Michigan State University
Depart of Electrical and Computer Engineering

ECE 202 Circuits and Systems II
(Fall 2007)

Instructor(s):

Michael S. Chan	G. M. Wierzba (also ECE 203)
2214A EB	3215 EB
432-3525	355-5225
schan@msu.edu	wierzba@msu.edu

Lectures:

M W F, 8:00 a.m. – 8:50 a.m., 1145 EB

Office Hours:

M W F, 9:00 a.m. – 10:00 a.m., or by appointment, 2214A EB

Help Room:

TBA

Prerequisite:

ECE 201 (Circuits and Systems I) or equivalent course

Co-requisite:

MTH 235, ECE 203 (**new**)

Course Web Page:

http://www.egr.msu.edu/classes/ece202/schan/
This web site will serve as the main mechanism for information exchange in this course. All homework assignments, solutions, and any other handouts will be made available at this site. Course announcements and lecture schedule updates will also be posted here so please visit the web site frequently.

Text:

G.M. Wierzba, *ECE 202 Course e-Notes, Fall 2007 Edition*
(available on CD at Agriculture Hall Document Center, Room 47 Agriculture Hall).

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

Course Synopsis:

This course provides a fundamental background in the analysis of circuits and systems in the frequency domain. Topics covered include phasor representation, Laplace transform, frequency response, Fourier series, mutual induction and power in sinusoidal steady state. The course will also utilize PSPICE and MATLAB software packages to for circuit analyses.

Grading:

Exam I (Friday, 9/21, 8:00-8:50 a.m.):	25%[1]
Exam II (Friday, 10/19, 8:00-8:50 a.m.):	25%[1]
Exam III (Friday, 11/16, 8:00-8:50 a.m.):	25%[1]
Final Exam (Wednesday, 12/12, 7:45-9:45 a.m.):	40%[2]
Homework Assignments (normalized):	10%[2]
Attendance (≥ 85%):	true[2]

[1] ***The midterm exam with the lowest score will be dropped***
[2] ***You must obtain a passing grade for this component to pass the course***

1. *Examinations*
   There will be three in-class midterm exams and a final exam. The midterm exam with the lowest score will not be used in calculating the final course grade. The midterm exams will count 50%, and the final exam 40%, toward your course grade. The midterm exams are NOT cumulative. The final exam IS comprehensive. **No makeup exams will be given**.

2. *Homework Assignments*
   There will be **11** problem sets/assignments in this course, assigned approximately weekly (except for the weeks when there is a midterm examination for this course). The homework assignments will constitute 10% of the final grade. The lowest homework grade will be dropped in computing the normalized homework grade.

   Each homework assignment will be posted on the course web site with due date. Posting of new assignments will be announced in class. Solutions to each homework problem set will be posted on the web site after the due date.

   Homework solutions must be submitted during the class period on the due date unless prior permission has been obtained from the instructor to submit otherwise. No late homework solution submissions will be accepted. Submitted homework solutions must be originals in the student's own handwriting. No other submissions (electronic, fax, etc.) will be graded. Solutions must be legible and clear to receive credit.

   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 is considered academic dishonesty and will be dealt with severely.

3. *Attendance*
   An 85% attendance is required to pass the course (i.e., although strongly discouraged, you may miss at most 7 classes). ***Please keep your own record of absences*.**

Course Grade Point:

The final quality point score (e.g., 3.5, 4.0) will be assigned according to a curve.

Incomplete Grade:

An *Incomplete* grade will be given only in unusual cases of illness or other personal emergency which causes the student to miss a significant amount of the course. ***This grade cannot be given for any other reason.*** A student who misses the final exam without satisfactory explanation will receive a failing grade in the course.

Important Dates:

1. Midterm Examinations: Fridays, 9/21, 10/19 and 11/16, 8:00-8:50 a.m.
2. Final Examination: Wednesday, 12/12, 7:45-9:45 a.m.
3. ECE 203 Final Examination: Friday, 11/30, 8:00-8:50 a.m., 1145 EB (in class)
4. No Class: Monday, 9/3 (Labor Day)
5. No Class: Friday, 11/23 (Thanksgiving Break)

Academic Honesty and Integrity:

Article 2.3.3 of the *Academic Freedom Report* states:

> *The student shares with the faculty the responsibility for maintaining the integrity of scholarship, grades, and professional standards.*

In addition, the Department of Electrical and Computer Engineering and this instructor adhere to the University regulations, policies, and ordinances on academic honesty and integrity, as specified in *General Student Regulation 1.0, Protection of Scholarship and Grades*, the *All-University Policy on Integrity of Scholarship and Grades*, and *Ordinance 17.00, Examinations*, all of which are included in *Spartan Life*, *Student Handbook and Resource Guide*, as well as on the MSU web site (www.msu.edu). Students who violate these rules may receive a penalty grade, including, but not limited to, a failing grade on the assignment or in the course. The following conduct is specifically cited: (1) Supplying or using work or answers that are not one's own; (2) Providing or accepting assistance with completing examinations; (3) Interfering through any means with another's academic work; and (4) Faking data or results.

Accessibility:

Michigan State University is committed to providing equal opportunity for participation in all programs, services and activities. Accommodations for individuals with current RCPD documentation may be requested by contacting the instructor at the start of the term and/or two weeks prior to the accommodation date (e.g., examination). Requests received after this date will be honored whenever possible.

DETAILED COURSE TOPICS

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

Chapter 8: Sinusoidal Steady-State Response

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, Thévenin 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

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