week

Lab: 3 hours/week

Course description:

This course is designed to understand fundamental concept of electric and electronic circuits.

Course objectives:

After completion of this course students will be able to:

- 1. Differentiate between active and passive elements and circuits.
- 2. Identify and explain the working principle of electric circuits.
- 3. Identify and explain the working principle of electronic circuits.

Course Contents:

Theory

Unit 1. Basic Electric System

[6 Hrs.]

- 1.1. Constituent parts of an electric system (Source, Load, Communication and Control)
- 1.2. Current flow in a circuit
- 1.3. Electromotive Force and Potential Difference
- 1.4. Electrical Units
- 1.5. Passive Components: Resistance, Inductance & Capacitance, Series and Parallel Combinations
- 1.6. Voltage and Current Sources: Independent, Dependent, VCVS, VCCS, CCCS, CCVS
- 1.7. Ohm's Law
- 1.8. Temperature rise and Temperature Coefficient of Resistance

Unit 2. DC Circuits and Network Theorems

[6 Hrs.]

- 2.1. Power and Energy
- 2.2. Kirchhoff's Law and Its Application: Nodal Analysis and Mesh Analysis
- 2.3. Star Delta and Delta Star Transformation
- 2.4. Superposition Theorem
- 2.5. Thevenin's Theorem
- 2.6. Norton's Theorem
- 2.7. Maximum Power Transfer Theorem
- 2.8. Reciprocity Theorem

Unit 3. Alternating Quantities

[4 Hrs.]

- 3.1. AC system
- 3.2. Waveform, Terms and Definitions
- 3.3. Average and rms values of Current and Voltage
- 3.4. Phasor Representation

Unit 4. Single – Phase AC Circuits

[4 Hrs.]

- 4.1. AC in Resistive Circuits
- 4.2. Current and Voltage in an Inductive circuit

- 4.3. Current and Voltage in an Capacitive circuit
- 4.4. Concept of Complex Impedance and Admittance
- 4.5. AC Series and Parallel Circuits
- 4.6. RL, RC and RLC Circuit Analysis and Phasor Representation

Unit 5. Power in AC Circuits

[5 Hrs.]

- 5.1. Power in Resistive Circuits
- 5.2. Power in Inductive and Capacitive Circuits
- 5.3. Power in Circuits with Resistance and Reactance
- 5.4. Active and Reactive Power: Power Factor, Importance and Measurement of Power Factor

Unit 6. Diode [6 Hrs.]

- 6.1. Conductor, Insulator and Semiconductor
- 6.2. Types of Semiconductors: Intrinsic and Extrinsic, P type and N type
- 6.3. Semiconductor Diode Characteristics
- 6.4. Diode Circuits: Clipper and Clamper Circuits
- 6.5. Zener Diode, LED, Photodiode, Varacter Diode, Tunnel Diode
- 6.6. DC Power Supply: Rectifier (Half Wave and Full Wave), Zener Regulated Power Supply

Unit 7. Transistor [6 Hrs.]

- 7.1. BJT: Types, Configurations, Modes of Operations, Working Principle
- 7.2. Biasing of BJT
- 7.3. BJT as an Amplifier and a Switch
- 7.4. Small and Large Signal Models
- 7.5. BJT as Logic Gates
- 7.6. Concept of Differential Amplifier using BJT

Unit 8. MOSFET [4 Hrs.]

- 8.1. Types and Construction of MOSFET
- 8.2. Working Principle of MOSFET
- 8.3. Biasing of MOSFET
- 8.4. Construction and working of CMOS
- 8.5. MOSFET and CMOS as Logic Gates

Unit 9. The Operational Amplifier (Op - Amp)

[4 Hrs.]

- 9.1. Basic Model, Ideal and Real Characteristics, Virtual Ground Concept
- 9.2. Inverting and Non Inverting Mode Amplifier
- 9.3. Some Applications: Summing Amplifier, Differentiator, Integrator, Comparator

Practical: [45 Hrs.]

- 1. Measurement of Voltage, Current and Power in DC Circuits
 - a) Verification of Ohm's Law
 - b) Temperature Effect in Resistance
- 2. Kirchhoff's Current and Voltage Law
 - a) Evaluate Power from V and I
 - b) Note Loading Effects in Meters
- 3. Measurement of Amplitude, Frequency and Time in Oscilloscope
 - a) Calculate and Verify Average and rms Values

- b) Examine Phase Relation in RL and RC Circuits
- 4. Measurement of Alternating Quantities
 - a) R, RL, RC Circuits with AV Excitation
 - b) AC Power, Power Factor, Phasor Diagram
- 5. Diode Characteristics, Rectifiers and Zener Diode
- 6. BJT Characteristics
- 7. MOSFET Characteristics
- 8. Voltage Amplifier using OP Amp, Comparators

Final written exam evaluation scheme			
Unit	Title	Hours	Marks Distribution*
1	Basic Electric System	6	10
2	DC Circuits and Network Theorems	6	10
3	Alternating Quantities	4	8
4	Single – Phase AC Circuits	4	8
5	Power in AC Circuits	5	8
6	Diode	6	10
7	Transistor	6	10
8	MOSFET	4	8
9	The Operational Amplifier (Op - Amp)	4	8
	Total	45	80

^{*} There may be minor deviation in marks distribution.

References:

- 1. B. L. Theraja and A. K. Theraja, "A Textbook on Electrical Technology", S Chand, Latest Edition
- 2. J. R. Cogdell, "Foundations of Electrical Engineering", Prentice Hall, Latest Edition
- 3. J. B. Gupta, "A Textbook on Electrical Technology", Katson, Latest Edition
- 4. S. Sedra and K. C. Smith, "Microelectronic Circuits", Oxford University Press, Latest Edition
- 5. Thomas L. Floyd, "Electronic Devices", Pearson Education, Latest Edition