MAHARSHI DAYANAND SARASWATI UNIVERSITY, AJMER

पाठ्यक्रम

SYLLABUS

SCHEME OF EXAMINATION AND COURSES OF STUDY

FACULTY OF SCIENCE

M.Sc. PHYSICS

M.Sc. Physics (Previous) & (Final)

2009–10 से प्रभावी(w.e.f.)

सत्र 2013–14

महर्षि दयानन्द सरस्वती विश्वविद्यालय, अजमेर

NOTICE

1. Change in Statutes/Ordinances/Rules/Regulations/ Syllabus and Books may, from time to time, be made by amendment or remaking, and a candidate shall, except in so far as the University determines otherwise comply with any change that applies to years he has not completed at the time of change. **The decision taken by the Academic Council shall be final.**

सूचना

1. समय-समय पर संशोधन या पुन: निर्माण कर परिनियमों /अध्यादेशों / नियमों / विनियमों / पाठ्यक्रमों व पुस्तकों में परिवर्तन किया जा सकता है, तथा किसी भी परिवर्तन को छात्र को मानना होगा बशर्ते कि विश्वविद्यालय ने अन्यथा प्रकार से उनको छूट न दी हो और छात्र ने उस परिवर्तन के पूर्व वर्ष पाठ्यक्रम को पूरा न किया हो। **विद्या परिषद द्वारा लिये गये निर्णय अन्तिम होंगे।**

M.SC. (PREVIOUS) PHYSICS EXAMINATION

Scheme of examination:

Four Theory Papers		**Max. Marks 400**
Paper-I		
Classical And Statistical Mechanics And Mathematical Physics	3 hrs. duration	100 marks
Paper-II		
Electrodynamics and Plasma Physics.	3 hrs. duration	100 marks
Paper-III		
Quantum Mechanics and Atomic and Molecular Physics	3 hrs. duration	100 marks
Paper-IV:		
Electronics, Computational Methods and Progamming	3 hrs. duration	100 marks
Practical		
12 hrs. duration		**Max. marks : 200**

Note: There will be two experiments of 6 hrs. duration each, selecting one from each group for two days. The distribution of marks will be as follows:

Two experiments (each of 60 marks)	-	120	Marks
Viva Voce	-	40	Marks
Record	-	40	Marks
Total	=	200	Marks

A candidate to pass the M.Sc. (Previous) Physics examination shall be required to obtain at least 36 % marks in aggregate both in four theory papers and practical separately. Apart from that, candidate shall be required to obtain at least 25% marks in each individual theory paper. If a candidate clears any paper (s)/ practical after a continuous period of three years, than for the purpose of working out his/her division, the minimum pass marks only viz. 25% in case of theory (or *36%* in case of practical) shall be taken into account in respect of such paper (s)/ practical.

Note : Non-collegiate candidates are not eligible to appear in the examination where practical is involved.

Work load

Each theory paper must be given 4 Hrs. per week for theory. Practical must be given 30 periods per week per batch. Each laboratory batch for practical must not be of more than 10 students. This gives 120 Hrs. for each theory paper with 30 weeks of teaching every year.

PAPER-I

CLASSICAL AND STATISTICAL MECHANICS AND MATHEMATICAL PHYSICS

Time: 3 hrs. **Max. Marks: 100**

NOTE - Question paper will have three part viz. Part -A (20 marks), Part-B (20 Marks) and Part- C (60 Marks). Students are required to answer all ten very short type questions (20 words each) in Part-A. Each question carry equal marks.

In Part-B, answer all five short type questions (50 words each). Internal choice has been given to each question. Each question carry equal marks.

In Part- C, candidates are required to attempt all three essay type questions (400 words each). Internal choice has been given to each question. Each question carry equal marks.

Unit -I

Constraints; their classification, D'Alembert's principle, generalized co-ordinates. Lagrange's equations; gyroscopic forces; dissipative system; Jacobi integral; gauge invariance; generalized coordinates and momenta; integrals of motion; symmetries of space and time with conservation laws; invariance under Galilean transformations.

