Department of Physics, IIT Kanpur

PHY224: Optics

2024-2025 Semester I

Instructors:

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Schedule

Lectures: Tue, Wed 17:00 - 18:00 at T210
Laboratory: Thu, Fri 14:00 - 17:00 in the Optics Lab, (New Core Lab Building 106)

Contents

Theory Lecture Topics

1. Review of Maxwell's equations, electromagnetic waves and Fourier transforms.
2. Fresnel formulae for reflection and refraction at a plane interface.
3. Polarization: states of polarization, Jones vectors and matrices, Optical anisotropy and chirality.
4. Interference: 2-beam and multiple beam interference, Michelson interferometer, Fabry-Perot interferometer, layered media
5. Diffraction: Formalism, Fraunhofer diffraction, Gratings, Fresnel Diffraction
6. Coherence: Spatial and temporal coherence, quantifying coherence.
7. Dispersion, Phase velocity and Group velocity
8. Introduction to selected advanced topics (if time permits): Imaging, Lasers, Fiber Optics, Nonlinear Optics.

Laboratory Experiments

1. Width of a Gaussian beam
2. Fresnel Formulae
3. Polarimetry
4. Birefringence and Optical Activity
5. 2-slit and N-slit interference, Gratings
6. Michelson interferometer
7. Fabry Perot Interferometer
8. Diffraction - Single slit, Babinet's principle

Experimental Project

This will be an additional experiment to be designed and performed by each student after the eight experiments listed above are completed.

Suggested Textbooks and References

1. E. Hecht, *Optics* (Addison-Wesley / Pearson)
2. J. Peatross and M. Ware, *Physics of Light and Optics*, 2015 edition available at https://optics.byu.edu/docs/opticsBook.pdf
3. The Lab Manual (this will be made available to students)

Topic-wise references for further study will be suggested during the course.

Evaluation

Evaluation mode	Points
Mid-Semester Examination (Theory)	25
End-Semester Examination (Theory)	25
Laboratory Reports	20
Experimental Project	15
End-Semester Laboratory Examination	15
Total	100

Academic Misconduct Policy

Any plagiarism or copying in laboratory reports, deliberate data fabrication or falsification, or cheating in examinations to any extent whatsoever, if found, will be punished by awarding a F grade in the course. In addition, the student will not be allowed to drop the course, and findings will be reported to the relevant authorities in the Institute for disciplinary action.

Attendance Policy

Attendance in both classes and labs will be monitored. A student will be penalised 1 point from the total score for each missed lecture below 80% attendance (max. 10 points). Absence can be condoned only when leave has been obtained officially via the DUGC.

Lab Policy

1. Details of the experiments together with the schedule will be provided during the first lab session. Lab partners will also be allotted during the first lab session.

2. During each experiment, the data must be recorded **in ink** (not pencil) directly on to the lab report sheet.

3. At least one measurement must be performed in the presence of the instructor or a TA, who must verify the measurement and place his/her signature next to the corresponding reading on the lab report. Lab reports will not be accepted for evaluation without this signature of a TA or instructor.

4. In general, extra lab sessions **will not** be available to make up for absence in the regular scheduled weekly lab hours.

5. For experiments conducted each week, the lab report for each experiment must be submitted at the beginning of the next week's lab session before beginning the next experiment. Failing to submit the lab report on time will lead to a deduction of 25% of the total marks allotted to that report.

6. In the End Semester Laboratory Examination, a random experimental problem will be assigned to each student. In case a student wishes to change his/her experiment, **5 Marks** will be **deducted**, unless the student had missed the corresponding lab hours due to offically approved leave.