

ELECTRICAL CIRCUIT ANALYSIS

(Core Subject)

Course Code:	10B11EC111	Semester:	1 st Semester, B. Tech (ECE/CSE/IT/CE)
Credits:	4	Contact Hours:	L-3, T-1, P-0

Course Objectives

The objective of this course is to provide insight into the circuits and the study of different techniques in different domains to use them in the analysis of circuits. Become familiar with electrical quantities such as current, voltage, resistance, power, and frequency in simple DC and AC resistive circuits. Become familiar with multiport network.

Course Outcomes

After studying this course the students would gain enough knowledge:

1. To have a crystal clear understanding of fundamentals of Ohm's law, Kirchhoff's current and voltage laws
2. To develop mathematical equations for a given circuit (using matrices and simultaneous equations, integration and differentiation) for analysis
3. To analyze a given circuit depending on types of elements, DC analysis, Transient analysis and Frequency analysis.
4. To design circuits (at least proto type models) for a given set of specifications whether in time domain or in frequency domain.
5. Perform analysis using the fundamental electrical theorems and model simple electrical systems.
6. Derive the natural, forced and complete response of simple networks

Course Contents

Unit	Topics	References (chapter number, page no. etc)	Lectures
1	Introduction: Charge, Current, voltage and power, Voltage and Current sources, Ohm's law.	Hayt: Chapter 2	2
2	Circuit Concepts: Electromotive Force (EMF), Terminal Voltage; Open-circuit and Short-circuit; Circuit Elements – Active and Passive; Voltage Divider, Current Divider; Star-Delta Transformation.	Hayt: Chapter 3, 7	4

3	Network Analysis : Voltage Source and Current Source, Source Transformation, Combination of Sources; Kichhoff's Circuit Laws; Loop-Current Analysis, Supermesh; Mesh Analysis; Node-Voltage Analysis, Supernode; Choices of Method of Analysis.	Hayt: Chapter 4	8
4	Network Theorems (DC Circuits) : Superposition Theorem; Thevenin's Theorem; Norton's Theorem; Maximum Power Transfer Theorem	Hayt: Chapter 5	8
5	DC Transients : Simple RL Circuit, Time Constant, Decay and Growth of Current; Simple RC Circuit, Discharging of a Capacitor, Charging of a Capacitor; Initial and Final Value.	Hayt: Chapter 8, 9	4
6	Alternating Voltage and Current : Physical Model for a Sinusoid, Phase and Phase Difference; Average Value, Effective Value, Form Factor and Peak Factor; Nonsinusoidal Waveforms; Power and Power Factor	Hayt: Chapter 11	2
7	AC Circuits : Concept of Phasors, Addition of Phasors Using Complex Numbers; Behaviour of R, L and C in AC Circuits. Series RL Circuit, Complex Impedance; Series RC Circuit, Complex Power; Parallel RL Circuit; Parallel RC Circuit; Series RLC Circuit and its Phasor Diagram; Parallel RLC Circuit and its Phasor Diagram, Network Theorems (AC Circuits)	Hayt: Chapter 10	8
8	Resonance in AC Circuits : Series Resonance Circuit, Effect of Variation of Frequency, Quality Factor, Voltage Magnification; Resonance Curve, Selectivity, Relationship between f_1 , f_2 , f_0 and BW; Parallel Resonant Circuit; Ideal Parallel Resonant Circuit, Current at Resonance; Quality Factor.	Hayt: Chapter 16	4
9	Two-Port Networks : Impedance, Admittance, Hybrid, Transmission Parameters; Equivalent Networks, Determination of Different Parameters.	Hayt: Chapter 17	2
Total Number of Lectures			42

Evaluation Scheme

1. Test 1: 15 marks
2. Test 2 : 25 marks
3. Test 3 : 35 marks
4. Internal Assessment : 25 marks
 - 10 Marks : Class performance, Tutorials & Assignments
 - 10 Marks : Quizzes
 - 5 marks : Attendance

Text Books

1. W.H. Hayt, J. E. Kemerly & S.M. Durbin, “Engineering Circuit Analysis (Sixth Edition)”, McGraw Hill, 2006

Reference Books

1. D.C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill Education, 2011
2. Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda, “Basic Electrical Engineering”, Tata McGraw Hill Publishing Co, 2008.
3. Van Valkenburg, “Network Analysis”, Prentice-Hall India Ltd., 2001.

Web Resources

1. <http://www.tina.com/course/course>
2. <http://nptel.ac.in/courses/108105053/>
3. <http://nptel.ac.in/syllabus/syllabus.php?subjectId=108102042>