ECE 202

CIRCUITS AND SYSTEMS II

Summer 2008

COURSE:	M W F	12:40 pm - 2:30 pm	Room 1255 AH
PRE-REQ:	ECE 201		
CO-REQ:	MTH 235		
INSTRUCTOR:	G.M. Wierzba	Room 3215 EB	355-5225; wierzba@msu.edu
WEB SITE:	www.egr.msu.edu/~wierzba		
OFFICE HRS:	M W F	11:30 - 12:00 or by appointment	

TEXTS: G.M. Wierzba, *ECE 202 Course e-Notes*, *Summer 2008 Edition*, available at http://stores.lulu.com/willowepublishing

Thomas & Rosa, *The Analysis and Design of Linear Circuits*, Wiley, 2006 (5th Edition)

GRADING:

Three one-hour exams (7/14, 7/25, 8/6)	200 pts
Final exam (W 8/13 @ 12:40 - 2:30)*	200 pts
Homework (normalized)*	50 pts

**You must obtain a passing grade to pass the course.*

POLICIES: You are expected to arrive for class on time. No laptop computers are allowed during class. No student can wear earphones during class.

HOMEWORK: 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 **zero**. You must type and run all of your own computer work. Copying of old assignments or computer files will be dealt with severely.

OTHER: Only simple scientific calculators are allowed for exams. Exam questions have little or no partial credit. There are NO MAKE UP EXAMS. One 1-hour exam will be dropped in computing your grade. Late homework WILL NOT be accepted. Your lowest homework grade will be dropped in computing your normalized homework grade.

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.

DETAILED TOPICS:

Chapter 8: Sinusoidal Steady-State Response

5.4 The Sinusoidal Waveform
Cycle, Period, Frequency, Amplitude, Phase Angle

8.1 Sinusoids and Phasors
Vector Representation of Sinusoids, Euler's Formula, Complex Numbers, Rectangular and Polar Form, Phasor Transform, Inverse Phasor Transform, Addition- Subtraction- Multiplication-Division of Complex Numbers

8.2 Phasor Circuit Analysis
Kirchhoff's Current Law, Kirchhoff's Voltage Law, Resistance in Phasor Form, Capacitance in Phasor Form, Inductance in Phasor Form, Impedance, Admittance

8.3 Basic Circuit Analysis with Phasors
Series Equivalence of Impedances, Reactance, Phasor Analysis Algorithm, Voltage Divider Rule, Parallel Equivalence of Impedances, Susceptance, Current Divider Rule, SPICE, Resonant Frequency of an Impedance, Series Resonance, Parallel Resonance

8.4 Circuit Theorems with Phasors
Superposition, Source Transformations, Thevenin and Norton Equivalent Circuits

8.5 General Circuit Analysis with Phasors
Node-Voltage Method, MATLAB, Mesh-Current Method

8.6 Energy and Power
Average Power for a Resistance, Inductance and Capacitance, Root-Mean-Square

Chapter 9: Laplace Transforms

9.1 Signal Waveforms and Transforms
Definition of the Laplace Transformation, Step Function, Impulse Function, Inverse Transformation, Uniqueness Property

9.2 Basic Properties and Pairs
Linearity, Integration Property, Ramp Function, Differentiation Property, Nth Derivative, S-Domain Translation Property, Time Domain, Translation Property, Table of Transform Pairs

9.3 Pole-Zero Diagrams
Definition of pole and zero, Sketches, MATLAB

9.4 Inverse Laplace Transforms
Rational Function, Partial Fraction Expansion, Residues, Complex Poles, Sum of Residues

9.5 Some Special Cases
Improper Rational Function, Multiple Poles, MATLAB

Chapter 10: S-Domain Circuit Analysis

10.1 Transformed Circuits
Element Constraints in the S-Domain, Sources, Connection Constraints, Examples of the Complete Response of RC and RL switching circuits

10.2 Basic Circuit Analysis in the S-Domain
Phasors revisited

10.3 Circuit Theorems in the S-Domain
Proportionality, Superposition, Norton Equivalent Circuits
10.4 Node-Voltage Analysis in the S-Domain
S-Domain Node Equations by Inspection
10.5 Mesh-Current Analysis in the S-Domain
S-Domain Mesh Equations by Inspection

Chapter 11: Network Functions

11.1 Definition of a Network Function
Natural and Forced Response, Stability
11.2 Network Functions of One- and Two-Port Circuits
Driving Point Impedance, Transfer Functions
11.3 Network Functions and Impulse Response
Definition, Pspice Example of an Impulse Response
11.4 Network Functions and the Step Response
Definition
11.6 Impulse Response and Convolution
Definition of Convolution, Causal and Non-Causal Signals, Equivalence of S-Domain and t-Domain Convolution, Graphical Approach
11.7 Network Function Design
Synthesis, First Foster RC Forms, NAB Equalizer Design, Magnitude Scaling

Chapter 12: Frequency Response

12.1 Frequency Response Descriptors
Types of Filters, Pass Bands, Stop Bands
12.5 Bode Diagrams
Product of Terms, Decibel, First-Order Inspections Forms, Making Log Paper and Reading Points
12.2 First Order Circuit Frequency Response
Audio Frequency Inverting Amplifier, Interpretations of Poles and Zeros, RIAA Playback Equalizer, First-Order High-Pass Response, Audio Frequency Intergrator, First-Order Low-Pass Response, Low-Noise Inverting Amplifier, Band-Pass Using First-Order Circuits
12.3 Second-Order Circuit Frequency Response
Second-Order Inspection Forms, RLC Low-Pass Filter, Hiss Filter, RLC High-Pass Filter, RLC Band-Pass Filter, RLC Band-Stop Filter, Design Procedure, Bandwidth, Data Recorder Filter Design

Chapter 13: Fourier Series

13.2 Fourier Coefficients
Fourier Series, Sawtooth Example, Fundamental Frequency, Harmonics, Alternative Form of the Fourier Series
13.3 Waveform Synthesis
Even Symmetry, Odd Symmetry, Half-Wave Symmetry

Chapter 15: Mutual Inductance

15.1 Coupled Inductors
Magnetic Flux, V-I Characteristics
15.2 The Dot Convention
Examples of Coupled Coils
15.3 Energy Analysis
Coupling Coefficient
15.4 The Ideal Transformer
Perfect Coupling, Equivalent Input Resistance
15.5 Transformers in Sinusoidal Steady-State
Model

Chapter 16: Power in Sinusoidal Steady-State

16.1 Average and Reactive Power
16.2 Complex Power
Apparent Power, Power Factor, Reactive Power Factor, Power Factor Angle, Power Triangle, Complex Power and Load Impedance
16.3 AC Power Analysis
Conservation of Complex Power Theorem, Power in Purely Resistive Circuits, Power in Purely Capacitive Circuits, Power in Purely Inductive Circuits
16.4 Load-Flow Analysis
Power Factor Correction, Step-up and Step-Down Transformers, Maximum Real Power Transfer Theorem
16.5 Three-Phase Circuits
Three- Phase Voltage Sources, Phase Sequence, Line / Phase Relationships
16.6 Three-Phase AC Power Analysis
Y-Connected Source and Y- Connected Load, Y-Connected Source and Δ-Connected Load