Linear Circuit Analysis

Code	Credit Hours
EE – 111	3 - 1

Course Description

The Linear Circuit Analysis is the first course covering the Electric Circuits and Electronics stream. This course provides the undergraduate students with the foundation of basic laws and theory of basic linear electric circuits using passive elements. The course introduces concepts of charge, current and voltage to be followed with the description of current and voltage sources. An introduction to networks and circuits is accompanied by detailed discussion of Ohm's law and the Kirchhoff's laws. This is followed by circuit analysis techniques using Nodal and Mesh Analysis with particular reference to super-node and super-mesh. A comparison of Nodal and Mesh analysis is also made. The course also covers Circuit Analysis Techniques including linearity and superposition and source transformations; important theorems like Thevenin's, Norton's and Maximum Power Transfer Theorem. The circuit reduction techniques covering Delta-Wye conversion are also covered to allow the students to analyze the simplified circuits. After the resistive circuit analysis, the study of an important building block (Operational Amplifier) and energy storage elements (capacitors and inductors) is made. Transient and Steady State analysis of first order RC and RL circuits with unit step forcing function.

Text Book:

1. "Engineering Circuit Analysis (9th edition) by Hayt, Kemmerly, and Durbin." New York. McGraw-Hill Education Ltd

Reference Books:

1. "Fundamentals of Electric Circuits (4th Ed) by Charles K Alexander & Mathew N O Sadiku"

2. "Electric Circuits by Nilsson and Reidel 2. Arthur P Boresi "Advanced Mechanics of Materials", 6th Edition, John Wiley &Sons Inc.,

Prerequisites

Nil

ASSESSMENT SYSTEM FOR THEORY

Quizzes	10%
Assignments	10%
Mid Terms	30%
ESE	50%

ASSESSMENT SYSTEM FOR LAB

Quizzes	10%-15%
Assignments	5% - 10%
Lab Work and Report	70-80%
Lab ESE/Viva	20-30%

Teaching Plan

Week No	Topics	Learning Outcomes
1-2	Introduction	Introduction to Electrical Engineering. Learning Strategies. Course Conduct and Policies. Review of Units and Scales. Charge, Current, Voltage Power & Energy. Problem regarding power. Circuit Elements. Voltage and current sources Independent/dependent sources. Networks and Circuits Ohm's Law, Conductance
2-3	Voltage and Current Laws	Defining Nodes, Paths, Loops and Branches Examples of Nodes, Paths, Loops and Branches Kirchhoff's Current Law. Kirchhoff's Voltage Law Single loop circuit. Kirchhoff's Voltage Law Single loop circuit. Resistors in Series and Parallel Voltage and current division
4-5	Basic Nodal & Mesh Analysis:	Introduction, Basic Nodal Analysis The Super-node Basic Mesh Analysis. The Super-mesh Comparison of Nodal and Mesh Analysis Computer Aided Circuit analysis
6-8	Useful Circuit Analysis Techniques	Linearity and Superposition principle Source Transformations. Practical sources. Thevenin's Theorem, Practice Problems Norton's Theorem, Practice Problems Maximum Power Transfer Theorem, Practice Problems Delta – Wye Conversion. Selecting an Approach: A summary of Various Techniques Review & Problem Solving
9	**MID TERM EXAM IN WEEK 9**	
10	The Operational Amplifier.	The Ideal Op Amp. Cascaded Stages Comparators & Instrumentation Amplifiers Practical Considerations
11-13	Capacitors & Inductors	Capacitors: Voltage Current relationship, Energy Storage Inductors: Voltage Current relationship, Energy Storage Inductance and Capacitance combinations. Linearity and its Consequences. Simple Op Amp Circuits with Capacitors. Duality Computer Modelling of Circuits with Capacitors and Inductors
14-15	Basic RC and RL Circuits	Source-free RC circuits (covering exponential response) Source-free RL circuits A more General Perspective. Unit Step Function
16-17	Basic RC and RL Circuits	Driven RC Circuits. Driven RL Circuits Predicting the Response of Sequentially Switched Circuits Review of the Course
18	**End Semester Exams**	

Practical:

Experiment No	Description
1	Introduction To Basic Laboratory Equipment and Identification of Resistor colour codes
2	Introduction To PSPICE/LTSpice
3	Verification of KVL, KCL, Voltage & Current Divider Rule
4	Introduction to Multisim
5	Introduction to MATLAB
6	Nodal Analysis
7	Mesh Analysis
8	Thevenin's Equivalent Circuit
9	Norton's Equivalent Circuit
10	Verification of Maximum Power Transfer Theorem
11	Verification of DELTA-WYE Conversion
12	Operation of Oscilloscope and Function Generator
13	Operational Amplifier
14	RC and RL Circuits Transient and Forced Response
15	RC and RL Circuits Transient and Forced Response
16	Lab Exam/Semester Project Presentation