St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2019 Onwards

M. Sc. I Semester **Max Marks- 40**

Passing Marks - 14

Paper-I: Mathematical Physics

The students are expected to acquire the knowledge of the following:

Course Outcome

- Special functions, such as Hermite, Legendre and Laguerre polynomials and Bessel functions.
- Complex numbers, their functions and properties such as analyticity, poles and residues. Residue theorem and its applications in evaluating definite integrals.
- Fourier transform, inverse Fourier transform, their properties. Laplace transform, inverse Laplace transforms and their applications in solving physical problems.
- Green Function and its application in solving non homogeneous differential equations.

Unit -I

Differential equations: Recursion relation, generating functions and orthogonality of Bessel functions of first and second kind, Hermite, Legendre, Associate Legendre and Laguerre Polynomials. Curvilinear co-ordinate system with specific cases of Cartesian, Cylindrical, and Spherical coordinate systems.

Unit -II

Integral transforms. Fourier integral. Fourier transform and inverse Fourier transforms. Fourier transform of derivatives. Convolution theorem. Elementary Laplace transforms. Laplace transform of derivatives. Application to a damped harmonic oscillator.

Unit -III

Green's functions: Non-homogenous boundary value problems, Green's function for one dimensional problems, eigen function expansion of Green's function, Fourier transform. Method of constructing Green's function, Green's function for electrostatic boundary value. Problems and quantum-mechanical scattering problem.

Unit -IV

Complex variables: Analyticity of complex functions. Cauchy Riemann equations. Cauchy theorem. Cauchy integral formula. Taylors, Maclaurin, Laurent series & mapping. Theorem of residues. Simple cases of contour integration. Jordan's lemma Integrals involving multiple valued functions(Branch points).

Unit - V

This unit will have questions covering all the four units. In addition to the problems given below the unit will consist of problems given in Text / Reference books.

1. Green's function for a linear oscillator, Green's function and the Dirac δ-function, finding Green's function for Linear operators in 1-D.
2. Potential due to discrete or continuous charge distribution; vibration of a circular membrane, solving the 1-D harmonic oscillator Schrodinger equation; Relation of the hydrogen atom, Schrodinger equation with Laguerre equation and solution.
3. Solution of initial value problems by using Laplace transform; LT and inverse LT of various functions,
4. Solution of limit dept problems by Fourier transform; FT of Gaussian function, Application of FT of Dirac delta function.
5. Verification of analyticity of simple function, Evaluation of some definite integral using residues etc.
6. Evaluation of integrals in complex variables

Text and Reference Books

➢	Mathematical Methods for Physicists	:	G. Arfken
➢	Advanced Engineering Mathematical	:	E. Kreyszig
➢	Special functions	:	E.D. Rainville
➢	Special functions	:	W.W. Bell
➢	Mathematical Methods for Physicists and Engineers	:	K.F. Reily, M.P.Hobson and S.J. Bence
➢	Mathematics for Physicist	:	Mary L Boas

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2019 Onwards

M. Sc. I Semester **Max Marks- 40**

Passing Marks - 14

Paper-II: Classical Mechanics

Course Outcome

The students are expected to acquire the knowledge of the following:

- Newtonian, Lagrangian and Hamiltonian formulations of classical mechanics and their applications in appropriate physical problems.
- D'Almbert's principle in generalized coordinates. Lagrange's equation from D'Almbert's principle.
- The equations of canonical transformation and generating functions. Poisson's brackets and its applications.
- Small oscillation problems.
- Recapitulate the special theory of relativity. Postulates of the special theory of relativity, Lorentz transformations on space-time and other four vectors, four-vector notations. Covariant Lagrangians and Hamiltonians.

Unit - I

Newtonian mechanics of one and many particles systems: Conservation laws, Constrains their classification, Principle of virtual work; D'Almbert's principle in generalized coordinates, The Lagrange's equation from D'Almbert's principle. Configuration space, Hamilton's principle deduction from D'Almbert's principle, Generalized momenta and Lagrangian formulation of the conservation theorems, Reduction to the equivalent one body problem; the equation of motion and first integrals, the differential equation for the orbit.

