

**Laser Theory and Design**  
EEL 4446 Section 2C27  
**Class Periods:** Tuesday 2 & 3, Thursday 3  
**Location:** Black Hall, Room 415  
**Academic Term:** Fall 2019

**Instructor:** Prof. Henry Zmuda  
**email:** zmuda@ece.ufl.edu  
**Phone:** (352) 392 – 0990

**Mobile** (850) 225 – 9200 (emergencies only please)

**Office Hours:** TBA, always by appointment or chance. The Thursday class begins at 9:35, however, I will be present in the classroom from 8:30 to discuss class material or to answer questions.

**Teaching Assistants:** none

**Course Description**

Credits: 3; Studies the field of semiconductor optoelectronics and the physics of optoelectronic devices including the interaction of photons with electrons and holes in a semiconductor leading to the realization of optoelectronic devices such as photon amplifiers, LEDs, diode lasers, electro-absorption modulators, and detectors, including their design and application-specific characteristics.

**Course Pre-Requisite:** Physics of Electrical Engineering. The ability to write a computer program is essential. A working knowledge of Matlab is sufficient.

**Course Objectives:** The student will learn how to design, construct, and test (in principle, no actual construction is performed) a variety of optoelectronic devices to meet specifications with regard to emission/detection wavelength, power level, and size.

**Materials and Supply Fees:** None

**Professional Component (ABET):**

State the contribution of the course to meeting the professional components of the ABET-accredited degree.

**Relation to Program Outcomes (ABET):**

The table below is an example. Please consult with your department's ABET coordinator when filling this out.

| <b>Outcome</b>   | <b>Coverage*</b> |
|--|------------------|
| 1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.                      | High             |
| 2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.                        | High             |
| 3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.            |                  |
| 4. An ability to communicate effectively with a range of audiences   |                  |
| 5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact |                  |

|   |      |
|---|------|
| of engineering solutions in global, economic, environmental, and societal contexts.   |      |
| 6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately. | High |
| 7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty             |      |

\*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

### Required Textbooks and Software

None – Extensive course notes developed by the instructor are posted on the Canvas page.

### Recommended Textbooks

Title: Laser Diodes and Photonic Integrated Circuits

Authors: Larry Coldren, Scott Corzine, and Milan L. Mashanovitch

Publisher: Wiley, 2012, 2<sup>nd</sup> Edition, ISBN: 978-0470484128

### Course Schedule

Weeks 1, 2: Electromagnetic for lasers  
Exam 1

Weeks 3, 4: Atomic radiation, solid-state amplifiers and lasers

Weeks 5, 6: Essentials of quantum mechanics  
Exam 2

Weeks 7, 8: Essentials of solid-state physics

Week 9: Light emitting diodes

Weeks 10, 11: Semiconductor optical amplifiers and lasers  
Exam 3

Week 12: Further discussion of various lasers  
Exam 4

Week 13, 14: Advanced topics on laser physics

Week 15: Final Exam

### Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is required and is monitored electronically via i-Clicker.

Quizzes, generally five minutes in duration, are given at the beginning of class and are not necessarily announced in advance. Anything covered or discussed in class is possible quiz material. Students who arrive late will not be given extra time. Time limits for quizzes will be strictly adhered to. Students continuing to work on the quiz once the time is up may receive a reduced grade for the quiz. In general, there are no make-ups for quizzes. Students with excused absences should notify the instructor as soon as possible to see if special arrangements can be made.

Cell phone use during class is not permitted. Laptops/tablets may be open and used, but ONLY for lecture-related material. Engaging in activity not related to the course (e.g., doing homework or studying for another class) is not permitted.

**Homework Policy:** Homework is due no later than 5:00 pm of the assigned due date. Late homework policy: 1 day late, 25% reduction in grade; 2 days later, 50% reduction in grade; 3 or more days late, 75% reduction in grade. To help deter procrastination, questions concerning the homework will not be entertained the day that the homework is due. Plots and graphs must be done on a computer. Hand-drawn graphs will not be accepted.

Working together on the homework is allowed and highly encouraged, but each student must individually submit homework and is responsible to understand its content. If your solution is questionable in any way you may be asked to provide an oral clarification before a grade is issued.

If ANY external reference is used it MUST be cited.

For legitimate excused absences (sickness, unavoidable university-related travel, personal emergencies) must be documented. Arrangements for make up exams for excused absences will be scheduled between the student and

Excused absences are consistent with university policies in the undergraduate catalog (<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance>) and require appropriate documentation.

***Evaluation of Grades***

**Determination of Course Grades:**

| Assignment | Percentage of Final Grade |                     |
|------------|---------------------------|---------------------|
|            | Points                    | Graduate            |
| Attendance | 1                         | 15%                 |
| Homework   | 10                        | 10%                 |
| Quizzes    | 10                        | 20% (2 dropped)     |
| Exams      | 100                       | 30% (1 dropped)     |
| Final Exam | 100                       | 25% (comprehensive) |
| Total      | 100                       | 100%                |

**Grading Policy**

| Percent      | Grade | Grade Points |
|--------------|-------|--------------|
| 90.0 - 100.0 | A     | 4.00         |
| 87.0 - 89.9  | A-    | 3.67         |
| 84.0 - 86.9  | B+    | 3.33         |
| 81.0 - 83.9  | B     | 3.00         |
| 78.0 - 80.9  | B-    | 2.67         |
| 75.0 - 79.9  | C+    | 2.33         |
| 72.0 - 74.9  | C     | 2.00         |
| 69.0 - 71.9  | C-    | 1.67         |
| 66.0 - 68.9  | D+    | 1.33         |
| 63.0 - 65.9  | D     | 1.00         |
| 60.0 - 62.9  | D-    | 0.67         |
| 0 - 59.9     | E     | 0.00         |

More information on UF grading policy may be found at:  
<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

***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.

***Course Evaluation***

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

### ***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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-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.

### ***Commitment to a Safe and Inclusive Learning Environment***

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, [rbielling@eng.ufl.edu](mailto:rbielling@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto:nishida@eng.ufl.edu)

### ***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.

### ***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: <https://registrar.ufl.edu/ferpa.html>

### ***Campus Resources:***

#### ***Health and Wellness***

##### **U Matter, We Care:**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**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 Discrimination, Harassment, Assault, or Violence**

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, [title-ix@ufl.edu](mailto:title-ix@ufl.edu)

**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 support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto: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](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

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