Rotating frames; inertial forces; terrestrial and astronomical applications of coriolis force.

Central force; definition and characteristics; Two-body problem; closure and stability of circular orbits; general analysis of orbits; Kepler's laws and equation; artificial satellites; Rutherford scattering.

Principle of least action; derivation of equations of motion; variation and end points; Hamilton's principle and characteristic functions; Hamilton Jacohi equation.

Canonical transformation; generating functions; Properties; group property; examples; infinitesimal generators; Poisson bracket; Poisson theorems; angular momentum PBs; small oscillations; normal modes and coordinates.

Unit -II

Orthogonal curvilinear co-ordinate system, scale factors, expressions for gradient, divergence and curl and their applications to Cartesian, cylindrical and spherical polar co-ordinate systems. Co-ordinate transformation, transformation of covariant, contravaiant and mixed tensor. Addition, multiplication and contraction of tensors, quotient law, pseudotensors. Metric tensor, its use in transformation of Tensors.

Vector Spaces and Matrices: linear independence; Bases; Dimensionality; Inner product; Linear transformations; Matrices; Inverse; Orthogonal and unitary matrices; Independent elements of a matrix; Eigenvalues and eigenvectors; Diagonalization; Complete Orthonormal sets of functions.

Differential Equations and Special Functions; Second order linear ODEs with variable coefficicnts; Solution by series expansion; Legendre, Bessel, Hermite and Lagaurre equations; Physical application; Generating functions; reccurence relations.

Integral Transforms: Laplace transform; First and second shifting theorems; inverse L T by partial fractions; L T; derivative and integral of a function; Fourier series; FS or arbitrary period; Half-wave expansions; Partial sums; Fourier integral and transforms; F T of delta function.

Unit -III

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

Density matrix, statistics of ensembles, statistics of indistinguishable particles, Maxwell-Boltzman, Fermi-Dirac and Bose-Einstein statistics, properties of ideal Bose and Fermi gases, Bose-Enstein condensation.

Cluster expansion for a classical gas, Virial equation of state, Ising model, mean-field theories of the ising model in three, two and one dimensions Exact solutions in one-dimension.

Landau theory of phase transition, critica, indices, scale transformation and dimensional analysis.

Text and Reference Books :

1. Mathematical Methods for Physics, by G Arfken
2. Matrices and Tensors for Physicists, by A W Joshi
3. Advanced Engineering Mathematics. by E Kreyzing
4. Special Functions, by E D Rainville
5. Special Functions, by W W Bell
6. Mathematical Methods for Physics and Engineerings. by K F Reily. M P Hobson and S Js Bence
7. Mathematics for Physics, by Marry Boas
8. Statistical and Thermal Physics, by F Reif
9. Statistical Mechanics, by K Huang
10. Statistical Mechanics, R K Pathria
11. Statistical Mechanics, R Kubo
12. Statistical Physics, Landau and Lifshitz

13. Classical Mechanics, by N.C Rana and P.S. Joag (Tata McGraw-Hill, 1991)
14. Classical Mechanics, by H. Goldstein (Addison Wessley, 1980). Mechanics, by A Sommerfeld (Academic Press, 1952).
15. Introduction to Dynamics, by I. Perceival and D. Richards (Cambridge University Press,] 982).

PAPER-II:

ELECTRODYNAMICS AND PLASMA PHYSICS

Time: 3 hrs. **Max. Marks: 100**

NOTE - Question paper will have three part viz. Part A (20 marks), Part B (20 Marks) and Part C (60 Marks). Students are required to answer all ten very short type question (20 words each) in Part A. Each question carry equal marks.

In Part B, answer all five short type question (50 word each). Internal choice has been given to each question. Each question carry equal marks.

In Part C, candidates are required to attempt all three essay type question (400 word each). Internal choice has been given to each question. Each question carry equal marks.

Unit - I

Electrostatics: Electric field; Gauss law, Differential form of Gauss law. Another equation of electrostatics and the scalar potential, surface distribution of charges and dipoles and discontinuities in the electric field and potential, Poisson and-Laplace equations, Green's Theorem, Uniqueness of the solution with Dirichlet or Neumann Boundary conditions, Formal solution of Electrostatic Boundary value problem with Green's Function, Electrostatic potential energy and energy density, capacitance.

