No: ECE 3570

Title: Electronics I.

Credits: 4 (LCT:3, Lab:1)

WSU Catalog Description: Prereq. or coreq: ECE3300 and ECE 3330. DC and small signal analysis of diodes, MOSFETs, and BJTs circuits; operational amplifiers, single-stage amplifiers, differential pair, gain, input resistance, output resistance, and bandwidth of amplifiers. (T)

Prerequisites and co-requisites are checked automatically at the time of registration. However, it is ultimately a student's responsibility to make certain that they have the prerequisites and co-requisites for a course. Students must remain registered for a co-requisite course throughout the semester. Advisors will check course prerequisites and co-requisites during the 5th and 6th week of the semester. Any student found to be registered for a course without meeting these requirements, and without an official waiver on file, will be administratively withdrawn from the course.

Coordinator: Yong Xu, Professor of Electrical and Computer Engineering

Instructor: Yong Xu
Office Hours: T 2 pm-3:30 pm (or by appointment) Office Location: 3131 Engineering Phone: 313-577-3850 Email: yongxu@wayne.edu
Course Meeting Time: T Th 3:30 PM – 5:00 PM
Course Meeting Location: 1163 Main

Goals: To provide students with basic analytical and laboratory skills in the analysis and design of fundamental analog circuits. To prepare students for more advanced courses in circuit design/analysis.

Learning Objectives: At the end of this course, students will be able to:

1. Understand the terminal characteristics of operational amplifiers, and design/analyze fundamental circuits based on operational amplifiers.
2. Understand the operation principle and characteristics of diodes, and design/analyze fundamental circuits based on diodes.
3. Understand the operation principle and characteristics of BJTs, and design/analyze fundamental amplifiers based on BJTs.
4. Understand the operation principle and characteristics of MOSFETs, and design/analyze fundamental amplifiers (including differential pair) based on MOSFETs.
5. Construct and study fundamental circuits based on operational amplifiers, diodes, BJTs, and MOSFETs experimentally (lab skills).


Reference Texts: none
Prerequisites by Topic: (ECE 3300 Introduction to electrical circuits and ECE 3330 Electrical circuits II) Electrical quantities, waveforms, Ohm’s law, Kirchhoff’s laws, nodal and mesh analysis, Thevenin’s theorem, Norton’s theorem, and other network theorems, independent current source and voltage source, dependent current source and voltage source, principle of superposition, complex frequency concepts, frequency response.

Topics:
1. Chapter 1: introduction (1 lecture)
2. Chapter 2: Operational amplifiers (3 lectures)
   a. terminal characteristics of ideal op amp.
   b. inverting configuration
   c. non-inverting configuration
   d. difference amplifier
   e. large signal operation: output voltage saturation and output current limits
3. Chapter 3: Diodes (5 lectures)
   a. ideal diode
   b. terminal characteristics and models of real diodes (pn junctions)
   c. small signal analysis
   d. zener diode
   e. diode rectifiers and other diode circuits
   f. basic semiconductor physics behind pn junctions
4. Chapter 4: Bipolar junction transistors (BJTs) (7 lectures)
   a. physical structure and modes of operation.
   b. DC analysis of BJT circuits
   c. small signal analysis
   d. single-stage configurations
5. Chapter 5: Metal-oxide-semiconductor field-effect transistors (MOSFETs) (6 lectures)
   a. physical structure and modes of operation
   b. DC analysis of MOSFETs circuits
   c. small-signal analysis.
   d. single-stage configurations.
   e. frequency response of amplifiers
6. Chapter 6: Differential amplifiers (2 lectures)
   a. large signal operation
   b. small signal operation, equivalent half circuit

Course Structure: The class meets twice a week, 1.5 hours each for total 3 credit hours. The lab session meets once a week.

Computer Resources: Multisim or Altium will be used for the circuit simulation.

Laboratory Resources: Please refer to the syllabus of Lab session.

Laboratory Policy: Please refer to the syllabus of Lab session.

