ECE 3413 – Intro to Electronic Circuits
Textbook: G. Rizzoni, Principles and Applications of Electrical Engineering, 4th Edition, McGraw-Hill 2004.

I. Fundamentals of electric circuits

A. Definitions of Circuit Elements and Terminology
B. Charge, Current, and Kirchoff's Current Law
C. Voltage and Kirchoff's Voltage Law
D. Electric Power and Sign Convention
E. Circuit Elements and their *i*-*v* Characteristics
F. Resistance and Ohm's Law
    a. Open and Short Circuits
    b. Series Resistors and the Voltage Divider Rule
    c. Parallel Resistors and the Current Divider Rule
G. Practical Voltage and Current Sources
H. Measuring Devices
    a. The Ohmmeter
    b. The Ammeter
    c. The Voltmeter

II. Resistive Network Analysis

A. Network Analysis
B. The Node Voltage Method
C. The Mesh Current Method
D. Node and Mesh Analysis with Controlled Sources
E. The Principle of Superposition 97
F. One-Port Networks and Equivalent Circuits
    a. Thévenin and Norton Equivalent Circuits
    b. Determination of Norton or Thévenin Equivalent Resistance
    c. Computing the Thévenin Voltage
    d. Computing the Norton Current
    e. Source Transformations
    f. Experimental Determination of Thévenin and Norton Equivalents
G. Maximum Power Transfer

III. Ideal Operational Amplifiers

A. The loop model
B. Closed-loop mode

IV. AC Network Analysis

A. Energy-Storage (Dynamic) Circuit Elements
    a. The Ideal Capacitor
    b. Energy Storage in Capacitors
    c. The Ideal Inductor
    d. Energy Storage in Inductors
B. Time-Dependent Signal Sources
    a. Sinusoids
    b. Average and RMS Values
C. Solution of Circuits Containing Energy Storage Elements (Dynamic Circuits)
    a. Forced Response of Circuits Excited by Sinusoidal Sources

D. Phasors Solution of Circuits with Sinusoidal Excitation
    a. Euler's Identity
    b. Phasors
    c. Superposition of AC Signals
    d. Impedance
    e. The Resistor
    f. The Inductor
    g. The Capacitor
    h. Admittance
E. AC Circuit Analysis Methods and Equivalent Circuits

V. Transient Analysis

A. Writing Differential Equations for Circuits Containing Inductors and Capacitors
B. DC Steady-State Solution of Circuits Containing Inductors and Capacitors: Initial and Final Conditions
    a. DC Steady-State Solution
    b. Continuity of Inductor Currents and Capacitor Voltages, and Initial Conditions
C. Transient Response of First-Order Circuits
    a. Elements of the Transient Response
    b. General Solution of First-Order Circuits
    c. Natural Response
    d. Forced Response
    e. Complete Response
    f. Energy Storage in Capacitors and Inductors
D. Transient Response of Second-Order Circuits
    a. Deriving the Differential Equations for Second-Order Circuits
    b. Solution of Second-Order Circuits
    c. Elements of the Transient Response
    d. Natural Response of a Second-Order System
    e. Forced Response
    f. Complete Response

VI. Frequency Response and System Concepts

A. Sinusoidal Frequency Response
B. Fourier Analysis
    a. Computation of Fourier Series Coefficients
    b. Response of Linear Systems to Periodic Inputs
C. Filters
    a. Low-Pass Filters
    b. High-Pass Filters
    c. Bandpass Filters, Resonance, and Quality Factor
    d. Resonance and Bandwidth
D. Bode Plots of Higher-Order Filters

VII. Operational Amplifiers Circuits and Applications

A. Active Filters
B. Integrator and Differentiator Circuits
    a. The Ideal Integrator
    b. The Ideal Differentiator
C. Physical Limitations of Operational Amplifiers
    a. Voltage Supply Limits

b. Frequency Response Limits
c. Input Offset Voltage
d. Input Bias Currents
e. Output Offset Adjustment
f. Slew Rate Limit
g. Short-Circuit Output Current
h. Common-Mode Rejection Ratio (CMRR)

VIII. AC Power

A. Power
C. Complex Power
D. Transformers