

FACULTY OF SCIENCE
M. Sc. III – Semester Examination, December 2019

Subject : Physics

Paper – I : Modern Optics

Time : 3 Hours

Max. Marks: 80

Note : Answer all questions from Part–A and Part–B. Each question carries 4 marks in Part–A and 12 marks in Part – B.

PART – A (8 x 4 = 32 Marks)
(Short Answer Type)

- 1 Describe the main components in laser devices.
- 2 Discuss different pumping mechanisms in Lasers.
- 3 Explain the working of Dye laser. Mention its applications.
- 4 What are the applications of Excimer laser?
- 5 What is spatial frequency filtering? Explain.
- 6 Write a short note on Fourier transform hologram.
- 7 Discuss the phase transformation properties of a thin-lens.
- 8 Explain the self focusing of light in a non-linear medium.

PART – B (4 x 12 = 48 Marks)
(Essay Answer Type)

- 9 (a) Derive the rate equations for three level and four level lasers systems.
OR
(b) What is an active medium? Describe the absorption and emission processes in an active medium and derive Einstein's relations.
- 10 (a) Describe the construction and working of Nd: YAG laser.
OR
(b) Describe the principle, construction and working of CO₂ laser. Mention some of its industrial applications.
- 11 (a) Distinguish between in-line and off-axis holograms. Give the detailed theory of off-axis holography.
OR
(b) Describe in detail about volume hologram with necessary theory.
- 12 (a) Describe how optical mixing is achieved and explain parametric generation of light.
OR
(b) Describe the Fourier transforming property of a thin-lens when the object is placed in front of the lens.

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Subject : Physics

Paper – II : Advanced Solid State Physics

Time : 3 Hours

Max. Marks: 80

Note : Answer all questions from Part–A and Part–B. Each question carries 4 marks in Part–A and 12 marks in Part – B.

PART – A (8 x 4 = 32 Marks)
(Short Answer Type)

- 1 Write a note on Brillouin zones.
- 2 State and explain DeHass – Von Alphan effect.
- 3 Discuss in detail concept of local field.
- 4 Explain in detail ferroelectric hysteresis .
- 5 Discuss in detail Weiss theory of spontaneous magnetization.
- 6 Explain in detail on ferrites and applications.
- 7 What is Meissner effect?
- 8 Discuss in detail Josephson effect.

PART – B (4 x 12 = 48 Marks)
(Essay Answer Type)

- 9 (a) Explain in detail Fermi surfaces in simple cubic, bcc and FCC lattice.
OR
(b) Discuss in detail effect of electric and magnetic fields on Fermi surfaces.
- 10 (a) Discuss in detail about ionic, electronic and orientational polarization and derive the expression for Clausius – Moscottic relation.
OR
(b) What is dipole relaxation and discuss the theory of ferroelectrics?
- 11 (a) Explain detail Langevin's and quantum theory of diamagnetism.
OR
(b) Write a note on (i) Heisenberg exchange interaction (ii) Neel's theory of anti-ferromagnetism and (iii) Ferromagnetic domains.
- 12 (a) Discuss in detail (i) Effect of magnetic field on super conductivity, (ii) type I and type II super conductors and (iii) Isotope effect.
OR
(b) Explain in detail BCS theory of superconductivity and applications of superconductivity.