Unit - II

The equations of canonical transformation and generating functions; The Hamilton- Jacobi Action and Angel variables. Poisson's brackets; simple algebraic properties of Poisson.s brackets. The equation of motion in Poisson's Brackets notation. Poisson theorem; principle of least action. The Kepler problem, Inverse central force field, Rutherford scattering.

Unit - III

Theory of small oscillations, Equations of motion, Eigen frequencies and general motion, normal modes and coordinates, Applications to coupled pendulum and linear bistable molecule. Rotating coordinate systems. Acceleration in rotating frames. Coriolis force and its terrestrial astronomical applications, Elementary treatment of Eulerian coordinates and transformation matrices. Angular momentum inertia tensor. Euler equations of motion for a rigid body. Torque free motion for a rigid body.

Unit - IV

Symmetries of space and time. Invariance under Galilian transformation, Covariant four dimensional formulation, 4 -Vectors and 4 - scalars. Relativistic generalization of Newton's laws, 4 - momentum and 4 - force, variance under Lorentz transformation relativistic mechanics. Covariant Lagrangian, covariant Hamiltonian, Examples.

Unit - V

This unit will have questions covering all the four units. In addition to the problems given below the unit will consist of problems given in Text / Reference books.

(1) Simple pendulum with rigid support. Two connected masses with string passing over a pulley, virtual work.

(2) Various Poisson's brackets thin relation with PBs in quantum mechanics stability of orbits under central force' orbital elements of planetary orbits.

(3) Rotating frames, small oscillations in Linear triatomic molecule and coupled pendulum.

(4) 4-momentum and 4-force, Relativistic Kinetic energy, mass variation,

The problems given in this Text and preference books will form tutorial course.

TEXT AND REFERENCES BOOKS

Classical Mechanics	:	N. C. Rana and P.S. Jog (Tata Mc Graw Hill, 1991)
Classical Mechanics	:	H. Goldstein (Addision Wesley, 1980)
Mechanics	:	A Sommerfiels (Academi Press 1952)
Introduction to Dynamics	:	I. Perceival & Richards(CambridgeUniv.Press,1982)

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2019 Onwards

M. Sc. I Semester **Max Marks- 40**

Passing Marks - 14

Paper-III: Digital Electronics & Electronic Devices

Course Outcome

The students are expected to acquire the knowledge of the following:

- Digital Electronics and Boolean functions. Techniques of simplification of digital circuits
- Operational amplifiers and their applications in various logic circuits.
- Metal oxide semiconductors JFET, MOSFET, MESFET,
- Microwave devices such as Tunnel, IMPATT and Gunn Diodes.
- Various Photonic devices and their I-V characteristic curve.
- Experimental learning of Op-Amp, and I-V characteristic curve of FET, Tunnel, LED, etc.

Unit – I

Digital Electronics: Number systems (decimal, Binary, Octal, hexadecimal) and their conversion, Logic Gates: AND, OR, NOT, NAND, NOR, EX-OR (Truth table, Boolean expression, symbol), diode and transistor as logic gate, laws of Boolean algebra, K-map, De Morgan's theorem.

Bistable Circuits: RS Flip-flop, clocked RS Flip flop, Edge trigger Flip flop, D Flip flop Preset and clear.

Unit – II

Operational Amplifiers: DC Amplifier, Difference amplifier, Op-Amp symbol, OP-AMP Parameters: Input bias current, Input offset current, Input offset voltage, Open loop gain, CMRR, Slew Rate, Concept of virtual ground, summing point, ideal Op-Amp.

Application of Op-Amp: Inverting and Non-Inverting modes of Op-Amp, Use of OPAMP as adder, subtractor, differentiator, integrator, IC 741 as Op-Amp.

Unit – III

Transistors: Junction Field Effect Transistor (JFET); Physical Structure, Principles of Operation, Metal Oxide Semiconductor Field Effect Transistor (MOSFET); Physical Structure, Electronics Mechanism, Mode of Operation, and Metal-Semiconductor Field-

Effect-Transistors (MESFET); Physical Structure, Principles of Operation,derivations of the equations for I-V characteristics under different condition.

Microwave devices: Tunnel diode, Transfer electron devices (Gunn diode), Avalanche transits time devices, Impatt diodes and Parametric devices.