Boundary- Value Problems in Electrostatics: Methods of Images, Point charge in the presence of a grounded conducting sphere, point charge in the presence of a charge insulated conducting sphere, Point charge near a conducting sphere at fixed potential, conducting sphere in a uniform electric field by method of images, Green function for the sphere, General solution for the potential, Conducting sphere with Hemispheres at different potential.

Multipoles, Electrostatics of Macroscopic Media Dielectrics: Multipole expansion, multipole expansion of the energy of a charge distribution in an external field, Elementary treatment of electrostatics with permeable media, Boundary value problems with dielectrics. Molar polarizability, and electric susceptibility. Models for molecular polarizability, Electrostatic energy in dielectric media..

Unit - II

Magnetostatics: Vector potential and Magnetic induction for a circular current loop, Magnetic fields of a localized current distribution, Magnetic moment, Force and torque on and energy of a localized current distribution in an external magnetic induction, Macroscopic equations. Boundary conditions on Band H. Methods of solving Boundary-value problems in magnetostatics, Uniformly magnetized sphere, Magnetized sphere in an external field, Permanent magnets, Magnetic shielding, spherical shell of permeable material in a uniform field.

Maxwell's equations Conservation Laws: Energy in a magnetic field, Vector and Scalar potentials. Gauge transformations, Lorentz gauge, Coulomb gauge, Green functions for the wave equation, Derivation of the equations of Macroscopic Electromagnetism, Poyntingis theorem and conservations of energy and momentum for a system of charged particles. and EM fields. Conservation laws for macroscopic media.

Plane Electromagnetic Waves and Wave Equation: Plane wave in a nonconducting medium. Frequency dispersion characteristics of dielectrics, conductors and plasmas, waves in a conducting or dissipative medium, superposition of waves in one dimension, group velocity, casualty connection between D and E. Kramers-Kroning relation.

Review of Four-Vector and Lorentz Transformation in Four-Dimensional Space, Electromagnetic Field Tensor in Four Dimension and Maxwell's Equations. Dual FieJd Tensor, Wave Equation for Vector and Scalar Potential and Solution Retarded Potential and Lienard-Wiechart Potential.

Unit - III

Electric and Magnetic fields due to a uniformly moving charge and an accelerated Charge, Linear and Circular Acceleration and Angular distributuion of power Radiated, Bramsstrahlung, Synchrotron radiation and Cerenkov Radiation, reaction Force of Radiation.

Motion of charged Particles in Electromagnetic Field: Uniform E and B FieJds. Non-uniform Fields, Diffusion Across Magnetic Fields, Time varying E and B Fields, Adiabatic Invariants: First, Second Third Adiabatic Invariants.

Plasma Physics Elementary Concepts; Derivation of moment equations from Boltzmann equation, Plasma oscillations, Debye Shielding, Plasma Parameters, Magneloplasma, Plasma Confinement. Hydrodynamical description of Plasma: Fundamental. Hydromagnetic Waves: Magnetosonic and Alfven Waves. .

Wave phenomena in Magnetoplasma: Polarization, Phase velocity, Group velocity, Cut- offs, Resonance for Electromagnetic Wave propagating parallel and perpendicular to the Magnetic Field, Propagation at Finite

Angle and CMA Diagram, Appleton-Hartece Formula and Propagation through Ionosphere and Magnetosphere: Helicon, Whistler, Faraday Rotation.

Text and Reference Books

1. Panofsky and Phillips: Classical Electricity and Magnetism.
2. Bitlencourt : Plasma Physics.
3. Chen: Plasma Physics.
4. Jackson: Classical Electrodynamics.

PAPER-III

QUANTUM MECHANICS, ATOMIC AND MOLECULAR PHYSICS

Time: 3 hrs. **Max. Marks: 100**

NOTE - Question paper will have three part viz. Part A (20 marks), Part B (20 Marks) and Part C (60 Marks). Students are required to answer all ten very short type question (20 words each) in Part A. Each question carry equal marks.

