EE 5388 Lasers

(Tentative syllabus subject to change, Spring 2015)

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Class Meetings: Tu/Th 3:30-4:50 pm, ERB 129
Office Hours: 4:50 – 5:50 pm Thursdays or by appointment, NH 532
Credits: 3

Course Description and Objectives

This course will discuss physics, technology, and applications of laser systems. Students will learn how electromagnetic radiation interacts with gain medium, how optical cavity provides feedback, and how population inversions are produced to make a laser. Key technologies such as model locking and Q-switching will be introduced. With these background, we will study different types of laser systems such as semiconductor lasers, dye/liquid lasers, solid state lasers (Nd:YAG), gas lasers (CO_2), etc. Recent research trends and new development in the field will be highlighted as well.

Required Text

J. T. Verdeyen, "Laser Electronics," 3rd Edition, ISBN-13: 978-0137066667

Reference Text

W. T. Silfvast, "Laser Fundamentals," 2nd Edition, ISBN-13: 978-0521541053
K. J. Kuhn, "Laser Engineering", ISBN-13: 978-0023669217

Tentative Topics

Introduction to lasers
Review of electromagnetic theory
Optical beams: propagation of Gaussian beams; higher order modes; guided waves
Optical resonators: stable and unstable resonators; F-P etalons; distributed feedback and distributed Bragg reflectors
Laser fundamentals: Blackbody radiation; Einstein coefficients; Lineshape; Broadening; Gain; Threshold conditions; Saturation; Laser oscillation; Amplifiers; Laser efficiency and dynamics
Q-switching and mode locking
Characteristics of specific lasers: solid state (Nd:YAG); atomic (He-Ne); molecular (CO2); semiconductor; dye/liquid
Recent research topics: microresonators; microfluidic lasers; random lasers; etc.

Grading: Quiz 10%, Final exam 40%, and Term paper 50%

Grading Scale: A (>=89%); B (>=79% to <89%); C (>=60% to <79%); F (<60%).