Exam Questions in

Electrodynamics & Optics

Year 2025-’26, semester 1

1. Properties of Electric Charges, Triboelectric Effect, Coulomb’s Law, Static Electric Field
2. Electric Field of a Continuous Charge Distribution, Electric Flux, Gauss’s Law
3. Electric Potential, Conductors in Electrostatic Equilibrium, Faraday cage, Electrostatic Tip Effect
4. Capacitance of a Conductor, Combinations of Capacitors, Energy Stored in a Charged Capacitor
5. Electric Dipole in an Electric Field, Atomic Model of Dielectrics, Dielectric Displacement Vector
6. Classification of Dielectrics, Boundary Conditions at Material Interfaces
7. Electric Current, Ohm's law, A Model for Electrical Conduction
8. Insulators, Conductors, Semiconductors, Conductivity of Liquids and Gases
9. Electromotive Force, Resistors in Series and Parallel, Kirchhoff’s Rules, Simple RC Circuits
10. Magnetic Field, Magnetic Force Acting on a Charged Particle and on a Conductor, Hall Effect
11. The Biot–Savart Law, Ampère’s Law, The Magnetic Force Between Two Parallel Conductors, Gauss’s Law in Magnetism
12. Magnetism in Matter, Paramagnetic, Diamagnetic and Ferromagnetic Materials
13. Faraday’s Law of Induction, Lenz’s Law, Generators and Motors, Eddy Currents
14. Self- and Mutual Inductance, RL Circuits, Energy in a Magnetic Field,
15. LC and RLC Circuits, Resonance in a Series RLC Circuit
16. Alternating-Current Circuits, Resistors, Capacitors and Inductors in an AC Circuit
17. Power in an AC Circuit, The Transformer and Power Transmission, The Skin Effect
18. Displacement Current and the General Form of Ampère’s Law, Maxwell’s Equations in Integral and Differential forms
19. Electromagnetic Waves, Hertz’s experiment, Wave equation, Properties of EM waves
20. Energy Carried by Electromagnetic Waves, Momentum and Radiation Pressure, The Spectrum of Electromagnetic Waves
21. The Nature of Light, Historical and Modern Light Models, Reflection, Refraction, Dispersion
22. Total Internal Reflection, Polarization of Light Waves, Brewster's Effect, The Ray Approximation
23. Interference, Young’s Double-Slit Experiment, The Michelson Interferometer, Coherence of Light
24. Diffraction, Diffraction Patterns from Narrow Slits and Circular Apertures, Resolution of an Optical system

On the oral exam, two questions are given to each student, selected randomly from the 1-13 and 14-25 questions respectively. The basic requirement is the understanding of physical phenomena, the knowledge of quantitative laws and the description of the essential experiments related to the topic of the question. The reproduction of the detailed calculations and derivations is not a basic requirement, but it might help to the knowledge of quantitative laws. For the excellent note, some extra questions will be raised checking the overall physical understanding of the curriculum.

Have a nice exam period!

Pal Koppa

11.12.2025