Unit - IV

Photonic devices: Radiative and non-radiative transitions, Photo Conductive Devices (LDR), Diode Photo Detectors, Solar cell (open circuit voltage and short circuit current, fill factor), LED (structure, high frequency limit, Working, operation of LED, Applications), Diode lasers (Construction, Population Inversion, Optical Gain, Working and Application) .

Unit - V

This unit will have questions covering all the four units. In addition to the problems given below the unit will consist of problems given in Text / Reference books.

1. Half adder and Full adder; its design, working, truth table.
2. JK Flip Flop and JKMS Flip Flop; its design, working, truth table.
3. Application of Op-Amp as a Function generator.
4. Application of Op-Amp as a Regenerative Comparator (Schmitt Trigger).
5. Design of MOSFET amplification in different configurations.
6. Microwave oscillators: Klystron and Magnetron.
7. Deviation of the condition of lasing action in a two level system, optical pumping.
8. Derivation of rate equation for three – Laval Devices system.

The problems given in this Text and preference books will form tutorial course.

Text and reference books:

1. Semi Conductor Devices – Physics and Technology : SM Sze (Wiley)

2. Introduction to Semiconductor devices : M.S. Tyagi (John Wiley and Sons)

3. Optical Electronics :AjoyGhatak and K. Thygarajan (Cambridge Univ. Press.).

4. Digital and Analogue Technique: G.N.Navneetha, V.M.Gokhale, R.G.Kale (Kitab Mahal)

5. Electronic Devices and Circuit Theory; Robert L. Boylestad, Louis Nashelsky (Pearson)

6. Microwave Devices and Circuits: Samuel Y. Liao (Pearson)

7. Electronic Devices and Circuit Theory; Louis Nashelsky and Robert Boylestad (Pearson Education).

8. Electronic Devices and Integrated Circuits: Singh, B. P., Singh, Rekha (Pearson Education).

9. Op-Amps and Linear Integrated Circuits: Ramakant A. Gayakwad (Prentice Hall)

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2019 Onwards

M. Sc. I Semester **Max Marks- 40**

Passing Marks - 14

Paper-IV: Computational Methods and programming

Course Outcome

The students are expected to acquire the knowledge of the following:

- C language and programming.
- Solve and determine zero in linear and non-linear equations using different methods.
- Eigen values and vectors of matrices using different methods.
- Interpolation and its determination by various methods.

Unit – 1

Introduction to C: Data type (int, float, double, char, long, long double etc.) operators (Unary.Binary and ternarys), input /output statement (scanf(), printf()), control statements (if, for, while, do while, switch -case-default), Function (type of Function, function definition, function calling, formal arguments, actual arguments, function prototype), Program structure, string (Array, character array), string manipulation functions like strlen(), strcpy(), strcat(), strcmp(), etc.

Unit – 2

Method for determination of zeros: linear and non-linear algebraic equation and transcendental equations using bisection method, false position method and Newton Raphson method, convergence of solutions, solutions of simultaneous linear equation, Gaussian elimination method, pivoting, iterative method, Matrix inversion.

Unit – 3

Eigen Value and Eigen Vectors of Matrices: Power and Jacobi method, finite difference interpolation with equally and unequally spread points, curve fitting, polynomial least squares and cubic spline fittings. Numerical differentiation and Integration, Newton-Cotes Formulae, error estimates, Gauss-Method.

Unit – 4

Interpolation: Lagrange's Interpolation, Finite difference and operators, Newton forward, Newton backward, Games forward, Games backward, Stirling's interpolation divided difference formula.

Unit – 5

Numerical solution of ordinary differential equation : Euler and Runga-Kutta Methods, predicators and corrector method. Introduction to partial differential equations & their classification. Solution of Laplace Equation by Finite Difference Method. Random variables, Monte Carlo evaluation of integrals

Suggested Readings:

1. Introduction method of numerical analysis : Sastry

2. Numerical Analysis : Rajaraman

3. Programming with C : Gottfried

4. Programming with C : Balagururswamy

5. Numerical Analysis : Balaguruswamy

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2019 Onwards

M. Sc. II Semester **Max Marks- 40**

Passing Marks - 14

Paper-I: Quantum Mechanics-I

Course Outcome

The students are expected to acquire the knowledge of the following:

- Familiar with quantum mechanics formulation.
- Hilbert space, bra and ket notations, creation and annihilation operators, Schwartz inequality.
- Interpretation of wave function of quantum particle and probabilistic nature.
- Behavior of quantum particle encountering a barrier, potential step and square well.

