PURDUE
UNIVERSITY

SCHOOL OF ELECTRICAL
AND COMPUTER ENGINEERING
UNDERGRADUATE COUNSELING OFFICE

To: The Engineering Faculty
From: School of Electrical and Computer Engineering
Re: ECE 20002

The School of Electrical and Computer Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

ECE 20002 Electrical Engineering Fundamentals II
Lecture: 3 credits
Semesters offered: Fall, Spring Summer
Non-repeatable

Pre-requisites: ECE 20001 Minimum Grade of C and (MA 26200 [may be taken concurrently] or MA 26600 [may be taken concurrently] or MA 366 [may be taken concurrently]).

Requisites by Topic:
Prerequisites: Elementary linear circuit analysis including dc, transient, and phasor techniques. Concurrent Prerequisites: Differential equations.

Course Description
Continuation of Electrical Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic components through single-transistor and operational amplifiers. The course ends with consideration of how circuits behave and may be modeled for analysis at high frequencies.

Reason
Content from current ECE 20100, 20200 and 25500 has been evaluated and redistributed into two new courses that will replace these three aforementioned courses. Please see syllabus (currently being taught as a variable title experimental course ECE 29595).

History of Previous Offering
This course has run as an experimental course for three semesters.

Michael R. Melloch, Associate Department Head of ECE

465 Northwestern Avenue · West Lafayette, IN 47907-2035 USA
Phone: (765)494-3390 · FAX: (765)494-3393 · E-mail: *eceugo@ecn.purdue.edu*

SPRING 2018

ECE 29595-H02
ECE Fundamentals II – Honors
(CRN 21048)

EE 226: 7:30-8:20 MWF

Instructor: Dr. Thomas M. Talavage (tmt@purdue.edu)
Office: MSEE 362 / 49-45475
Office Hours: "Open Door" policy (Best: MF afternoons, T/Th most times)

Teaching Assistant: Sumra Bari (sbari@purdue.edu)
Office: MSEE 399
Office Hours: T 9am-Noon; Th 3pm-6pm

Required Text: Siebert, ***Circuits, Signals and Systems***, MIT Press, 1986, ISBN 9780262690959.

Class Homepage: *See Blackboard*

Course Description: Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic components through single-transistor and operational amplifiers. The course ends with consideration of how circuits behave and may be modeled for analysis at high frequencies.

Learning Objectives: A student who successfully fulfills the course requirements will have demonstrated:

i. an ability to analyze 2nd order linear circuits with sources and/or passive elements [a,e,k]

ii. an ability to compute responses of linear circuits with and without initial conditions via one-sided Laplace transform techniques [a,e,k]

iii. an ability to compute responses to linear circuits using transfer function and convolution techniques [a,e,k]

iv. the ability to analyze and design transistor amplifiers at low, mid and high frequencies [a,c,e,k]

v. an ability to work with transmission line models to analyze circuits at high-frequency [a,e,k]

vi. the ability to use a CAD tool (e.g., SPICE) in circuit analysis and design [a,b,c,e,k]

Projects: Circuit simulation/modeling projects (using SPICE or MATLAB) will be assigned at various times during the semester with due dates indicated at the time the assignment is distributed. All projects are to be submitted *electronically* (code plus a PDF document) by the due date.

Homework: Homework will be assigned approximately on a weekly basis, with due dates indicated on the assignment document.

All homework problems are to be turned in during lecture, at the beginning of the class period.

Please print your name legibly at the top of each submitted page.

Be sure to clearly identify the final answer in each problem by drawing a box around it. Include units in your answers and only the appropriate number of significant digits. Also, please ***staple*** all assignments. We will not be responsible for lost pages if your assignment is not stapled.

Quizzes: I frequently give short in-class quizzes to encourage thought about the material being presented during lecture. These quizzes will comprise the equivalent of *one* homework assignment with regard to final grade computation.

Exams: Three lecture period (50 minute) exams will be given during the course of the semester, at the approximate times indicated in the course schedule.

Grading: It is anticipated that grades will be assigned using a straight 90/80/70/60 scale, however some allowance may be made for exams written such that the class performs at an average level below 70%. *If everyone performs extremely well, there will be many high grades. If everyone performs extremely poorly, there will be many low grades.*

Assignment	*Points*
Homework	50
Quizzes	50
Circuit Simulation/Modeling Projects	100
In-Class Exam 1	100
In-Class Exam 2	100
In-Class Exam 3	100
Final Exam	200
Total	*700*

Outline:

Principal Topics	*#Weeks*
Circuit Analysis Foundations	1
2nd Order Circuits	2
Laplace Transforms in Circuit Analysis	3
Variable Frequency Circuits	3
Transistor Amplifiers	2
Operational Amplifiers	2
High-Frequency Effects and Circuit Models	2

Course Policies:

- I will assume that you have read relevant material BEFORE coming to class (see the attached schedule).
- Come to class ON TIME.
- I encourage you to use e-mail to communicate with me. You'll probably find it easier to get short questions answered by e-mail rather than during office hours.
- **LATE HOMEWORK WILL NOT BE ACCEPTED.** All assignments are to be turned in at the beginning of the indicated class period.

