Course Specification

EE - 4490
Laser Systems and Applications

Curricular Designation:  EE: elective  CpE: elective

Catalog Description:
EE 4490 – Laser Systems and Applications Survey of laser types and analysis of common physical and engineering principles, including energy states, inversion, gain, and broadening mechanisms from a quantum mechanical perspective. Laser applications and laser properties are explored in the laboratory portion.
Credits: 4.0 Lec-Rec-Lab: (3-0-2) Semesters Offered: Spring Pre-Requisite(s): EE 3140

Textbooks(s) and/or Other Required Materials:

Prerequisites by Topic:
1. Knowledge of Maxwell’s equations
2. Familiarity with wave equation and simple solutions
3. Basic physics including familiarity with atomic models and thermodynamics

Course Objectives:
1. Understand classical and quantum nature of matter
2. Understand particle and wave nature of electromagnetism
3. Understand the interaction of electromagnetic waves with matter
4. Understand atomic states and population
5. Understand stimulated emission
6. Understand laser threshold and gain

Topics Covered:
1. Wave Nature of Light
2. Particle Nature of Light
3. Radiative Transitions and Emission Linewidth
4. Energy Levels and Radiative Properties of Molecules, Liquids and Solids
5. Radiation and Thermal Equilibrium- Absorption and Stimulated Emission
6. Conditions for Producing a Laser
7. Laser Oscillation above Threshold
8. Laser Cavity Modes
### Relationship of the Course Content to Program Outcomes:

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<tr>
<th>Outcome</th>
<th>Important</th>
<th>Moderately</th>
<th>Minimally</th>
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<tr>
<td>an ability to apply knowledge of mathematics, science and engineering</td>
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<td>an ability to design and conduct experiments, as well as to analyze and interpret data</td>
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<td>the ability to design a system, component, or process to meet desired needs within realistic constraints such as as economic, environmental, social, political, health and safety, manufacturability and sustainability</td>
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<td>an ability to function on multi-disciplinary teams</td>
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<td>an ability to identify, formulate and solve engineering problems</td>
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<td>an understanding of professional and ethical responsibility</td>
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<td>an ability to communicate effectively</td>
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<td>the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context</td>
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<td>a recognition of the need for, and an ability to engage in life-long learning</td>
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<td>a knowledge of contemporary issues</td>
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<td>the ability to use the techniques, skills, and modern engineering tools necessary for the practice of electrical engineering</td>
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### Contribution of Course to Meeting Degree Requirements:

3 Credit Hours – Engineering Topics

### Class/Laboratory Schedule (note: 1 hour = 50 minutes):
Lecture: 42 hours = 3 hours/week for 14 weeks

### Prepared by:
Warren Perger, Professor, March 10, 2017