Unit - I

Basic Postulates of quantum Mechanics, equation of continuity, Normality, orthogonality and closure properties of eigen functions, expectation values and Ehrenfest theorems, solution of Schrödinger equation for one dimensional (a) potential well (b) potential step and (c) Potential barrier.

Unit - II

Linear vector space, concept of Hilbert space, bra and ket notation for state vector, representation of state vectors and dynamical variables by matrices and unitary transformation (Translation and rotation), creation and annihilation operators, matrices for x and p. Heisenberg uncertainty relation through operators (Schwartz inequality).

Unit -III

Solution of Schrödinger equation for (a) linear harmonic oscillator (b) hydrogen - like atom (c) square well potential and their respective application to atomic spectra, molecular spectra and low energy nuclear states (deuteron).

Unit - IV

Angular momentum in quantum mechanics, Eigen values and Eigen function of L_2 and L_z in term of spherical harmonics, commutation relation.

Identical particles with spin, symmetric and antisymmetric wave functions, Pauli's exclusion principle, Pauli's spin matrices, Slater determinant.

Unit - V

This unit will have questions covering all the four units. In addition to the problems given below the unit will consist of problems given in Text / Reference books.

(1) Plotting of Harmonic oscillator wave functions in 1-d.

(2) Energy levels of a particle of mass m moving in one-dimensional potential.

$$V(x) = \begin{cases} +\infty, & x < 0 \\ +\frac{1}{2} m\omega^2 x^2, & x > 0 \end{cases}$$

(3) Wave function corresponding to minimum uncertainty product. Gaussian wave packet. Spread of wave packet in time.

(4) Continuous basis corresponding to position eigen values and wave functions corresponding to state vectors using position and momentum representation.

(5) Rotational spectra of diatomic molecules.

(6) Vibrational and rotational spectra of diatomic molecules.

(7) Spin and statistics

Books Recommended

- L I Schiff, Quantum Mechanics
- S Gasiorovvicz, Quantum Physics
- B Craseman and J D Powell Quantum Mechanics
- A P Messiah Quantum Mechanics
- J. J. Sakurai Modern Quantum Mechanics
- Mathews and Venkatesan Quantum Mechanics

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2019 Onwards

M. Sc. II Semester **Max Marks- 40**

Passing Marks - 14

Paper-II: Statistical Mechanics

Course Outcome

The students are expected to acquire the knowledge of the following:

- Concept of statistical mechanics
- Gibbs paradox, equipartition of energy and concept of negative temperature in two level system.
- Combinational studies of particles with their distinguishably and indistinguishably. Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac distribution laws .
- Quantum statistical mechanics (Cluster Expansion).
- Bose-Einstein condensation law and liquid Helium.
- Fermi energy and Fermi level, strongly degenerate Fermi gas, electronic contribution to specific heat of metals.
- F-D statistical distribution law and thermodynamic functions of a degenerate Fermi gas. Electron gas in metals.

Unit - I

Foundation of statistical mechanics, specification of states of a system contact between statistics and thermodynamics, classical ideal gas entropy of mixing and Gibb's paradox. Microcanonical ensemble, phase space, trajectories and density of states, Liouville theorem, canonical and grand canonical ensembles, partition function, calculation of statistical quantities, energy and density fluctuations.

Unit-II

Statistics of ensembles, statistics of indistinguishable particles, density matrix, Maxwell Boltzmann, Fermi Dirac and Bose- Einstein statistics, properties of ideal Bose gases, Bose Einstein condensation, properties of ideal Fermi gas, electron gas in metals, Boltzman transport equation.

Unit-III

Cluster expansion for a classical gas, virial equation of state, mean field theory of Ising model in 3, 2 and 1 dimension. Exact solution in one-dimension.

