Syllabus
ECE 345 – Electronics, fall 2013

Lecturer: James W. Phegley, Ph.D.
Office: ENGR. E-210
Office Phone: 453-7044
Office Hours: Monday, Wednesday, and Friday from 1:00 to 3:00 and by appointment.
Email: phegley@engr.siu.edu

Lecture: M, W, F − 9:00 to 9:50, ENGR. A-222
Labs: Section 001 Tuesday − 11:00 to 1:50 ENGR. E-237
Section 002 Thursday − 2:00 to 4:50 ENGR. E-237

Textbook: Behzad Razavi, "Fundamentals of Microelectronics", John Wiley and Sons, Inc., 2008.

References: Adel S. Sedra and Kenneth C. Smith, "Microelectronic Circuits, 6th edition", Oxford University Press, 2010. Marc E. Herniter, "Schematic Capture with Cadence PSpice, 2cd edition", Prentice Hall 2003.

Course Topics:
Chapters 1 – 3: Introduction to microelectronics, Basic physics of semiconductors, Diode Models and circuits (Test 1).
Chapters 4 and 5: Physics of bipolar junction transistors and Bipolar amplifiers (Test 2).
Chapters 6 and 7: Physics of MOSFETs and MOSFET amplifiers (Test 3)
Chapter 8: Operational amplifiers, op-amp circuits, and non-ideal characteristics of the op-amp (Final Exam).

Evaluation:

Test 1, Chaps. 1 – 3, (Friday, Sept. 20)	20%
Test 2, Chaps. 4 – 5, (Friday, Oct. 18)	20%
Test 3, Chaps. 6 – 7, (Friday, Nov. 15)	20%
Final Exam, Chaps. 1 – 8, (Wednesday, Dec 11, 7:50 - 9:50 P.M.)	20%
Homework	10%
Lab	10%

Notes:
1.) Students are responsible for all announcements made in class.
2.) If a test (other than the final exam) is missed for a legitimate reason a grade may be given based on the remaining work.
3.) Late homework is not accepted.
4.) Students are expected to conduct themselves in a professional and ethical manner. Failure to do so could count against the final grade.
5.) Attendance will be taken at random throughout the semester; excessive absences could count against the final grade.

1. **Course number and name**: ECE 345 Electronics
2. **Credits and contact hours**: 4 credits, Three 50-minute sessions per week, Ten 3-hour laboratory experiments
3. **Course Committee**: S. Ahmed, M. Sayeh, H. Wang
4. **Text book**:
   [1] Behzad Razavi, "Fundamentals of Microelectronics", John Wiley and Sons, Inc., 2008
   Reference and supplemental materials:
   [1] Adel S. Sedra and Kenneth C. Smith, "Microelectronic Circuits, 6th edition", Oxford University Press, 2010
   [2] Marc E. Herniter, "Schematic Capture with Cadence PSpice, 2cd edition", Prentice Hall, 2003
5. **Specific course information**
   a. (catalog description): Fundamental electronics and basic signal processing. Characteristics and typical applications of analog and digital electronics modules. Operational amplifiers. Fundamentals of transistors.
   b. prerequisites or co-requisites: PHYS 205b, ECE 235
   c. Required for EE and CpE majors
   d. Professional Component {Credit Hours}

Mathematics	0	Sciences	0	General Ed.	0
Eng. Science	3	Eng. Design	1		

A. By the time of Exam #1 (after about 15 lectures), the students should be able to do the following:

1. Solve circuit problems with ideal diodes. (a, e, k)
2. Apply the constant voltage drop model and the piece-wise linear diode model to diode problems. (a, e, k)
3. Apply the small signal diode model to calculate the changes in the diode voltage for changes in the diode current. (a, e, k)
4. Calculate the carrier concentration in p and n type materials. Calculate the resistivity of doped semiconductors. Calculate the built-in voltage, reverse saturation current, and the junction capacitance of p-n junctions. (a, e, k)
5. Use diodes to design half wave, full wave and bridge rectifiers. (a, e, k)
6. In the laboratory obtain diode characteristics and measure and verify currents and voltages in diode circuits. (a, b, e, j, k)

