

CALIFORNIA INSTITUTE OF TECHNOLOGY
Applied Physics
APh 132 Optoelectronic Materials and Devices
Spring Term 2006

Class Schedule

(Lectures in 104 Watson 10:30-12 noon unless specified in parentheses below;
nonstandard class meeting dates and times are listed in [blue](#))

- | | Date | Topic |
|----|---|--|
| 1. | March 30 | Lecture 1 <i>Maxwell's Equations, Power Flow</i> |
| 2. | March 31st
(12:30-2 pm; 102 Steele) | Lecture 2 <i>Complex Poynting Vector and Gaussian Beams</i> |
| | HW #1 out | |
| 3. | April 5th
(11am-12:30pm; location tbd) | Lecture 3 <i>Gaussian Beams (cont'd), Slab Waveguides and Single Mode Fibers</i> |
| 4. | April 6th | Lecture 4 <i>pn Junction Photonic Devices: pin photodetectors, avalanche devices, photoconductors</i> |
| | HW # 2 out | |
| 5. | April 11th | Lecture 5 <i>pn Junction Photonic Devices(cont'd): Solar Cells, LEDs</i> |
| 6. | April 12th
(11am-12:30pm; location tbd) | Lecture 6 <i>Spontaneous and Stimulated Emission, 3 and 4 Level System, Inversion, Gain</i> |
| | HW #3 out | |
| 7. | April 13th | Lecture 7 <i>Gain (cont'd), Laser Rate Equations, Small Signal Modulation</i> |
| 8. | April 24th
(3:30-5 pm location tbd) | Lecture 8 <i>Resonator Models and Coupled Modes</i> |
| | HW #4 out | |
| 9. | April 25 th | Lecture 9 <i>Distributed Feedback and High Q Resonators Based on Periodic Structures, Photonic Crystals</i> |

10. April 27th **Lecture 10** *Propagation in Anisotropic Media, Index Ellipsoid, Uniaxial Media;*

HW #5 out

-4/26/06-5/2/06 Midterm Exam Period –

11. **Lecture 11** Atomistic models for polarizability and electric susceptibility, magnetic susceptibility. Inhomogeneous dielectric media, Clausius-Mossotti equation, Effective media: Maxwell-Garnett, Bruggemann models

12. **Lecture 12** Introduction to nonlinear susceptibility, Linear Electro-optic Effect, electro-optic materials

HW #6 out

13. **Lecture 13** Nonlinear Susceptibility and Introduction to Nonlinear Optics; Second Harmonic Generation, Sum and Difference Frequency Generation

14. **Lecture 14** Introduction to Nonlinear Optics (cont'd); optical parametric oscillation, Third Harmonic Generation, Kerr Effect, Stimulated Raman Scattering, Absorption Saturation, Two Photon Processes

HW #7 out

15. **Lecture 15** Introduction to Nonlinear Optics (cont'd); Coupled Wave analysis, Phase Matching, Manley-Rowe Relations, Optical Bi-stability

16. **Lecture 16** Electro-optical and Electro-absorption modulators; directional couplers

HW #8 out

17. **Lecture 17** Tuning Material Dispersion; resonances in electric and magnetic susceptibilities

18. **Lecture 18** *Plasmonics; surface plasmon polariton dispersion relations, waveguides, resonances of metallic nanostructures,*

-5/26/06: Last Day of Classes for Graduating Seniors and Grad Students-

19. **Lecture 19** Faraday rotation, magneto-optical materials,
optical isolators

20. **Lecture 20** Negative Index Materials

-6/2/06: *Last Day of Classes for Undergraduates and non-graduating Grad Students-*

-6/7/06-6/09/06: **Final Exams**