Unit - IV

Thermodynamics fluctuation spatial correlation Brownian motion, Langevin theory, fluctuation dissipation theorem, the Fokker-Planck equation, Onsager reciprocity relations

Unit - V

This unit will have questions covering all the four units. In addition to the problems given below the unit will consist of problems given in Text / Reference books.

(1) Calculation of number of states and density of states.

(2) Relative population of particles in two energy levels.

(3) Liquid helium II

(4) Electrical and thermal conductivities.

(5) Evaluation of virial coefficient

(6) Critical indices.

(7) Applications of Onsager relation

(8) Diffusion co-efficient

Books Recommended

- F Reif Statistical and thermal Physics
- K Huang Statistical Mechanics
- R K Pathria Statistical Mechanics
- R Kubo Statistical Mechanics
- Tandan Statistical Physics

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2019 Onwards

M. Sc. II Semester **Max Marks- 40**

Passing Marks - 14

Paper-III: Electrodynamics & Plasma Physics

Course Outcome

The students are expected to acquire the knowledge of the following:

- Basics of electrostatics and magnetostatics, Maxwell's equations.
- Retarded potentials, Lienard Wiechert potentials, electric and magnetic fields due to a moving charge, power radiated.
- Four vector and Lorentz transformation in 4-dimensional spaces, Langragian and Hamiltonian for a relativistic charged particle in External EM field.
- Elementary concept of occurrence of plasma and study of Gaseous and solid state plasma.
- Magneto hydrodynamics and plasma Physics.

Unit - I

Review of Basics of electrostatics and magnetostatics, electric field, Gauss's law, Laplace and Poisson equations, method of images, Biot-Savart law, Ampere law, Maxwell's equations, scalar and vector potentials, gauge transformation, Lorentz gauge, Coulomb Gauge, Solution of Maxwell equations in conducting media radiations by moving charges, retarded potentials, Lienard-wiechert potentials, fields of charged particles in uniform motion, fields of arbitrarily moving charge particle.

Unit-II

Fields of an accelerated charged particles at low velocity and high velocity, angular distribution of power radiated, Review of four vector and Lorentz transformation in 4-dimensional spaces, Invariance of electric charge, relativistic transformation properties of E and H fields. Electromagnetic fields tensor in 4- dimensional Maxwell equation, Four Vector current and potential and their invariance under Lorentz transformation, covariance of electrodynamics. Langragian and Hamiltonian for a relativistic charged particle jn External EM field; motion of charged particles in electromagnetic fields, uniform and nonuniform E and B fields.

Unit -III

Elementary concept of occurrence of plasma. Gaseous and solid state plasma. Production of gaseous and solid state plasma. Plasma parameters. Plasma confinement pinch effect instability in a pinched- plasma column. Electrical neutrality in a plasma. Debye screening distance. Plasma oscillations: Transverse oscillations and longitudinal oscillations.

Unit - IV

Domain of Magnetohydrodynamics and plasma Physics : Magnetohydrodynamic equations, magnetic hydro-static pressure hydrodynamic waves: Magneto-sonic and Alfven waves, particle orbits and drift motion in a plasmas, Experimental study of Plasma, the theory of single and double probes.

Unit - V

This unit will have questions covering all the four units. In addition to the problems given below the unit will consist of problems given in Text / Reference books.

(1) Obtain the formal solution for electromagnetic boundary value problem with Green function.

(2) Discuss the problem of conducting sphere is a uniform electric field by method of images and Green's functions.

(3) For a solenoid wound with N turns per unit length and carrying a current I, show that the magnetic flux density on a point on the axis is given (for $N \rightarrow \infty$) by

$$B_z = \frac{2\pi NI}{C}(\cos\theta_1 + \cos\theta_2)$$

Where θ_1, θ_2 are the angles between the axis and the lines joining the point on the axis to the first and last turns of the solenoid.

(4) A linear accelerator accelerates protons to almost relativistic speeds. Determine fraction of power radiated by the protons to the power supplied in terms of the gradients of the linear electric field.

(5) A charged particle oscillated according to the harmonic law Determine the total average intensity of the emitted radiation.

(6) Discuss the Lagrangian and Hamiltonion for a relativistic charged particle in External electromagnetic field.