In Part B, answer all five short type question (50 word each). Internal choice has been given to each question. Each question carry equal marks.

In Part C, candidates are required to attempt all three essay type question (400 word each). Intern. l choice has been given to each question. Each question carry equal marks.

Unit -I

Why Quantum Mechanics? Revision; Inadequacy of classical mechanics; Schrodinger equation; Admissible wave function; Stationary states. Solution of Harmonic oscillator by Schrodinger equation and by operator method.

Uncertainty relation of x and p, States with minimum uncertainty product; General formalism of wave mechanics, Commutation relations; Representation of states and dynamical variables; Completeness of eigen functions; Dirac delta function; bra and ket notation; Matrix representation of an operator; Unitary transformation.

Solution of Schrodinger equation for spherically symmetric potentials; Hydrogen atom. Angular Mometum Algebra, Addition of angular momenta Time-independent perturbation theory; Non-degenerate and degenerate cases; Applications such as Stark effect.

Unit -II

Variational method; WKB approximation; Time-dependent perturbation theory; Harmonic perturbation; Fermi's golden rule; Adiabatic and sudden approximations.

Collision in 3-D and scattering; Laboratory and centre of mass reference frames; Scattering amplitude; differential scattering cross section and total scattering cross section: Scattering by spherically symmetric potentials; Partial wave analysis and phase shifts; Scattering by a perfectly rigid sphere and by square well potential; complex potential and absorption.

Identical particles; Symmetric and anti symmetric wave functions; collision of identical particles; Spin angular momentum; Spin functions for a many electron system.

Unit -III

Semi classical theory of radiation; Transition probability for absorption and induced emission; Electric dipole and forbidden transitions; Selection rules.

Spectroscopy(qualitative) : General features of the spectra of one and two electron system singlet, doublet and triplet characters of emission spectra, general features of Alkali spectra, rotation and vibration band spectrum of a molecule, PQ and R branches, Raman spectra for rotational and vibrational transitions, comparison with infra red spectra. general features of electronic spectra. Frank and Condon's principle.

Text and Reference Books

1. LI. Schiff, Quantum Mechanics (McGraw-Hili)
2. S. Gasiorowicz, Quantum Physics (Wiley)
3. B Craseman and J.D. Powell, Quantum Mechanics (Addison Wesley)
4. A.P. Messiah, Quantum Mechanics
5. J J Sakurai, Modem Quantum Mechanics
6. Mathews and Venkatesan : Quantum Mechanics (TMH)

PAPER-IV

ELECTRONICS, COMPUTATIONAL METHODS AND PROGRAMMING

Time: 3 hrs. **Max. Marks: 100**

NOTE - Question paper will have three part viz. Part A (20 marks), Part B (20 Marks) and Part C (60 Marks). Students are required to answer all ten very short type question (20 words each) in Part A. Each question carry equal marks.

In Part B, answer all five short type question (50 word each). Internal choice has been given to each question. Each question carry equal marks.

In Part C, candidates are required to attempt all three essay type question (400 word each). Internal choice has been given to each question. Each question carry equal marks.

Unit-I

Operational Amplifiers -Differential amplifier - circuit configurations - dual input balanced output differential amplifier - DC analysis -AC analysis, inverting and non inverting inputs CMRR - constant bias level translator.

Block diagram of a typical Op-amp-analysis. Open loop configuration inverting and non-inverting amplifiers Op-amp with negative feedback - voltage series feed back - effect of feed back on closed loop gain, input resistance output resistance, bandwidth and output offset voltage - voltage follower.

Practical op-amp input offset voltage input bias current-input offset current, total output offset voltage. CMRR frequency response. DC and AC amplifier summing scaling and averaging amplifiers instrumentation amplifier, integrator and differentiator.

Oscillators principles - oscillator types - frequency stability - response The phase shift oscillator. Wien bridge oscillator - LC tunable oscillators Multivibrators - Monostable and Astable - comparators - square wave and triangle wave generators, Diode clipping and clamping circuits.

