OPTI 380B- Intermediate Optics Laboratory II

Course Description:

Diffraction gratings, spatial filtering, Fourier optics and imaging filtering, electronics (basic analytic instruments, linear and non-linear circuit elements, transistors, op-amps, active filters, oscillators, voltage regulators, logic, gates and flip-flops, counters, data converters, interfacing with Lab View, and data acquisition using microcontrollers).

Textbooks:

Notes available online

Special Materials:

A lab notebook is required. All equipment for labs will be provided.

Grading Policy:

- Lab Notebook 60%
- Pre- and Post-Lab Questions 20%
- Final Analysis 15%
- Unannounced quizzes 5%

A detailed lab notebook is to be maintained for each lab session. The Final Analysis is a written report (2-3 pages) due at the end of the semester. It is a "critical analysis" of specific misunderstandings, misconceptions or things you had trouble learning about.

Attendance Policy:

It is important to attend all lab recitation sessions, as what is discussed provides the theoretical and experimental background for the next lab. If you must be absent, it is your responsibility to obtain and review the information you missed. Unannounced quizzes will be given to encourage attendance, and to help you gauge your progress in learning the material.

Attendance for all of your scheduled lab sessions is mandatory. If you miss a lab session, it may not be made up unless you have a documented medical or family emergency. Quizzes may not be made up for any reason.

Schedule:

- One 3-hour lab session per week, 14 lab sessions in the semester.
- One 50-minute recitation session per week.

Objectives:

Upon successful completion of this course, each student should:

- be able to apply the optical principles discussed in OPTI 330 and OPTI 360.
- be able to clearly and accurately summarize and communicate experimental procedures and results, in a lab notebook.
- be proficient with data handling and analysis, using a computer.
- learn common optical methods and procedures that are routinely used in the optics industry.
- understand the safe and proper handling of basic optical equipment.

Topics:

- Lab 1- Basic Electronic Instrumentation and Circuit Construction
  Soldering, breadboards, digital multi-meters, oscilloscopes, basic electronic measurements
- Lab 2- Introduction to LabVIEW Programming
  Basic programming techniques in LabVIEW
- Lab 3- Instrument Control Using LabVIEW
  Basic control of instruments using LabVIEW
- Lab 4- Linear and Non-linear Circuit Elements
  Oscilloscope probes, measurement of capacitance, inductance, and impedance
- Lab 5- Physical Optics Lab—Diffraction Gratings
  Reflection and transmission gratings, blaze angle
- Lab 6- Introduction to Operational Amplifiers: Basic Circuits
  Open-loop gain, inverting and non-inverting amplifiers, followers, current source, current-to-voltage converter (Trans-impedance amplifier for optical detectors)
- Lab 7- Physical Optics Lab
- Lab 8- Op-amp Circuits: Active Filters, Oscillators, Voltage Regulators, Analog Interfaces to Opto-electronic Devices
  High and low-pass filters, active filters, voltage regulators
- Lab 9- Physical Optics Lab—Aberrations and the Airy Disk
  Diffraction-limited performance, Effect of 3-order aberrations on the Airy Disk
- Lab 10-Digital Logic: Combinatorial (gates, flip-flops)
  Truth tables, TTL levels, exclusive OR gates, BCD decoders
- Lab 11-Physical Optics Lab—Computer Generated Holograms (CGH)
  Computer generation of a CGH pattern, manufacture of a CGH using the Maskless Lithography Tool (MLT) at the Optical Sciences College
- Lab 12-Digital Logic: Sequential (counters, binary arithmetic)
  Flip flops, counters
- Lab 13-Data Converters and Interfacing
  A/D and D/A converters, PLL as a frequency multiplier
- Lab 14-Data Acquisition and Signal Processing
  GPIB bus, sampling rates, aliasing