(7) Obtain the expression for energy radiated as Cherenkov radiation per unit distance along the path of the particle.

(8) Consider a magnetic field configuration that is cylindrically symmetric and a charged particle is injected into it. Use the adiabatic invariant of motion to describe conditions in which the injected particle would bounce back from the direction of increasing field gradient.

(9) Consider the problem of waves in an electronic plasma when an external magnetic field B_0 is present. Use the fluid model, neglecting the pressure term as well as collisions.

(a) Write down the linearized equations of motion and Maxwell equations, assuming all variables vary as exp (ik.x-iωt).

(b) Show that the dispersion relation for the frequencies of the different modes in terms of the wave number can be written.

$\omega^2(\omega^2-\omega_p{}^2)\,(\omega^2 - \omega^{p2}- k^2c^2) = \omega^2{}_B\,(\omega^2 - k^2c^2)\,[\omega^2\,(\omega^2 - \omega p^2-k^2c^2) + \omega p^2c^2\,(k\,.b)^2]$

where b is the unit vector in the direction of $B_,$ ω_p and ω_B are the plasma and precession frequencies, respectively.

(c) Show that for propagation parallel to B_0 the dielectric constant is recovered.

(d) Assuming $\omega_B << \omega_p$, solve approximately for the various roots for the cases

(i) K parallel to b

(ii) K perpendicular to b. Sketch your result for w^2 versus k^2 in the two cases.

Books Recommended

- Bitteneerort Plasma Physics
- Chen Plasma Physics
- Gupta, Kumar, Singh Electrodynamics
- Sen Plasma state and matter
- Jackson Classical electrodynamics
- Pamolsky & Philips Classical electricity and Magnetism

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2019 Onwards

M. Sc. II Semester **Max Marks- 40**

Passing Marks - 14

Paper-IV: Condensed Matter Physics

Course Outcome

The students are expected to acquire the knowledge of the following:

- Interaction of X-Ray with matter. Defects and its types.
- Concept of Free electron Fermi gas, Energy bands and band theory.de Haas-Von Alphen effect. Super conductivity and high temperature superconductors.
- Concept of atomic and molecular Polariziblity and its related phenomena like Hall effect and Quantum Hall Effects etc.
- Theories of Ferromagnetism, law for susceptibility and ferri and anti-Ferro-magnetic order in condense matter.

Unit - I

Interaction of X-ray with matter, absorption of X-rays, Elastic scattering from a perfect lattice. The reciprocal lattice and its application to diffraction techniques, the Lave, power and rotating crystal methods. Crystal structure factor and intensity diffraction maxima. Extinction due to lattice centering.

Point defeats, line defects and planer (stacking) faults. The role of dislocation in plastic deformation and crystal growth. The observation of imperfections in crystals. X-ray and electron microscopic techniques

Unit - II

Free electron Fermi gas, Energy levels of orbital in one and three dimensions. Electrons in a periodic lattice. Bloch theorem, band theory of solids, Classification of solids effective mass. Tight binding, cellular and pseudopotential methods. Fermi surface. De Hass von Alfen effect, Super conductivity, critical temperature persistent current. Meissner effect, general idea about high temperature superconductors.

Unit-III

Atomic and molecular Polariziblity, Claussius-Mossotti relation, types of polarzibility, dipolar polarizibility and frequency dependence of dipolar polarizibility, ionic and electronic polarizibilty, Hall effect. Quantum Hall Effects, Magnetoresistance.

Unit - IV

Weiss Theory of Ferromagnetism. Heisenberg model and molecular field theory, spin waves and magnous, Curie-waves law for susceptibility, ferri and anti-Ferro-magnetic order. Domains and Bloch-wall energy.

Unit - V

This unit will have questions covering all the four units. In addition to the problems given below the unit will consist of problems given in Text / Reference books.

(1) Given that the primitive basis vectors of a lattice a = (a/2) (i + j), b = a/2 (j + k) and c = a/2 (k + j) where i, j and k are usual three unit vectors along cartesion coordinates. What is the Bravais lattice?

(2) Determine planes in a fcc structure having highest density of atoms.

Or

Evaluate density of atoms for Cu in atoms/cm^2.

