EEL 6447    Laser Electronics

1. **Catalog Description** – (3 credits) Study of lasers from basic principles to operational characteristics.

2. **Pre-requisites** - EEL 4473 and EEL 4458 or consent of instructor

3. **Course Objectives** - The student will learn the basic principles of operation, analysis, and design of several types of lasers used in modern engineering applications.

4. **Contribution of course to meeting the professional component** (ABET only – undergraduate courses) - 1.5 credits of Engineering Design, 1.5 credits of Engineering Science

5. **Relationship of course to program outcomes** (ABET only undergraduate courses) - EE2, EE3, a, c, e, i

6. **Instructor** – Dr. Henry Zmuda
   a. Office location: 235 Larsen Hall
   b. Telephone: 392-0990
   c. E-mail address: zmuda@ece.ufl.edu
   d. Web site: www.zmuda.ece.ufl.edu
   e. Office hours: MWF 4th or by appointment

7. **Teaching Assistant** - None
   a. Office location
   b. Telephone
   c. E-mail address
   d. Office hours

8. **Meeting Times** - MWF 2nd

9. **Class/laboratory schedule** - 3 class periods consisting of 50 minutes ea

10. **Meeting Location** - Benton 328

11. **Material and Supply Fees** - None

12. **Textbooks and Software Required**
   a. Title: *Laser Electronics*
   b. Author: Joseph Verdeyen
   c. Publication date and edition: 3rd Edition
   d. ISBN number: 0-13-706666-x

13. **Recommended Reading** – None
   a. Title:
14. **Course Outline**

Weeks 1-2: Gaussian Beams
   - TEM Modes
   - Higher Order Modes

Weeks 2-3: Ray Tracing
   - Ray Matrices
   - Rays Analysis of Cavities
   - Cavity Stability

Weeks 4-5: Resonant Optical Cavities
   - General Cavity Concepts
   - Gaussian Beams in Cavities
   - Cavity Q and Finesse
   - Photon Lifetime

Weeks 6-7: Atomic Radiation
   - Blackbody Radiation
   - Einstein’s A and B Coefficients
   - Line Shape
   - Amplification
   - Line Broadening

Weeks 8-9: Laser Oscillation and Amplification
   - Threshold Conditions
   - Gain Saturation
   - Amplified Spontaneous Emission

Weeks 11: General Characteristics of Lasers
   - CW Lasers
   - Laser Dynamics
   - Mode Locking
   - Saturable Absorbers

Weeks 12: Laser Excitation
   - Three and Four Level Lasers
   - Rare Earth Lasers
   - Tunable Lasers

Weeks 13-14: Semiconductor Lasers
   - Semiconductor Theory Review
   - Diode Lasers
   - Quantum Effects

15. **Attendance and Expectations** - Attendance is not required. Cell phones are to be silenced. No text messaging during class or exams. Requirements for class attendance and make-up exams, assignments, and other work are consistent with university policies that can be found at: [https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx](https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx)
16. **Grading** –
    Homework (graded S/U) – 10%
    Approximately 10 quizzes (lowest 2 grades are dropped) – 50%
    Final exam – 40%

17. **Grading Scale** - Grades will be curved.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>94-100</td>
</tr>
<tr>
<td>A-</td>
<td>90-93</td>
</tr>
<tr>
<td>B+</td>
<td>87-89</td>
</tr>
<tr>
<td>B</td>
<td>84-86</td>
</tr>
<tr>
<td>B-</td>
<td>80-83</td>
</tr>
<tr>
<td>C+</td>
<td>77-79</td>
</tr>
<tr>
<td>C</td>
<td>74-76</td>
</tr>
<tr>
<td>C-</td>
<td>70-73</td>
</tr>
<tr>
<td>D+</td>
<td>67-69</td>
</tr>
<tr>
<td>D</td>
<td>65-66</td>
</tr>
<tr>
<td>F</td>
<td>0-64</td>
</tr>
</tbody>
</table>

“In order to graduate, graduate students must have an overall GPA and an upper-division GPA of 3.0 or better (B or better). Note: a B- average is equivalent to a GPA of 2.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit:

http://gradschool.ufl.edu/catalog/current-catalog/catalog-general-regulations.html#grades

18. **Make-up Exam Policy** - Lowest quiz grade is dropped. Make-up quiz given only with an UF officially approved excuse.

If you have a University-approved excuse and arrange for it in advance, or in case of documented emergency, a make-up exam will be allowed and arrangements can be made for making up missed work. University attendance policies can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Otherwise, make-up exams will be considered only in extraordinary cases, and must be taken before the scheduled exam. The student must submit a written petition to the instructor two weeks prior to the scheduled exam and the instructor must approve the petition.

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.
“…failure to comply with this commitment will result in disciplinary action compliant with the UF Student Honor Code Procedures (http://www.dso.ufl.edu/sccr/procedures/honorcode.php)

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:
   - UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
   - Career Resource Center, Reitz Union, 392-1601, career and job search services.

22. **Software Use** – All faculty, staff and student 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.