Voltage regulators- fixed regulators - adjustable voltage regulators switching regulators

Unit-II

Communication Electronics Amplitude modulation - Generation of AM waves - Delmodulatin of AM waves - DSBSC modulation. Generation of DSBSC waves, Coherent detection of DSBSC waves, SSB modulation, Generation and detection of SSB waves. Vestigial sideband modulation. Frequency Division multiplexing (FDM).

Combinational Logic : The transistor as a switch, OR, AND and NOT gates NOR and NAND gates, Boolean algebra - Demorgan's theorems - Exclusive OR gate Decoder/ Demultiplexer Data selector/multiplexer - Encoder.

Sequential Logic Flip - Flops: AI - bit memory - The RS Flip - Flop, JK Flip - Flop – JK master slave Flip - Flops - T Flip - Flop - D Flip - Flop- Shift registers - synchronous and asynchronous counters - cascade counters, A/D and D/A convertors

Computational Methods

Methods for detennination of zeroes of linear and nonlinear algebraic equations and transcendental equations, convergence of solutions. Solution of simultaneous linear equations, Gaussian elimination, pivoting,iterative method, matrix inversion. Eigenvalues and eigenvectors of matrices, Power and Jacobi Method. Finite differences, interpolation with equally spaced and unevenly spaced points, Curve fitting. Polynomial least squares and cubic Spline fitting.

Unit-III

Numerical differentiation and integration, Newton-Cotes formulae, error estimates, Gauss method.Random variable, Monte Carlo evaluation of Integrals, Methods at importance sampling, Random walk and Metropolis method.

Numerical solution of ordinary differential equations, Euler and Runge Kutta methods, Predictor and corrector method, Elementary ideas of solutions of partial differential equations.

Microprocessors and Programming

Introduction to microcomputers - memory - input/output - interfacing devices 8085 CPU - Architecture - BUS timings - Demutiplexing the address bus, generating control singals - Instruction set - addressing modes - :Ilustrative programmes - writing assembly language programmes looping counting and indexing - counters and timing delays - stack and subroutine.

Programming Elementary infomation about Digital computer Principles, Compilers, Interpreters and Operating systems, Fortran programming, Flow Charts, Integer and Floating Point Arithmitic, Expressions. built in functions, executable and non-executable statements assignment, control and input- output elements Subroutines and functions, Operation with files.

Reference Books

1. Electronic Devices and circuit theory by Robert Boylested and Louis
2. Nasnasky PHI. New Delhi-1 1000 I, 1991
3. OP-Amps & Linear integrated circuits, by Ramakanth A. Gayakwad PHI, Second Edition. 1991
4. "Digital principles and Applications" by A.P. Malvino and Donald P. Laacn. Tata Mcgraw - Hill company. New Delhi, 1993.
5. Microprocessor Architecture. programming and Applications with 80851 8086 by Ramesh S. Gaonkar, Wiley - Eastem Ltd., 1987 (for unit v) Sastry: Introductory Methods of Numerical Analysis
6. Rajaraman : Numerical Analysis
7. Rajaraman: Fortran Programming
8. Vetterming, Teukolsky, Press and Flannery: Numerical Recipes

LIST OF EXPERIMENTS

Total number of experiments to be performed by the students during the academic session should be 16 selecting any eight from each section.

Few more experiments may be set at the institutional level, at par with

- the standard of M.Sc. (Pre) class. Laboratory tutorials are to be discussed in laboratory Periods and in examination due weight age be give in viva.

