Advanced Physics
Max. Marks : 80
Time: 3 Hrs.
Note: Nine questions are to be set by selecting two questions from each unit. Question No.1 is compulsory and will consist of 6 to 8 questions covering whole of the syllabus.

Unit-I Semiconductor Physics

Energy Bands, Instrinsic carrier concentration. Donors and Acceptors, Direct and Indirect band semiconductors. Degenrate and compensated semiconductors. Elemental (Si) and compound semconductors (GaAs). Replacement of group III element and Group V elements to get tertiary alloys such as $Al_xGa_{(1-x)}As$ or $GaP_yAs_{(1-y)}$ and quaternary $In_xGa_{(1-x)}P_yAs_{(1-y)}$ alloys and their important properties such as band gap and refractive index changes with x and y. Doping of Si (Group III (n) and Group V (p) compounds and GaAs (Group II (P), IV (n.p.) and VI (n compounds). Diffusion of Impurities - Thermal Diffusion, Constant Surface Concentration, Constant Total Dopant Diffusion, Ion Implantation.

Unit –II Non Linear Optics

Harmonic generation. Second harmonic generation. Phase matching. Third harmonic generation, Optical mixing. Parametric generation of light, self focusing of light. Multiquantum photoelectric effect. Two photon processes. Experiments in two photon process. Doppler – Free two photon spectroscopy. Multiphoton processes. Second harmonic generation, parametric generation of light. Parametric light oscillator. Frequency unconversion.

Unit-III Laser Applications

Multiphoton photo-electric effects, Two-photon, Three-photon and Multiphoton Processes Raman Scattering, Stimulated Raman Effect. Introduction to Applications of Lasers : Physics, Chemistry, Biology, Medicine, Material working,optical communication, Thermonuclear Fusion, Holography, Military etc

Unit-IV Concepts of Theoretical Physics

Solution of 3-D Schrodinger equation for: one electron, two electrons and many electrons systems.

Solution of Poisson equation for : spherical potential.

Molecular dynamic simulation of: (i) 2-D trajectories of particles in space (ii) 3-D trajectories of particles in solids.

Energy bands in tight binding approximation: application for bee and fee crystals

References:

1. The Physics of semiconductor Devices by D.A. Eraser, Oxford Physics Series (1986)
2. Semiconductor Devices - Physics and Technology, by SM Sze Wiley (1985)
3. Thin film phenomena by K.L.Chopra
4. Deposition techniques for films and coating, R.F. Bunshah (Noyes publications)
5. Laser Electronics by J.T. Vardeyan Prentice hall Inc., New Jersey (1981)
6. Lasers and Non-linear optics by B.B. Laud Wiley Eastern Ltd.
7. Svelto : Lasers
8. Letekhov : Non-Linear Spectroscopy
9. Lasers and Non-linear Optics by B.B. Laud
10. Computer Simulation Methods by Harvey Gould and Jan Tobechnik, Addison Wesley Publishing Company, New York, 1988
11. Computational Physics by Steven E.Koonin, Addison-Wesley Publishing Company, New York, 1986
12. Introduction to Solid State Physics by C.Kittel, Wiley Easter Ltd., New Delhi, 1985