



OPTICAL SCIENCE & ENGINEERING

Department of Physics and Astronomy  
University of New Mexico

**PHYC 569, Advanced Optics in Modern Optics (53327)**

## **Laser Physics II**

**Tu,Th 5:30-6:45, Room 184, Fall 2016**

Homepage: <http://www.optics.unm.edu/sbahae/physics564/index.htm>

Note: This course was offered in the past under PHYC 564 (Laser Physics II)

**Instructors:** *Mansoor Sheik-Bahae* Room 1109, Tel: 7-2080 , E-mail: msb@unm.edu

**Reference Texts:** Laser Electronics by *J.T. Verdeyen*  
Optical Electronics in Modern Communications by *Amnon Yariv*  
Physics of Optoelectronic Devices by *S. L. Chuang*  
Foundations of Photonics, by *Saleh and Teich*  
Theory of Optical Properties in Semiconductors by *P. K. Basu*

**Pre-requisites:** *Advanced Optics, Laser Physics I, (Check UNM Catalog for more details). Basic knowledge of Quantum Mechanics is also required.*

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**Grading:** One midterm exam(40%), homework (20%), final presentation (40%)

### **TOPICS**

Some of the topics covered in this course may vary depending on the overall students' interests and requests.

- Review of laser principles (*1-2 lectures*)
- Semiconductor Lasers (*11 lectures*)  
*Review of band-theory,  $k,p$  theory and effective mass approximation, Derivation of optical transitions and gain in semiconductors, Optical propagation in dielectric waveguides, Heterojunction lasers, Quantum-confined structures, multiple quantum well (MQW) lasers, Vertical cavity surface emitting lasers (VCSEL), Optically Pumped Semiconductor Lasers (VECSELS), Quantum-cascade lasers*
- Optical Detectors and Detection Techniques (*3 lectures*)
- Statistical Optics, Noise in Detection (*2 lectures*)
- Topics in Ultrafast Phenomena (Femtosecond Metrology, Extreme Nonlinear Optics & Atto-Science) (*5-6 lectures*)
- Terahertz radiation (Generation and Detection) and Applications (*2-3 lectures*)

Other topics may include:

- Plasmonics, Nano-Optics
- Unstable resonators and applications
- Maxwell-Bloch equations, coherent transient effects