B. By the time of Exam #2 (after about 26 lectures), the students should be able to do the following:

1. Identify the different modes of operation of BJT. (a, e, k)
2. Identify the differences between large-signal and small-signal models of a BJT and the limits of these models. (a, e, k)
3. Calculate the gain and input/output resistance of a BJT circuit by replacing the BJT with a proper small signal model. (a, e, k)
4. Identify the configuration of single BJT circuit (i.e., common emitter, common collector or common base) and the advantages and disadvantages of the configuration with respect to gain and input/output resistance. (a, e, k)
5. Design, build, and verify BJT biasing circuits. (a, b, e, j, k)
6. Measure and verify the characteristics of BJT amplifiers. (a, b, e, j, k)

C. By the time of Exam #3 (after about 37 lectures), the students should be able to do the following:

1. Identify the different modes of operation of MOSFET. (a, e, k)
2. Identify the differences between large-signal and small-signal models of a MOS and the limits of these models. (a, e, k)
3. Calculate the gain and input/output resistance of a MOS circuit by replacing the MOS with a proper small signal model. (a, e, k)
4. Identify the configuration of single MOS circuit (i.e., common source, common drain or common gate) and the advantages and disadvantages of the configuration with respect to gain and input/output resistance. (a, e, k)
5. Design basic building blocks such as current mirror circuits and inverters. (a, e, k)
6. Design, build, and verify MOS FET biasing circuits. (a, b, e, j, k)
7. Measure and verify the characteristics of MOS amplifiers. (b, j, k)

D. By the time of Final Exam (after about 41 lectures), the students should be able to do the following:

1. Solve circuit problems with ideal operational amplifiers. (a, e, k)
2. Understand the effect of non-ideal characteristics of operational amplifiers on circuit performance. (a, e, k)
3. Calculate the voltage and frequency limits set by slew rate and bandwidth. (3, 6, 11)
4. Design inverting, non-inverting, Miller integrators. (a, e, k)
5. Measure the offset voltage and current of operational amplifiers. (b, k)

Outcome ➔	a	b	c	d	e	f	g	h	i	j	k
Assessed ➔	x	x			x					x	x

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

University Policies

A. **Incomplete Grades:** An *INC* is assigned when, for reasons beyond their control, students *engaged in passing work* are unable to complete all class assignments. An *INC* must be changed to a completed grade within a time period designated by the instructor but not to exceed one year from the close of the term in which the course was taken, *or graduation*, whichever occurs first. Should the student fail to complete the course within the time period designated, not to exceed one year, or graduation, whichever comes first, the incomplete will be converted to a grade of *F* and the grade will be computed in the student's grade point average. Students should not reregister for courses in which an *INC* has been assigned with the intent of changing the *INC* grade. Re-registration will not prevent the *INC* from being changed to an *F*.

B. **Academic Integrity:** You are expected to submit your original work and adhere to the academic policies as stated in the SIU Student Conduct Code: http://srr.siu.edu (listed under Additional Links). Any act of academic dishonesty, cheating, or plagiarism in any form, including anonymous internet sources used in student papers, will be reported. These acts are taken seriously and the consequences may range from failing as assignment to expulsion from the university.

C. **SIU Email:** Your SIU email account is an official form of University communication. Your instructor will use SIU email as a primary means of electronic communication with students. Please make sure that you maintain a valid password and acquire the habit of regularly checking your SIU email account for important instructor and University announcements. You may view the official SIU Student Email Policy at: http://policies.siu.edu/policies/email.html.