Group: A

1. To use a Michelson Interferometer to determine:
   (i) l-the wave length of Sodium yellow light
   (ii) $(l_1 - l_2)$' the difference between the wave length of the two sodium D-lines.
   (iii) the thickness of a mica sheet.
2. To test the validity of the Hartmann's prism dispersion formula using the visible region of mercury spectrum.
3. To find the refractive index of air by means of a Fabry-Perot Etalon, the thickness between the plates being given.
4. Determination of wave length of Neon light taking Hg source as a standard source applying Hartmann formula.
5. Determine Stetan's constant.
6. X-ray diffraction by Telexometer.
7. Determination of Ionization potential of Lithium.
8. Determination of e/m of electron by Normal Zeeman Effect.
9. Determinations of dissociation energy of Iodine (I) molecules by photography, the absorptions band of I in the visible region.
10. Using He-Ne laser light:
    (i) Measure of wavelength with the help of ruler.
    (ii) Measure the thickness of the wire.
11. Testing goodness of fit of Poisson distribution to cosmic ray busts by Chi-square test.
12. To study Faraday effect using He-Ne laser.

Group: B

1. Design of a Regulated Power supply.
2. Design of a Common Emitter Transistor Amplifier.
3. Experiment on Bias Stability
4. A stable, Monostable and Bistable Multivibrators.
5. Characteristics and applications of Silicon Controlled Rectifier.
6. Experiment on FET and MOSFET characterization and application as an amplifier.
7. Experiment on Uni-junction Transistor and its application,
8. Digital I : Basic Logic Gates, TTL, NAND and NOR.
9. Digital II: Combinational logic.
10. Flip-Flops.
11. Operational Amplifier (741)
12. Differential Amplifier.
13. Programming Exercises in FORTAN (Based on theory syllabus Paper-IV)

14. Simple Programming Exercises based on assembly language for microprocessor 8085.

Tutorial: Laboratory Practical Course-M.Sc (Previous)- Physics (Any eight).

1. Network Analysis-Thevenin and Nortan's equivalent circuits.
2. Basics of P.N junction-Diffusion current Drift current, Junction width, Forward and reverse biasing. significance of Fermi level in stabilizing the junction.
3. Zener Diode—characteristics and voltage regulation.
4. Transistor biasing and stability.
5. Wein's bridge and phase shift oscillators.
6. Solving Boolean expressions.
7. Mechanism and production of electrical pulse through absorption of nuclear radiation in medium.
8. Dead time efficiency. counting techniques, energy resolution.
9. Lattice extinctions in X-ray diffraction
10. Atomic scattering power and geometrical structure factor.
11. Effect of capacitance and load resistance on output of an amplifier.
12. Integrated circuit timer familiarization.
13. Op-amp differentiator.
14. Multiplexers and Demultiplexers.
15. Resistors and counters.
16. Radiation level and activity measurement.
17. Shielding, mass absorption coefficient.
18. Coincidence circuits. counters. timers.
19. Coherence and its relevance in diffraction.
20. Identification of charge type by Hall voltage measurement.
21. How does four probe method solve the problem of contact resistance?

M.SC. (FINAL) PHYSICS EXAMINATION

Scheme of examination:

Four Theory Papers **Max. Marks – 400**

Paper-V:	**Condensed Matter Physic**	3 hrs. duration	100 marks
Paper-VI:	**Nuclear and Particle Physics**	3 hrs. duration	100 marks
Paper VII:	**Special Paper -Anyone out of the following special papers:**	3 hrs. duration	100 marks
VII (A):	**Advanced Quantum Mechanics and introductory quantum field theory**		
VII (B):	**Atomic and Molecular Physics**		
VII (C):	**Quantum Electrodynamics and Quantum many body physics**		
Paper VIII-	**Elective Paper- Anyone out of the following elective papers:**	3 hrs. duration	100 marks
VIII (A):	**Microwave electronics**		
VIII (B):	**Solid State Electronics**		
VIII (C):	**Plasma Physics**		
VIII (D):	**Atmospheric Science and Environmental Physics**		
VIII (E):	**High Energy Physics**		
VIII (F):	**Informatics. (materials and Data communication)**		
VIII (G):	**Science and Technology of solar, hydrogen energy and the renewable energies.**		
VIII (H):	**Physics of Lasers and properties of bio molecules**		

Practical Examination 12 hrs duration 200 marks

Note: There will be two experiments of 6 hrs duration each day one from section A and the other from section B for two days. The distribution of marks will be as follows:

Two experiments (each of 60 marks)	120
Viva	40
Record	40
Total	200

M.SC. (FINAL)

Paper- V - Condensed Matter Physics

Duration: 3 hrs. Max. Marks: 100.

