Phys412 grading policy and syllabus

Physics of Lasers (3-0-3)

Spring 2006

Instructor: Abdulaziz Aljalal

Course Description

Topics covered are: Stimulated emission and coherence; population inversion; Gaussian beam propagation; optical resonators and cavity modes; stability criteria; unstable resonators; oscillation threshold and gain; line broadening; gain saturation; Q-switching; mode-locking and phase compression.

Text book

Orazio Svelto, "Principles of Lasers", Springer, 4th Ed 1998.

References

W. Silfvast, "Lasers Fundamentals", Cambridge, 2nd Ed. 2004.
P. Melonni, and J. Eberly, "Lasers", Wiley-Interscience, 1st Ed. 1988.
A. Siegman, "Lasers", University Science Books, 1986.
K. Shimoda, "Introduction to Laser Physics", Springer; 2nd Ed. 1990.
A. Yariv, Quantum Electronics, Wiley; 3rd Ed. 1989.

Grading policies

20% homework
20% project / term paper
20% first major
20% second major
20% final

Homework policy

A homework set is generally due one week from assignment. You may submit it after the due date but 5% of the grade will be deducted for every day after the due date.

Term paper policy

You are encouraged to find a suitable topic as soon as possible. Your work is expected to evolve over the course of the term. I would like to see your progress periodically. The project is due on Saturday, May 12, 2007 (almost three weeks before the final examination period). You may submit it late, but there will be a plenty of 5% for every day after the dead line.

Exams policies

Exams will be closed book. Useful formula will be provided.

Topics covered

lectrue	date	ch	sec	Section name
1	18-Feb	1		introduction
2	20-Feb	2	2	blackbody radiation
			3	spontaneous emission
3	25-Feb		4	absorption and stimulated emission
			5	line-broadening mechanisms
4	27-Feb		6	nonradiative decay and energy transfer
			7	degenerate and strongly coupled levels
			8	saturation
			9	fluorescence decay of optically dense medium

5	4-Mar	3	1	molecules
			2	Bulk semiconductor
6	6-Mar		3	semiconductor quantum wells
			4	quantum wires and quantum dot
7	11-Mar	4	2	matrix formation of geometric optics
			3	wave reflection and transmission at a dielectric interface
			4	multilayer dielectric coating
8	13-Mar		5	Fabry-Perot Interferometer
			6	diffraction optics in the paraxial approximation
9	18-Mar		7	Gaussian beams
10	20-Mar			first major
11	25-Mar	5	1	introduction-types
			2	eigenmodes and eigenvalues
			3	photon life time and cavity Q
12	27-Mar		4	stability condition
			5	stable resonators
			6	unstable resonators
13	1-Apr	6	2	optical pumping by incoherent light source
14	3-Apr		3	laser pumping
15	8-Apr		4	electrical pumping
16	10-Apr	7	2	rate equation
17	17-Apr		3	threshold condition and output power: four level laser
18	22-Apr		4	threshold condition and output power: quasi-three-level laser
19	24-Apr		5	optimum output coupling
20	29-Apr		6	laser tuning
21	1-May		7	reasons for multimode oscillation
			8	single-mode selection
22	6-May			second major
23	8-May		9	frequency pulling and limit to monochromaticy
			10	laser frequency fluctuations and frequency stabilization
24	13-May		11	intensity noise and intensity noise reduction
25	15-May	8	2	relaxation oscillations
			3	dynamics instabilities and pulsations in lasers
26	20-May		4	q-switching
			5	gain switching
27	22-May		6	mode locking
			7	cavity dumping
28	27-May	11	2	Monochromaticy
			3	first-order coherence
29	29-May		4	Directionality
			5	laser-speckle
30	3-Jun		6	Brightness