

# ECE 201

## ELECTRIC CIRCUITS AND SYSTEMS I

Summer 2011

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<b>COURSE:</b>	M W F	12:40 - 2:30 pm	Room 1145 EB
<b>CO-REQ:</b>	Math 234		
<b>INSTRUCTOR:</b>	G.M. Wierzba	Room 3215 EB	355-5225; wierzba@msu.edu
<b>WEB SITE:</b>	www.egr.msu.edu/~wierzba		
<b>OFFICE HRS:</b>	M W F	11:30 - 12:00 or by appointment	
<b>TEXTS:</b>	G.M. Wierzba, <i>ECE 201 Course e-Notes, Summer 2011 Edition</i> , available at <a href="http://stores.lulu.com/willowepublishing">http://stores.lulu.com/willowepublishing</a>  Thomas, Rosa & Toussaint, <i>The Analysis and Design of Linear Circuits</i> , Wiley, 2009 (6th Edition)		
<b>GRADING:</b>	Three one-hour exams (5/27, 6/10, 6/24)		200 pts
	Final exam (W 6/29 @ 12:40 - 2:30)*		200 pts
	Homework (normalized)*		50 pts
	<i>*You must obtain a passing grade to pass the course.</i>		
<b>POLICIES:</b>	You are expected to arrive for class on time. No laptop computers are allowed during class. No student can wear earphones during class.		
<b>HOMEWORK:</b>	Homework is to be done on 8.5" x 11" paper using only one side. It must be stapled and ragged edges must be trimmed. Whenever possible, the correct answer is to be circled or boxed. You may work with other students (list all names below yours) but the work you submit must be done by you. Assignments which are identical will all receive a grade of <b>zero</b> . You must type and run all of your own computer work. Copying of old assignments or computer files will be dealt with severely.		
<b>OTHER:</b>	Only simple scientific calculators are allowed for exams. Exam questions may have little or no partial credit. There are <b>NO MAKE UP EXAMS</b> . One 1-hour exam will be dropped in computing your grade. Late homework <b>WILL NOT</b> be accepted. Your lowest homework grade will be dropped in computing your normalized homework grade.  <i>An 85% attendance rate is required to pass the course, that is, you can miss 3.5 classes. Please keep your own record of absences.</i>		

## DETAILED TOPICS

- Chapter 1: Introduction
  - 1.1 About This Book
  - 1.2 Symbols and Units
    - Prefixes, Engineering Notation
  - 1.3 Circuit Variables
    - Current, Voltage, Power, Passive Sign Convention, Ground, Conservation of Energy, Conservation of Power
  
- Chapter 2: Basic Circuit Analysis
  - 2.1 Element Constraints
    - Electrical Network, Circuit, Resistance, Ohm's Law, V-I Characteristics, Conductance, Power, Resistor, Color Code, Precision Resistors, Ratings, Open and Short Circuits, Switches, Independent Voltage Sources, Independent Current Sources
  - 2.2 Connection Constraints
    - Kirchhoff's Current Law, Kirchhoff's Voltage Law
  - 2.3 Combined Constraints
    - Assigning Reference Marks
  - 2.4 Equivalent Circuits
    - Series Resistance, Parallel Resistance, Special Cases, Approximations, Equivalent Voltage Sources, Equivalent Current Sources, Source Transformations, Delta-to-Wye and Wye-to-Delta Transformations, Redundant Elements
  - 2.5 Voltage and Current Division
    - Voltage Divider Rule, Special Cases, Potentiometers, Current Divider Rule, Special Cases, Meter Movements, Wheatstone Bridge
  
- Chapter 3: Circuit Analysis Techniques
  - 3.1 Node-Voltage Analysis
    - Element Inspection Rule, Writing Node Equations by Inspection, Cramer's Rule, Evaluating Determinants, Node Analysis with Voltage Sources, Supernode
  - 3.2 Mesh-Current Analysis
    - Element Inspection Rule, Writing Mesh Equations by Inspection, Mesh Analysis with Current Sources, Supermesh
  - 3.3 Linearity Properties
    - Superposition Principle, Proportionality Property, Transfer Function, Unit Output Method
  - 3.4 Thevenin and Norton Equivalent Circuits
    - Thevenin's Theorem, Norton's Theorem, Relationships
  - 3.5 Maximum Signal Transfer
    - Second Derivative Test, Maximum Power Transfer Theorem, Maximum Efficiency Theorem, Computer-Aided Circuit Analysis
  - 2.7 Computer-Aided Circuit Analysis
    - SPICE, MATLAB

- Chapter 4: Active Circuits
- 4.1 Linear Dependent Sources
    - Voltage Controlled Sources, Current Controlled Sources, SPICE Models
  - 4.2 Analysis of Circuits with Dependent Sources
    - Node-Voltage Analysis, Mesh-Current Analysis, Thevenin and Norton Equivalent Circuits
  - 4.4 The Operational Amplifier
    - Notation, Ideal and Commercial Op-Amps, Non-inverting Amplifier, Zero Volt - Zero Current Property, Modeling a Non-inverting Amplifier, Limitations Due to the Power Supply, Voltage Follower, Inverting Amplifier and Model, Differential Amplifier and Model, Op-Amp Circuit Analysis, Bridge-T Amplifier
- Chapter 6: Capacitance and Inductance
- 6.1 The Capacitor
    - V-I Relationship of Capacitance, Plotting Power and Energy with SPICE, Capacitor, Modeling a Capacitor with Ideal Elements
  - 6.2 The Inductor
    - V-I Relationship of Inductance, Plotting Power and Energy with SPICE, Inductor, Modeling an Inductor with Ideal Elements
  - 6.4 Equivalent Capacitance and Inductance
    - Series and Parallel Combinations of Capacitance, Series and Parallel Combinations of Inductance
- Chapter 7: First- and Second-Order Circuits
- 7.2 First-Order Circuit Step Response
    - Step Response of an RC Circuit, Algorithm for any One Capacitance Circuit, Time Constant, Interpretation of the Time Constant, Step Response of an RL Circuit, Algorithm for any One Inductance Circuit, Time Constant, Sequential Switching, Algorithm for Sequential Switching, PSpice Simulation with Switches
  - 7.4 First-Order Circuit Sinusoidal Response
    - Natural and Forced Response, RC Circuits
  - 7.5 The Series RLC Circuit
    - Natural Response, Characteristic Equation, Overdamped, Critically Damped and Underdamped Response, SPICE
  - 7.6 The Parallel RLC Circuit
    - Natural Response, Characteristic Equation, Overdamped, Critically Damped and Underdamped Response, SPICE
  - 7.7 Second-Order Circuit Step Response
    - Complete Response of a Series RLC Circuit with a Step Input, SPICE