NOTE - Question paper will have three part viz. Part -A (20 marks), Part-B (20 Marks) and Part- C (60 Marks). Students are required to answer all ten very short type questions (20 words each) in Part-A. Each question carry equal marks.

In Part-B, answer all five short type questions (50 words each). Internal choice has been given to each question. Each question carry equal marks.

In Part- C, candidates are required to attempt all three essay type questions (400 words each). Internal choice has been given to each question. Each question carry equal marks.

Unit - I

Crystal physics and Defects in Crystals

Crystalline solids, unit cells and direct lattice, two and three dimensional Bravais lattices, closed packed structures.

Interaction of X-rays with matter, absorption of X-rays, Elastic scattering from a perfect lattice. The reciprocal lattice and its applications to diffraction techniques. The Laue, powder and rotating crystal methods, crystal structure factor and intensity of diffraction maxima, Extinctions due to lattice centering. Point defects, line defects and planer (stacking) faults. The role or dislocations in plastic deformation and crystal growth. The observation of imperfections in crystals, X-ray and electron microscopic techniques.

Lattice Vibrations and Thermal Properties: Interrelations between elastic constants CII, CI2 and C44 wave propagation and experimental determination of elastic constant of cubic crystals, vibrations of linear mono and diatomic lattices, Determination of phonon dispersion by inelastic scattering of neutrons

Unit -II

Theory of Metals :

Fermi Dirac distribution function, density of states, temperature dependence of Fermi energy, specific heat, Boltzmann equation and mean free path, relaxation time and scattering processes, thermal conductivity and electrical conductivity (using Fermi Dirac statistics) Widemann-Franz ratio, Hall effect, susceptibility, Drude theory of light absorption in Metals.

Electronic Properties of Solids

Electrons in a periodic lattice: Bloch theorem, band theory, Kronig – Penny Model, classification of solids, effective mass, nearly free electron model, Tight-bonding. cellular and APW, OPW and pseudo potential methods. Fermi surface, de Hass von Alfen effect. cyclotron resonance, magneto resistance.

Semiconductors: law of mass action, calculation of impurity conductivity, ellipsoidal energy. surfaces in Si and Ge, Hall effect, recombination mechanisms, optical transitions and Schockely-Read theory excitons, photoconductivity, photo-Luminescence.

Unit -III

Magnetism: Larmor diamagnetism. Para magnetism, Curie Langevin and Quantum theories. Susceptibility of rare earth and transition metals. Ferromagnetism: Domain theory, Weiss molecular field and exchange, spin waves: dispersion relation and its experimental determination by inelastic neutron scattering, heat capacity. Nuclear Magnetic resonance: Conditions of resonance, Bloch equations. NMR-experiment and characteristics of an absorption line.

Electron- Phonon Interaction

Experimental survey of Superconductivity critical temperature, persistent current, Meissner effect. Interaction of electrons with acoustic and optical phonons, Polarons, Superconductivity: manifestations of energy gap- Cooper pairing due to phonons, BCS theory of superconductivity, Ginzsburg Landau theory and application to Josephson effect: d-c Josephson effect. a-c Josephson effect. macroscopic quantum interference. Vortices and type II superconductors, high temperature superconductivity (elementary).

Text and Reference Books.

1. Verma and Srivastava: Crystallography for Solid State Physics
2. Azaroff: Introduction to Solids
3. Aschroft & Mermin : Solid State Physics
4. Kittel: Solid State Physics
5. Chaikin and Lubensky : Principles of Condensed Matter Physics .
6. Madelung: Introduction to Solid State Theory
7. Callaway: Quantum Theory of Solid State
8. Huang: Theoreticat Solid State Physics
9. Kittel: Quantum theory of Solids
10. Azaroff: X-ray Crystallography
11. Weertmann & Weertmann EJementary Dislocation Theory
12. Azaroff & Buerger: The Powder Method
13. Buerger: Crystal Structure Analysis
14. M. Ali Omar: Elementary Solid State Physics

PAPER VI: NUCLEAR AND PARTICLE PHYSICS

Duration 3 Hrs. Maximum marks : 100

NOTE - Question paper will have three part viz. Part A (20 marks), Part B (20 Marks) and Part C (60 Marks). Students are required to answer all ten very short type question (20 words each) in Part A. Each question carry equal marks.