Distribution of Points:
   Final score: 75% Lecture + 25% Lab
   Lecture: Midterm I (25%), Midterm II (25%), Final (40%) and quizzes (10%)
Grading Scale:  A: 90.0~100;  A-: 85.0~89.9;  B+: 80.0~84.9;  B: 75.0~79.9;  B-: 70.0~74.9;  C: 60.0~69.9;  F: <60

Attendance:  Students are expected to attend all lectures

Tentative Schedule:
1.  Chapter 1 Introduction (9/3/15)
2.  Chapter 2 Operational amplifiers (9/8/15-9/15/15)
3.  Chapter 3 Diodes (9/17/15 – 10/1/15)
4.  Midterm I (10/8/15)
5.  Chapter 4 Bipolar Junction transistors (10/13/15 – 11/5/15)
6.  Midterm II (11/10/15)
7.  Chapter 5 Field-effect transistors (FETs) (11/12/15-12/3/15)
8.  Chapter 6 Differential amplifiers (12/8/15, 12/10/15)
9.  Final (TBD)

Course Drops and Withdrawals:  In the first two weeks of the (full) term, students can drop this class and receive 100% tuition and course fee cancellation. After the end of the second week there is no tuition or fee cancellation. Students who wish to withdraw from the class can initiate a withdrawal request on Pipeline. You will receive a transcript notation of WP (passing), WF (failing), or WN (no graded work) at the time of withdrawal. No withdrawals can be initiated after the end of the tenth week. Students enrolled in the 10th week and beyond will receive a grade. Because withdrawing from courses may have negative academic and financial consequences, students considering course withdrawal should make sure they fully understand all the consequences before taking this step. More information on this can be found at: http://reg.wayne.edu/pdf-policies/students.pdf

Makeup Exam and Makeup Assignment Policy:  No makeup exams/quizzes.

Outcome Coverage:
(a) an ability to apply math, science and engineering knowledge.  The lectures, homework, lab projects and exams all require direct application of mathematics, scientific, and engineering knowledge, such as equation solving, circuit analysis, semiconductor physics, and hands-on lab skills.
(b) an ability to design and conduct experiments, as well as to analyze and interpret data.  Students conduct fundamental circuit experiments and process raw data to verify electronic theories.
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.  The students are expected to use the techniques and skills learned in this course, such as DC/small signal analysis and miller’s theorem, to solve practical electronic problems and software for assistance of the circuit analysis/design.

Religious holidays (from the online Academic Calendar):  Because of the extraordinary variety of religious affiliations of the University student body and staff, the Academic Calendar makes no provisions for religious holidays. However, it is University policy to respect the faith and religious obligations of the individual. Students with
classes or examinations that conflict with their religious observances are expected to notify their instructors well in advance so that mutually agreeable alternatives may be worked out.

Student Disabilities Services

- (edited statement from the SDS web site): If you have a documented disability that requires accommodations, you will need to register with Student Disability Services for coordination of your academic accommodations. The Student Disability Services (SDS) office is located in the Adamany Undergraduate Library. The SDS telephone number is 313-577-1851 or 313-202-4216 (Videophone use only). Once your accommodation is in place, someone can meet with you privately to discuss your special needs. Student Disability Services’ mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.

- Students who are registered with Student Disability Services and who are eligible for alternate testing accommodations such as extended test time and/or a distraction-reduced environment should present the required test permit to the professor at least one week in advance of the exam. Federal law requires that a student registered with SDS is entitled to the reasonable accommodations specified in the student’s accommodation letter, which might include allowing the student to take the final exam on a day different than the rest of the class.

Academic Dishonesty -- Plagiarism and Cheating (edited statement from the DOSO’s web site): Academic misbehavior means any activity that tends to compromise the academic integrity of the institution or subvert the education process. All forms of academic misbehavior are prohibited at Wayne State University, as outlined in the Student Code of Conduct (http://www.doso.wayne.edu/student-conduct-services.html). Students who commit or assist in committing dishonest acts are subject to downgrading (to a failing grade for the test, paper, or other course-related activity in question, or for the entire course) and/or additional sanctions as described in the Student Code of Conduct.

- Cheating: Intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information or assistance in any academic exercise. Examples include: (a) copying from another student’s test paper; (b) allowing another student to copy from a test paper; (c) using unauthorized material such as a "cheat sheet" during an exam.

- Fabrication: Intentional and unauthorized falsification of any information or citation. Examples include: (a) citation of information not taken from the source indicated; (b) listing sources in a bibliography not used in a research paper.

- Plagiarism: To take and use another’s words or ideas as one’s own. Examples include: (a) failure to use appropriate referencing when using the words or ideas of other persons; (b) altering the language, paraphrasing, omitting, rearranging, or forming new combinations of words in an attempt to make the thoughts of another appear as your own.

- Other forms of academic misbehavior include, but are not limited to: (a) unauthorized use of resources, or any attempt to limit another student’s access to educational resources, or any attempt to alter equipment so as to lead to an incorrect answer for subsequent users; (b) enlisting the assistance of a substitute in the taking of examinations; (c) violating course rules as defined in the course syllabus or other written information provided to the student; (d) selling, buying or stealing all or part of an un-administered test or answers to the test; (e) changing or altering a grade on a test or other academic grade records.