PHY 307: Modern Optics

Semester: 2026-2027-I

Department of Physics, I.I.T. Kanpur

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Schedule: Lectures on Wednesday and Friday: **Time**: 9:00-10:15 AM in ...

Objectives: Optics is an extraordinary field of study that allows direct experiential learning of subtle concepts that are universal to understanding nature. Its applicability spans across the largest spatio-temporal scales known to humankind. We will explore in-depth a variety of topics that relates to light-matter interaction and is of interest to you. A set of applications are listed below and would be revisited depending on the suggestions from the class.

Pre-requisites: Familiarity with the Maxwell's equations is mandatory.

Course contents

1. Recapitulate Maxwell's equations, plane wave solutions, Fourier series and transforms
2. Polarization of light
3. Sources of light - conventional sources and Lasers
4. Diffraction, Resolution Limit
5. Fourier Optics
6. Coherence
7. Application: Metamaterial Optics, Holography
8. Application: Anisotropic media, Photonic media
9. Application: Optical Waveguides and Integrated Optics
10. Recent Developments: Coherent media, Slow light-Fast light, Laser Cooling...

References

1. E. Hecht, *Optics*, 4th Ed. (Pearson Education Inc. 2002)
2. J. Peatross and M. Ware, *Physics of Light and Optics*, Available online at http://optics.byu.edu/textbook.aspx
3. F.L. Pedrotti, L.M. Pedrotti and L.S.Pedrotti: Introduction to Optics (Pearson International Edn)
4. M. Born and E. Wolf, *Principles of Optics*, 7th Edition, (Cambridge Univ. Press)
5. B.E.A. Saleh and M.C. Teich, *Fundamentals of Photonics* , (Wiley, 1991)

Course policies and evaluation:

Attendance : 85%†

Mid-semester Examination : 45 %

End-Semester Examination : 55 %

† Any absence can be condoned only when you have obtained official leave from the DUGC.