(3) For the delta function potential and with $p > 1$ find at $k = 0$ the energy of the lowest energy band. Also find the band gap at $k = \pi /a$.

(4) Consider a square, lattice in two dimensions with the crystal potential.

$U(x,y) = .4U \cos (\pi x/a) \cos (\pi y/a)$

Apply the central equation to find approximately the energy gap at the corner point $(\pi/a, \pi/a)$ of the Brillouine Zone.

(5) Explain why the Hall constant is inversely proportional to the electron concentration M.

Books Recommended

- Kittle Solid State Physics
- Aschroft & Mermin Solid State Physics
- L.V. Azaroff Introduction to Solid State Physics
- Verma & Srivastava Crystellographic Solid State Physics
- A.J. Dekker Solid State Physics
- P.M. Chaiken& T.C. Lubensky Principles of Condense Matter Physics

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2019 Onwards

M.SC. (PHYSICS) I & II SEMESTER: PRACTICAL COURSE

Note: Appropriate other experiments can be added based on prescribed syllabus in both labs A and B

LAB : A

Max. Marks: 50

Min. Marks: 18

Miscellaneous Topics in Optics I & II

(Preferably Five experiments per semester to be performed by the students)

1. Determination of the Wavelength of the LASER Light source using plane Transmission Gratting.
2. Determination of Separation Between Two Plates of Fabry Perot Etalon with the help of He- Ne Laser.
3. Determination of the radius of Curvature of Plano- convex Lens by Newton's Ring Method.
4. Determination f Wavelength of Spectral Line by Constant deviation Spectrograph.
5. Determination of Refractive index of the material of the prism By Using Spectrometer And Laser And Plotting i-δ Curve.
6. Sodium Light Determination of the Wavelength of the Source Fresnel's Biprism.
7. To Find the Brewster's angle of the Prism using Spectrometer and Polarizer.
8. To Find the Refractive Index of Water and to Study the variation of Refractive index With Wavelength of the Light Source.
9. To Find the Refractive index of Sugar Solution and to Study the Variation of the Refractive index With difference molar Concentration.
10. To measure the LASER beam divergence using Photo Sensor by Plotting the distance vs. current graph.
11. To Determine the Elastic constant of acrylic beam by Cornu's method.
12. To determine the Wavelength of the of the LASER Light Source using Plane Transmission grating.
13. Optical Fibre
    (a) Determination of numerical aperture.
    (b) Attenuation loses.
    (c) Bending loss.
14. Production and study of elliptically and circularly polarized light by Fresnel's Rhomb.
15. Verification of Hartman's formula by constant deviation spectrometer.
16. Verification of Fresnel's law of reflection for polarized light.

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M.SC. (PHYSICS) I & II SEMESTER: PRACTICAL COURSE

Note: Appropriate other experiments can be added based on prescribed syllabus in both labs A and B

LAB –B (ELECTRONICS –I & II)

Max. Marks: 50

Min. Marks: 18

(Preferably Five experiments per semester to be performed by the students)

(1) To study IV Characteristics of LED of different colour and determination of their threshold voltage and wavelength.

(2) To verify the De'Morgans theorem using the Logic gate.

(3) Design of a regulated power supply using IC78XX(7805,7809,7812).

(4) To study the truth table of RS Flip flop.

(5) To study the truth table of JK Flip flop.

(6) To verify truth table of NOT, AND, NAND, OR, NOR, Ex-OR using IC 74XX series.

(7) To design half adder using 74XX series IC.

(8) To design and study Astable multivibrator.

(9) To design a differentiator using IC 741 on multisim software and get different waveform for different input.

(10) To design a integrator using IC 741 on multisim software and get different waveform for different input.

(11) Design of a regulated power supply using IC78XX(7805,7809,7812) in multisim software.

(12) To design a adder and substractor using IC 741 on multisim software/ IC74XX.

(13) To design and study Butterworth High pass filter using IC 741 in multisim

(14) To design and study Butterworth Low pass filter using IC 741 in multisim

(15) Study of Astable, Monostable and bistable Multivibrator using IC 555.

(16) Characteristics and application of Silicon controlled Rectifier.

(17) Experiment on FET and MOSFET characterization and application as an amplifier.

(18) Experiment an UJT and its applications.