CONDENSED COURSE FOR SESSION – 2018-20

Semester – I

PHY F - 01 (Mathematical Physics, Classical Mechanics & Elements of Computational Techniques) (credit: 05, lectures: 60)

Unit-1

Special Functions: Legendre, Bessel, Hermite and Laguerre differential equations and their polynomials, orthogonality.

Unit-2

Green's Function: Introduction Construction of the Green's function for 1d, 2d and 3d problems.

Unit 3 -Group Theory:Definition and examples of physically important finite groups, Basic symmetry operations and their matrix representations, Multiplication table, Cyclic groups and subgroups, Classes. Reducible and Irreducible representation.

Unit-4 Classical Mechanics: Hamiltonian and Hamilton's equation and their applications, Hamilton's principle and characteristic function, Conservation laws and cyclic coordinates. Poisson brackets. Symmetry, invariance and Noether's theorem. Hamilton – Jacobi equation. Canonical transformation, generating functions, infinitesimal generators, Poisson bracket, Poisson theorems, angular momentum, Principle of Least action.

Reference Books :

1. Applied Mathematics for Engineers and Physicists : L.A. Pipes and R. Rarvill.
2. Mathematical Physics : A.K. Ghatak and I. Goyal.
3. Mathematical Physics : Satya Prakash.
4. Mathematical Physics : B.S.Rajput
5. Classical Mechanics: Herbert Goldestien , Pearson Education N.Delhi.
6. Classical Mechanics: S.L.Gupta, V.Kumar & H.V.Sharma – Pragati Prakashan.
7. Classical Mechanics: Rana and Joag.
8. Classical Mechanics: J.C.Upadhyaya
9. Classical Mechanics : Yashwant R. , Waghmare (PHI 1990)
10. Classical Mechanics : S.N. Biswas (Allied Publiser Kolkata)
11. Introductory Methods of Numerical Analysis : S.S.Sastry (PHI)

PHY C- 02 (Quantum Mechanics I and Laser Physics) (credit: 05, lectures: 60)

Quantum Mechanics - I

Unit-1

Harmonic Oscillator by Schrodinger equation .Variational methods-Application to ground state of Hydrogen atom and first excited state of harmonic oscillator. WKB approximation.

Unit-2

Angular Momentum: Commutation relations for angular operators, Eigen values and Eigenvectors, Pauli spin matrices and spin eigenvectors, addition theorem, Clebsch – Gordon coefficients, angular momentum and rotation, motion in centrally symmetric field, Schrödinger's theory of Hydrogen atom.

LASER

Unit-3 Laser: Spontaneous and stimulated emission, Einstein A and B coefficients, Basic Principles of Laser, Population Inversion-Two level and Three level Laser system, optical pumping, modes of resonator and coherence length, The Nd^{3+}, YAG laser, The Neodymium Glass laser, The CO2 Laser, Organic Dye lasers, Semi-conductor Laser, Requisites for producing LASER light, rate equations - four level LASER. [10 Lectures]

Reference Books :

1. Quantum mechanics: D.J. Griffiths
2. Quantum mechanics: L.I. Schiff (Mc Graw Hill)
3. Quantum mechanics: T K Thankappan
4. Quantum mechanics: B. Crasman and J D Powell
5. Quantum mechanics: Mathews and J J Sakurai
6. Quantum mechanics: Ghatak and Loknathan
7. Modern Quantum mechanics: J J Sakurai
8. Quantum mechanics: S N Biswas
9. Quantum mechanics: G P Singh
10. Quantum mechanics: G.S. Chaddha
11. LASER Fundamentals : Silfvast (Cambridge University , Press)
12. LASER's : Siegman (Univ. Science Books , USA)
13. Elements of Quantum Optics : Meystre and Sargent(Spriger – Verlag)
14. LASER Physics : Srgent, Scully and Lamb .
15. Essentials of LASER and non – linear optics : Baruah Pragati Prakashan, Meerut)

PHY C- 03 (Electrodynamics and Plasma Physics) (credit: 05, lectures: 60)

Electrodynamics

Unit-1

Electromagnetic Vector and Scalar Potentials, Wave equation. Lorentz condition. Non – Uniqueness of electromagnetic potentials and concept of gauge.

Unit-2 Electrodynamics of a moving charge and radiating systems : Lienard – Wiechert potentials and derivation of LW potential of a moving point charge .Electric and Magnetic fields due to uniformly moving point charge and accelerated charge. Angular Distribution of Radiation emitted by accelerated charge.

Plasma Physics:

Unit-3 General properties and Fundamental concepts of plasma. Introductory idea of different states of matter. Kinetic theory of plasma: Boltzmann's equation, Boltzmann – Vlasov Equation, Derivation of 1^{st} and 2^{nd} moment equations.

Unit-4 Plasma Characteristics: Debye Shielding and plasma parameter.

Reference Books :

1. Electromagnetic Theory , Chopra & Agarwal
2. Electrodynamics – Gupta , Kumar & Singh
3. Electromagnetic Theory & . Electrodynamics , Satyaprakash
4. Classical Electrodynamics , Jackson (Wiley)
5. Electromagnetic : B.B.Laud (New Age International Publ.)
6. Classical Electrodynamics : P. Sengupta(New Age International Publ.)
7. Plasma Physics: Francis F. Chen (Plenum Press)
8. Plasma Physics: Bittencourt
9. Magnetohydrodynamics : S.I.Pai
10. **Plasma Physics by Suresh Chandra , CBS Publishers**

PHY C/P- 04: Optics Lab. (credit: 05, lectures: 60)

Time: 6 hours

1. Determination of wavelength of Laser light using Grating .
2. Determination Of Wavelength Of Laser Light by using vernier callipers
3 Determination of thickness of thin wire using Laser light .
4 Verification of Brewster's Law using spectrometer.
5 Determination of wavelength of Sodium light using Michelson Interferometer.
6 Determination of wavelength of Sodium light using Fabry – Perot interferometer.
7 Determination of resolving Power of a Telescope.
8 Determination of specific rotation of given liquid sample using Polarimeter.
9 Determination of resolving esolving power of Prism.
10 Analysis of elliptically polarized light using $\lambda/4$ plate and Babinet's compensator.
11 Verification of Rayleigh's criterion for the limit of resolution of spectral lines using (a) prism spectrum and (b) grating spectrum.
12 Determination of optical constants of metal in thin film form.