Syllabus for EEL 3008 – Physics of EE

Fall 2018

1. Catalog Description

An introduction to the fundamental physics underlying components and devices and their application to electronics, power, and wireless. Credits: 3

2. **Pre-requisites and Co-requisites**

EEL 3111 Circuits I, MAC 2313 Calculus III, MAP 2302 Elementary differential equations, CHM 2045 General Chemistry I

3. **Course Objectives**

The objective of this course is to provide an understanding of the physics behind electrical components, systems, and applications.

4. **Contribution of course to meeting ABET professional component**

3 hours engineering science

5. **Relationship of course to ABET program outcomes**

a - an ability to apply knowledge of mathematics, science, and engineering: understanding and application of equations that describe the physics of conductors, capacitors, resistors, pn junctions, transistors, and electromagnetic waves

6. **Instructor:** Dr. David Arnold

Dr. David Arnold

a) Office location: LAR 213
b) Office hours: MF 3 9:25-10:25 am or by appointment
c) Telephone: 352-392-4931
d) E-mail address: darnold@ufl.edu

7. **Teaching Assistants:**

Paul Luckey

a) Office location: NEB 222
b) Office hours: TBD
c) E-mail address: pluckey@ufl.edu

8. **Meeting Times** MWF 2 8:30-9:20 am

9. **Meeting Location** NEB 202

10. **Laboratory Schedule** In-class projects

11. **Material and Supply Fees** None

12. **Textbooks and Software Required**

No textbook required. Analog Discovery Board (sold by National Instruments or Digilent)

13. **Recommended Reading/Videos**

Handouts, links, and other information posted on Canvas

14. **Course Outline** (approximate)

I. How do electrical components work at a fundamental level? (~3 Weeks)
   i. How a resistor works *Project 1 – Thermistors and Photoresistors*
   ii. How a capacitor works *Project 2 - Capacitors*
   iii. How an inductor works
   iv. How a transformer works

II. How do power systems work? (~2 Weeks)
   i. How motors/generators work *Project 3 – Motors/Generators*
   ii. How is power generated and distributed
   iii. Why ac 3-phase power?

III. How do solid-state (semiconductor) devices work? (~3 Weeks)
   i. How a diode works *Project 4 – Diodes*
   ii. How a MOSFET works

IV. How are semiconductor devices used in electronic circuits? (~2 Weeks)
   i. How does an amplifier work (analog circuit) *Project 5 – Diode Applications*
   ii. How does digital logic work (digital circuits) *Project 6 – MOSFETs*
   iii. Why does computation take time and consume power

V. How do radios and cellphones transmit and receive (~3 Weeks)
   i. Propagating electromagnetic waves
   ii. Transmission/reception of electromagnetic waves using an antenna

15. **Attendance and Expectations**

It is understood that all attendees will be focused on the lecture and will take every possible measure to minimize distractions for everyone (i.e. no newspapers, no cell phones, no electronics, no laptops, etc. unless instructed to use them for class). **Cell phones may not be used at any time**. Students who would like to take notes using an electronic device (e.g. tablet, laptop) must sit in the first two rows of the auditorium. **Students may not depart early from class unless approved in advance**. Leaving early is interpreted as "cheating" on the daily quiz, which is a proxy measure of attendance.

There will be no class on Wednesday September 26 so that students may attend Career Showcase.

16. **Grading** – methods of evaluation

The score, S, for the course will be determined by combining the average scores, out of 100, on Daily Quizzes, Q, Homework, H, Projects, P, and Tests, T, with $S = qQ + hH + pP + tT$ where weights q, h, p and t are determined as follows.

If Q>T then q=0.10	Otherwise q=0.10+(T-Q)*0.003	Maximum q=0.2
If H>T then h=0.15	Otherwise h=0.15+(T-H)*0.003	Maximum h=0.3
If P>T then p=0.15	Otherwise p=0.15+(T-P)*0.003	Maximum p=0.3
t=1-q-h-i		

a) Daily Quizzes: ~2 min quiz, typically ever class, starting 8:30am sharp. This quiz is intended to (a) sample attendance and (b) "activate" students' brains for the coming lecture. Any student arriving after 8:30:00 am will not be allowed to take the daily quiz.

The instructor, for various reasons, may elect not to do a daily quiz on any specific day. At least the lowest 10% of Daily Quiz scores will be dropped

b) Homework: ~8 Assignments – submitted as PDF via Canvas (no drops)

c) In-class/Take-home Projects ~6 Projects – submitted as PDF via Canvas (no drops)

- Students will be assigned activities that complement and reinforce the theory taught in lecture, including measurements/experiments using a portable electrical engineering laboratory kit (Analog Discovery Board).

d) Tests: There will be two evening tests on Wednesday **October 3** and Wednesday **November 14**, both starting at 7PM, and a final exam on Wednesday **December 12** from 3-5PM.

e) Pop Quizzes: Pop quizzes can occur at any time, however, they will likely occur whenever the instructor deems that the class is not prepared to start on time, if any student is using a computer, cell phone, iPod, iPad, etc., reading a newspaper, socializing or otherwise being rude, disrespectful or disruptive during class.

Any student causing a pop quiz will receive a zero on the pop quiz, and any student responsible for multiple pop quizzes will, at the instructor's discretion, receive a zero for their overall pop quiz score. Each pop quiz will count 2% of the overall score, the remaining portion of the overall score will be weighted as shown in the table below.

An overall score, OA will be tabulated for each student based on the average pop quiz score, PQ, the number of pop quizzes, N, along with the score, S, according to the formula below

$$OA = S(1-0.02N) + PQ(0.02N)$$

f) Late Submissions: Homework and Project submissions are due at beginning of class period (8:30 am) on the due date. Late assignments will receive a 20% deduction for first day late (submitted within 24 hr of due date), and an additional 30% deduction (50% total) for second day late (submitted within 48 hr of due date). No assignments accepted after 48 hr.

17. **Grading Scale:**

Numeric Cutoff	Letter Grade	Grade Points
90.00	A	4.00
86.67	A-	3.67
83.33	B+	3.33
80.00	B	3.00
76.67	B-	2.67
73.33	C+	2.33
70.00	C	2.00
66.67	C-	1.67
63.33	D+	1.33
60.00	D	1.00
56.67	D-	0.67
<56.67	E	0.0

18. **Make-up Exam Policy**

Makeup exam is contingent on appropriate justifications and legal documents (UF Dean of Students, certified physician, military active duty, judge for jury duty, etc.)

19. **Students Requiring Accommodations**

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc) by providing appropriate documentation. Once registered, students will receive an

accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

20. **Course Evaluation**

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu/evals. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/.

21. **University Honesty Policy**

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

22. **Software Use**

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

23. **Student Privacy**

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html

24. **Campus Resources:**

Health and Wellness

U Matter, We Care:
If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall*,* 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.