

# Syllabus for EEL 3008–Physics of EE

## 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. A. Turner

Contact information for Dr. A. Turner

- a) Office location: NEB 227
- b) Office hours: Monday and Wednesday (1:00-2:00 MW) or by appointment
- c) Telephone: (352) 392-2652
- d) E-mail address: turneral@ufl.edu
- e) Web site: <http://lss.at.ufl.edu/>

## 7. Teaching Assistants

8. Meeting Times MWF 10:40-11:30

9. Meeting Location TUR L011

10. Laboratory Schedule None

11. Material and Supply Fees \$20

## 12. Textbooks and Software Required

- a) Title: \* Note 1: No textbook exists currently
- b) Author: \*\* Note 2: One option is to combine separate texts into one composite text
- c) Publication date and edition:
- d) ISBN number:
- e) Digilent Analog Discovery board

## 13. Recommended Reading

Handouts, links, and videos on Canvas

## 14. Course Outline (provide topics covered by week or by class (approximate))

### I. How do components work at a fundamental level? (3 Weeks)

- i. How a resistor works
- ii. How a capacitor works
- iii. How an inductor works
- iv. How a transformer works

### II. Application to power (2 Weeks)

- i. How motors/generators work
- ii. Why ac 3-phase power
- iii. How is power distributed

### III. How do solid-state devices work? (2.5 Weeks)

#### i. How diode works

1. Example rectifier
2. Example solar cell
3. Example LED

#### ii. How a MOSFET works

1. Example switch

### IV. Application to electronics (1.5 weeks)

- i. How does an amplifier work
- ii. How does digital logic work

### V. Application to computing (1 week)

- i. Why does computation take time
- ii. Why does computation consume power (and drain the battery)

### VI. How do radios and cellphones transmit and receive (4.5 Weeks)

- i. Propagating E&M waves
- ii. Transmission of waves using an antenna (radiation from a small dipole antenna)

## 15. Attendance and Expectations

In a large class it is especially important to establish, and maintain, a productive, professional environment free from distractions and disruptions.

To that end it is understood that all attendees will

- Be focused on the lecture
- Minimize distractions for everyone.
  - no newspapers
  - no cell phones
  - no iPads
  - no iPODs
  - no laptops
- Be on-time and ready when class starts
- Attend the entire class, no early departures

## 16. Grading—methods of evaluation

### Option 1: Optional or No Attendance Quizzes\*

The score,  $S$ , for the course will be determined by combining the average scores, out of 100, Homework,  $H$ , In Class/Take Home Projects,  $I$ , and Tests,  $T$ , with  $S = hH + iI + tT$  where  $h$ ,  $i$  and  $t$  are determined as follows.

If $H > T$ then $h=0.15$	Otherwise $h=0.15+(T-H)*0.003$	Maximum $h=0.3$
If $I > T$ then $i=0.15$	Otherwise $i=0.15+(T-I)*0.003$	Maximum $i=0.3$
$t=1-h-i$		

### Option 2: Daily Attendance Quizzes

The score,  $S$ , for the course will be determined by combining the average scores, out of 100, Homework,  $H$ , In Class/Take Home Projects,  $I$ , Daily Attendance Quizzes,  $q$ , and Tests,  $T$ , with  $S = hH + iI + qQ + tT$  where  $h$ ,  $i$  and  $t$  are determined as follows.

If $H > T$ then $h=0.15$	Otherwise $h=0.15+(T-H)*0.003$	Maximum $h=0.3$
If $I > T$ then $i=0.15$	Otherwise $i=0.15+(T-I)*0.003$	Maximum $i=0.3$
If $Q > T$ then $q=0.10$	Otherwise $q=0.10+(T-Q)*0.002$	Maximum $q=0.2$
$t=1-h-i-q$		

- a) Homework: Weekly
- b) In class/ take home projects: Labs and projects
  - i. Students will be assigned activities that complement and reinforce the theory taught in lecture.
  - ii. These activities will include measurements on electrical components using a portable USB-based electrical engineering laboratory kit.
  - iii. Students will turn in screen captures demonstrating results.
- c) Two evening tests will tentatively be given on February 21<sup>st</sup> and April 4<sup>th</sup> and a third test will be given on May 2<sup>nd</sup> from 10am-12pm.
- d) \*Dr. Turner, at his discretion, may give a bonus quiz at any time. Bonus quiz results will be used to increase homework scores. Only students present in class may take a bonus quiz.

Pop quizzes can occur at any time, however, they will 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 pop quiz score,  $P$ , the number of pop quizzes,  $N$ , along with the score,  $S$ , according to the formula below

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

## 17. Grading Scale:

Grading Scale:  $\geq 90$  A,  $\geq 89$  A-,  $\geq 86$  B+,  $\geq 80$  B,  $\geq 79$  B-  $\geq 76$  C+,  $\geq 70$  C,  $\geq 69$  C-,  $\geq 66$  D+,  $\geq 60$  D,  $\geq 59$  D-,  $< 59$  E Examinations may be curved to an average of 5 with no score  $> 100$ .

## 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.) Late assignments will receive a 10% deduction per day late.

## 19. Honesty Policy

All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

## 20. Accommodation for Students with Disabilities

Students requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

## 21. UF Counseling Services

Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include: -University Counseling Center, 301 Peabody Hall, 392-1575, Personal and Career Counseling.

SHCC mental Health, Student Health Care Center, 392-1171, Personal and Counseling. -Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, sexual assault counseling. -Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.