BIRZEIT UNIVERSITY

Electrical and Computer Engineering Department

Circuits Analysis, ENEE2304

Fall 2024

Instructor: Dr. M. Abu-Khaizaran **Office: Masri 216**

Text book: J. W. Nilsson & S. A. Riedel, "Electric Circuits", Pearson Ed. Ltd., 10th Ed, 2015.

ENEE2304	**1**	**CIRCUIT ANALYSIS**	**T, R**	**08:00 - 09:20**	**Masri406**
ENEE2304	**3**	**CIRCUIT ANALYSIS**	**T, R**	**09:30 - 10:50**	**Bamieh101**

Office Hours: To be announced later

Intended Learning Outcomes (ILO's):

By the end of the course the students are expected to be:

- Able to understand and apply Kirchhoff's laws, voltage divider rule, and current divider rule in the analysis of DC and AC circuits
- Able to understand and apply basic circuit theorems (nodal analysis, mesh analysis, source transformation, superposition, Thevenin's and Norton's, maximum power transfer) to DC and AC circuits (implementing phasors)
- Able to analyze natural and step response of RL and RC first order circuits
- Able to analyze natural and step response of series and parallel RLC second order circuits
- Able to understand and calculate average, apparent, reactive, complex power, power factor and power factor correction for ac circuits
- Able to understand the general concept of three phase circuits and analyze simple three phase circuits
- Able to analyze circuits using Laplace transforms
- Able to analyze and design of passive filter circuits
- Able to analyze two-port networks
- Able to use software tools (ORCAD/PSPICE) to analyze various types of circuits

Teaching Methods:

Power Point Presentations, White Board and Marker illustrations, Interactive discussions, and simulation tools

Course Outline:

1. **Introduction**
    - Basic circuit elements
    - Ohm's law
    - Kirchhoff's laws

2. **DC Circuits**
    - Introduction
    - Voltage and current dividers
    - Resistor combinations and Y-Δ Transformation
    - Measurements of voltage and Current
    - Nodal analysis
    - Loop and mesh analysis
    - Source Transformations
    - Thévenin's and Norton's Theorems
    - Maximum Power Transfer
    - Superposition

3. **Transient Analysis**
    - Introduction
    - Capacitors and Inductors and their combinations
    - First order networks natural and step responses
    - Second order networks natural and step responses

4. **AC Steady State Analysis**
    - Introduction
    - Sinusoidal functions
    - Circuit elements in Frequency domain and phasor relationships
    - Impedance and admittance
    - Basic analysis using Kirchhoff's laws
    - Y-Δ Transformation
    - Nodal analysis
    - Mesh and loop analysis
    - Source transformation
    - Thevenin's and Norton's Theorems
    - Superposition

    MidTerm Exam on Wednesday 4/12/2024

5. **Steady State Power Analysis**
    - Introduction
    - Instantaneous Power and Average Power
    - Effective ***rms*** Values
    - Complex Power
    - The Power Factor
    - Power Factor Correction
    - Power Measurements
    - Maximum Power Transfer

6. **Introduction to Laplace Transform (Review)**
    - Definition of Laplace Transform
    - The Step and Impulse (Delta) Functions
    - Functional Laplace Transforms
    - Derivation of Laplace Transform of Some Functions
    - Laplace Transform Pairs
    - Operational Laplace Transforms
    - Applying the Laplace Transform
    - Inverse Laplace Transform
    - Partial Fraction Expansion
    - Poles and Zeros of F(s)
    - Initial- and Final-Value Theorems

7. **The Laplace Transform in Circuit Analysis**
    - Circuit Elements in the s-Domain
    - Circuit Analysis in s-Domain
    - Applications of Laplace Transform in Circuit Analysis
    - The Transfer Function
    - The Transfer Function in Partial Fraction Expansions

8. **Introduction to Frequency Selective Circuits (Filters)**
    - Overview of Fourier Analysis
    - Passive Filters
    - Types of Passive Filter: Low-Pass Filters (LPF), High-Pass Filters (HPF), Band-Pass Filters, and Band-Reject Filters

9. **Two Port Networks**
    - The Immittance (Impedance or Admittance) Parameters
    - The Hybrid Parameters
    - The Transmission Parameters
    - Relation Among the Two-Port Parameters

10. **Balanced Three Phase Circuits**
    - Three phase sources
    - Analysis of Y-Y circuits
    - Power calculations

11. **Mutual Inductance and Transformers**
    - Mutual Inductance
    - Ideal Transformer

Exams and Grading

Participation	5%
Short Exams	20%
PSpice Project	10%
Midterm exam **on Wednesday 4/12/2024**	25%
Final Exam	40%

Note: You are allowed to review and object any published mark of any assessment on ritaj within 3 days from the publication date.

References

[1] Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 11th ed. Pearson, 2012.

[2] Roland E. Thomas, Albert J. Rosa, and Gregory J. Toussaint, "The Analysis and Design of Linear Circuits", 7th ed. Wiley and Sons Inc. 2012.