D. **Emergency Procedures:** SIU is committed to providing a safe and healthy environment for study and work. Because some health and safety circumstances are beyond our control, we ask that you become familiar with SIU Emergency response Plan and building Emergency Response Team (BERT) program. Emergency response information is available on posters in buildings on campus, available on BERT's website at http://www.bert.siu.edu/, the SIU Department of Public Safety's website www.dps.siu.edu (disaster dropdown and video, "Shots Fired"), and in the Emergency Response Guideline pamphlet. Know how to respond to each type of emergency. Instructors will provide guidance and direction to students in the classroom in the event of an emergency affecting your location. **It is important that you follow these instructions and stay with your instructor during an evacuation or sheltering emergency.** The Building Emergency Response Team will provide assistance to your instructor in evacuating the building or

sheltering within the facility.

E. **Supplementary Assistance**: SIU is committed to assisting students with disabilities. With the cooperation of SIU's Disability Support Services (DSS), each student who qualifies for reasonable supplementary assistance has the right to receive it. Students requesting supplementary assistance must first register with DSS in Woody Hall, B-150, 618-453-5738 or 618-453-2293 (TTY), by email DSS@siu.edu, or http://disabilityservices.siu.edu/. Notice: If you have any type of special need(s) or disability for which you require accommodations to promote your learning in class, please contact me as soon as possible. The Office of Disability Support Services (DSS) offers various support services and can help you with special accommodations. You may wish to contact DSS to verify your eligibility and options for accommodations related to your special need(s) or disability.

Student Services

A. Learning Support Services: The Center for Learning Support Services (CLSS) assists students of all cultures, abilities, backgrounds and identities with enhancing their self-management and interdependent learning skills. Programs offered by CLSS include: group study sessions; math tutoring; academic coaching; early intervention program; and study skills seminars. For additional information please contact CLSS in Woody Hall, Room A-313, 618-453-2925, or www.tutoring.siu.edu.

B. Writing Center: The Writing Center offers free tutoring services and assistance with improving writing skills to all SIU undergraduate students and faculty. For center locations and hours, to schedule an appointment online, and to view information regarding the Online Writing Lab (OWL) contact the Writing Center at 618-453-1231 (Morris Library location); 618-453-2927 (Trueblood location), or www.write.siu.edu.

Saluki Cares: The purpose of Saluki Cares is to develop, facilitate and coordinate a university-wide program of care and support for students in any type of distress-physical, emotional, financial or personal. By working closely with faculty, staff, students and their families, SIU will continue to display a culture of care and demonstrate to our students and their families that they are an important part of the community. To make a referral to Saluki Cares click, call or send: http://salukicares.siu.edu/index.html; 618-453-5714, or siucares@siu.edu.

SIU Southern Illinois University
CARBONDALE

Syllabus Attachment

Fall 2013

"We emphasize student achievement and success because achievement and success are essential if we are to shape future leaders and transform lives"

IMPORTANT DATES

Last day to add a class (without instructor permission) **8/30/2013**
Last day to withdraw completely and receive a 100% refund **9/01/2013**
Last day to drop a course using SalukiNet **10/27/2013**
Last day to file diploma application (for name to appear in Fall Commencement program) **11/01/2013**
Final examinations ..... **12/9 – 12/13/2013**

Note: For outreach, internet, and short course drop/add dates, visit Registrar's Academic webpage http://registrar.siu.edu/

FALL SEMESTER HOLIDAYS

Labor Day 09/02/2013
Fall Break 10/12—10/15/2013
Thanksgiving Break 11/27—12/1/2013

WITHDRAWAL POLICY ~ *Undergraduate only*

Students who officially register for a session may not withdraw merely by the stopping of attendance. An official withdrawal form needs to be initiated by the student and processed by the University. For the proper procedures to follow when dropping courses and when dropping from the University, please visit http://registrar.siu.edu/pdf/ugradcatalog1314.pdf

