OSE 4520 - LASER ENGINEERING

Required Text: Laser Engineering, Kelin J. Kuhn, Prentice Hall, (1998)
ISBN 0-020366921-7

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Prerequisites: Calculus, Differential Equations, Vector Calculus, Electromagnetic Theory, Wave Propagation, Interference, Diffraction & Coherence,

Topics to be Covered:

I. Laser Fundamentals: Overview, Energy states in atoms, Basic stimulated emission, Power and energy, Monochromaticity, coherency and linewidth, spatial coherence, longitudinal and transverse modes, gain profile.

II. Energy States and Gain: Laser states, multiple-state laser systems, linewidth and the uncertainty principle, broadening of fundamental linewidths; basics of gain, blackbody radiation, gain.

III. The Fabry Perot Etalon: Longitudinal modes in the laser resonator cavity, quantitative analysis of a Fabry Perot etalon, illustrative Fabry Perot etalon calculations.

Mid-Term Exam

IV. Transverse Mode Properties: TEM transverse modes, Gaussian beam propagation, ray matricies, Gaussian beams in resonant cavities, ABCD Law

V. Gain Saturation: Saturation of the exponential gain process, homogeneous and inhomogeneous gain saturation, Rate equations, Laser output power characteristics

VI. Transient Processes: Relaxation oscillations, Q-switching; Mode-locking

Final Exam (Cumulative)

Expected Learning Outcomes: A students grade will also be assessed on their ability to:
1) Analyze the conditions for population inversion and optical amplification in gain media and determine the threshold gain for laser action.
2) Determine the layout of optical components that produce a laser spot of given dimensions at a given distance.
3) Model a stable cavity with prescribed beam characteristics.

Exam and Grade Policy

There will be a midterm exam and a final exam. Homework's will be assigned to provide guidance as to how to do problems. There will also be short "quizzes" that can serve as 'extra-credit'. The role of the quizzes will be to assist in the determination of final grades.

Approximate weighting: Homework/Quiz: 10%; Midterm: 45%; Final: 45 %; Total: 100%.
Grading Policy: The +/- system will be used.

Late homework is NOT accepted.

Plagiarism: It is your responsibility to know the rules regarding academic honesty. Failure to comply with these rules may result in failing the course, as well as expulsion from the program.