THERE WILL BE NO EXCUSED ABSENCES OR ASSIGNMENTS.

- There will be NO *written* make-up exams. If you cannot avoid missing an exam (and have supporting documentation), contact me BEFORE the exam and we'll arrange for an *oral* make-up exam, to take place at the whiteboard in my office.
- Regrade requests must be submitted within one week of the return of the exam or homework in order to receive consideration. A regrade request consists of the exam or homework in question and a written explanation of why you believe more points should have been awarded. Be aware that, under a regrade request, the ENTIRE assignment will be regraded.
- In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. In such an event, information will be provided through Blackboard Vista.
- I always welcome constructive comments on how the course can be improved. Please let me know of your suggestions.

Academic Honesty Policies:

- All ECE 29595 coursework must be done individually. I encourage you to discuss and collaborate on ideas for doing the homework, but what you hand in should be your own work. *Do not read another student's solution or allow yours to be read.*
- *All cases of cheating on homework or project assignments (e.g., plagiarism, duplicate assignments) will result in a SEMESTER homework/quiz or project grade of **0** for all parties concerned.* If you are uncertain as to what constitutes plagiarism or cheating, please consult Prof. Talavage **before** you undertake to complete an assignment.
- All cases of cheating on an EXAM will result in a grade of zero for either that exam *or the semester*, at the discretion of the instructor. When the end of an exam is announced, students who fail to cease working and to hand in their exams immediately will be considered to be cheating, and their exams will be confiscated and WILL NOT be graded.
- All cases of cheating will be reported to the Assistant Head of the School of Electrical and Computer Engineering and to the Office of the Dean of Students. If those involved in the cheating incident are found by either of these parties to be repeat offenders, disciplinary action may be taken by the University.

Along with the rest of the ECE faculty, I expect every member of the Purdue community to practice honorable and ethical behavior both inside and outside the classroom. Any actions that might unfairly improve a student's score on homework or examinations will be considered cheating and will not be tolerated. From the Purdue Dean of Students "Student Code of Conduct" web page:

The following actions constitute misconduct for which students may be subject to administrative action or disciplinary penalties.

Dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty. The commitment of the acts of cheating, lying, stealing, and deceit in any of their diverse forms (such as the use of ghost-written papers, the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest.

Once again, I encourage you to speak with me prior to engaging in any activity that may be construed as cheating.

Spring 2018 ECE 29595-H02 Schedule (Tentative)

Approx. Lectures	Topic(s)	Sources
1-2	Modeling circuits as differential equations; solutions	Notes
3	Computational models for circuit simulation	Notes
4-9	2nd order circuits (undamped/damped LC) with ODE solutions	Notes
10	Laplace Transforms: definitions, signals, simple pairs	*Siebert* 2.1-2.2
11	***EXAM #1***	
12	Laplace Transforms: Inverse via partial fraction expansion	*Siebert* 2.3
13	Laplace Transforms: Solution of integro-differential equations	*Siebert* 2.4
14	Laplace Transforms: Circuit analysis; incorporation of initial conditions	*Siebert* 2.5
15	Transfer function, H(s); Impedance; Admittance	*Siebert* 3.1-3.3
16	Impulse response, h(t); step response; initial/final value	*Siebert* 11.1-11.3
17	Time-domain convolution integral; convolution algebra	*Siebert* 10.1-10.2
18	Response decomposition; Steady-state analysis	Notes
19-20	System interconnection via Two-Ports (y- and h-parameters)	*Siebert* 3.App, 5.1
21	Switching in linear circuits	Notes
22	Complex plane: pole/zero plots & stability; frequency response, $H(j\omega)$	*Siebert* 4.1-4.2
23	***EXAM #2***	
24	Magnitude and Frequency scaling; Resonance	*Siebert* 4.2, 4.4
25-27	Passive filters (lowpass, highpass, bandpass)	*Siebert* 4.3
28	Transistors (FETs, BJTs)	Notes
29-32	Transistor applications: Amplifiers (single-stage and operational)	Notes
33-35	Operational amplifiers: Models and circuits	Notes
36	***EXAM #3***	
37-39	Active filters with operational amplifiers	Notes
40-41	High-frequency effects: Transmission lines	Notes
42-44	High-frequency effects: Behavior and nonidealities	Notes
	FINAL EXAM	