INCOMPLETE POLICY~ *Undergraduate only*

An INC is assigned when, for reasons beyond their control, students engaged in passing work are unable to complete all class assignments. An INC must be changed to a completed grade within one semester following the term in which the course was taken, or *graduation*, whichever occurs first. Should the student fail to complete the course within the time period designated, that is, by no later than the end of the semester following the term in which the course was taken, or graduation, whichever occurs first, the incomplete will be converted to a grade of *F* and the grade will be computed in the student's grade point average. *For More information please visit* http://registrar.siu.edu/grades/incomplete.html

REPEAT POLICY

An undergraduate student may, for the purpose of raising a grade, enroll in a course for credit no more than two times (two total enrollments) unless otherwise noted in the course description. For students receiving a letter grade of A,B,C,D, or F, the course repetition must occur at Southern Illinois University Carbondale. Only the most recent (last) grade will be calculated in the overall GPA and count toward hours earned. *See full policy at* http://registrar.siu.edu/pdf/ugradcatalog1314.pdf

GRADUATE POLICIES

Graduate policies often vary from Undergraduate policies. To view the applicable policies for graduate students, please visit http://gradschool.siu.edu/about-us/grad-catalog/index.html

DISABILITY POLICY

Disability Support Services provides the required academic and programmatic support services to students with permanent and temporary disabilities. DSS provides centralized coordination and referral services. To utilize DSS services, students must come to the disability office to open cases. The process involves interviews, reviews of student-supplied documentation, and completing Disability Accommodation Agreements. http://www.siu.edu/dss

STUDENT CONDUCT CODE

http://policies.siu.edu/other_policies/charter3/conduct.html

SALUKI CARES

The purpose of Saluki Cares is to develop, facilitate and coordinate a university-wide program of care and support for students in any type of distress—physical, emotional, financial, or personal. By working closely with faculty, staff, students and their families, SIU will continue to display a culture of care and demonstrate to our students and their families that they are an important part of the community. For Information on Saluki Cares: (618) 453-5714, or siucares@siu.edu, http://salukicares.siu.edu/index.html

EMERGENCY PROCEDURES

Southern Illinois University Carbondale is committed to providing a safe and healthy environment for study and work. We ask that you become familiar with the **SIU Emergency Response Plan** and **Building Emergency Response Team (BERT)** program. Emergency response information is available on posters in buildings on campus, available on BERT's website at www.bert.siu.edu, Department of Safety's website www.dps.siu.edu (disaster drop down) and in Emergency Response Guideline pamphlet. Instructors will provide guidance and direction to students in the classroom in the event of an emergency affecting your location. ***It is important that you follow these instructions and stay with your instructor during an evacuation or sheltering emergency.***

INCLUSIVE EXCELLENCE

SIU contains people from all walks of life, from many different cultures and sub-cultures, and representing all strata of society, nationalities, ethnicities, lifestyles, and affiliations. Learning from and working with people who differ is an important part of education , as well an essential preparation for any career.

MORRIS LIBRARY HOURS

http://www.lib.siu.edu/about

LEARNING AND SUPPORT SERVICES

Help is within reach. Learning support services offers free tutoring on campus and math labs. To find more information please visit Center for Learning and Support Services website for:
Tutoring : http://tutoring.siu.edu/
Math Labs http://tutoring.siu.edu/math_tutoring/index.html

WRITING CENTER

The Writing Center offers free tutoring services to all SIU students and faculty. To find a Center or Schedule an appointment please visit http://write.siu.edu/

AFFIRMATIVE ACTION & EQUAL OPPORTUNITY

Our office's main focus is to ensure that the university complies with federal and state equity policies and handles reporting and Investigating of discrimination cases. *For more information visit* http://diversity.siu.edu/#

Additional Resources Available:

SALUKINET: https://salukinet.siu.edu/cp/home/displaylogin
ADVISEMENT: http://advisement.siu.edu/
PROVOST & VICE CHANCELLOR: http://provaa.siu.edu/