In Part B, answer all five short type question (50 word each). Internal choice has been given to each question. Each question carry equal marks.

In Part C, candidates are required to attempt all three essay type question (400 word each). Internal choice has been given to each question. Each question carry equal marks.

Unit -I

Two Nucleon System and Nuclear Force:

Saturation Characteristics of nuclear force, charge independence and isospin invariance, spin, velocity dependence, Tensor and spin-orbital force, attractive and repulsive and central and non-central force. Introduction of nuclear potentials.

Nuclear characteristics of deuteron- binding energy, spin, magnetic and quadru-pole moments. Idea of central force and the deuteron problem. n-p scattering and understanding of the deuteron in ground state using square well potential, range-depth relationship, effective range theory, wave function and radius, Deuteron bound state, Coherent scattering of neutron in Ortho and Para hydrogen, Qualitative discussion of p-p scattering and hard core potential. Discussion of the One Boson Exchange Potential (OBEP). Mass and spin determination of a charged pion.

n-p Scattering and reactions

Partial wave analysis of n-p scattering, phase shift analysis of scattering and reaction cross sections, effective range, Breit Wigner single level relation for resonance and reaction cross sections and relatec' numerical problems.

Direct reaction and compound reaction, Bohr's theory, statistical theory and discussion of level density in case of even-even, even-odd and odd nuclei, probability, cross section of formation and decay of the compound nucleus. Ghosal experiment.

Unit -II

Models of Nuclear configuration

Empirical evidences of magic numbers, magnetic moments of proton and neutron, Shell model of nuclear structure using different potentials, spin-orbit coupling correction and shell closures. Single Particle Model (SPM) and spin and parity (J^P) of odd-A, even-even and odd-odd nuclei and Northeim rule and B-B rules and discussion of exceptional states, exercise of obtaining J^P for nuclei and their verification with experimental values. Magnetic and quadru-pole moments and the SPM, Schmidt lines and their modifications. Special discussion of Shell model in case of A< 150 and A >150 nuclei.

Shell model and Nuclear deformation, collective nuclear deformations – rotational and vibrational modes. Generalized nuclear deformation and Nielsson Model.

Unit-III

Gamma transitions and nuclear fission

Multiple electric and magnetic transition, Transition probabilities, Weiskopf units. Isomerism and shell model and isomeric states, land of isomers, Life time and width measurement.

Liquid drop model and nuclear fission, fissility and fission energy, critical reactors and neutronics in a reactor- four factor formula, thermal and fast neutron spectra, moderation of neutrons in a reactor. Mass distribution of fission products and their radio-toxicity. Nuclear waste and related problems. Radio-nuclide and their applications.

Scintillators and gamma spectrometry, identification of radio-nuclides, Surface barrier detectors and fission detectors.

Beta decay and weak interaction

Nuclear beta decay, continuous energy spectrum, neutrino hypothesis, kinematical considerations of b^-, b^+, electron conversion and double b emission, four lepton interaction. Fermi theory of b decay, Fermi and Gammow Teller transitions, Ft- value determination and allowed and forbidden beta decay. Parity violation, Wu's experiment, V-A interaction. Beta spectrometry and characterization XRF techniques.

Reference Books,

1. Experimental Nuclear Physics, Vol. I and II, K.N.Mukhin , Mir Publication, Moscow.
2. A text book of Nuclear Physics, CMH Smith, Pergamon Press.
3. Nuclear Physics by Kenneth S Krane
4. Elements of Nuclear Physics, W.E.burcham. ELBS Longman,
5. Nuclear Physics, R.R.Roy and B.P.Nigam Willey Basten, 1979
6. The Atomic Nucleus R.D. Evans, Mc Graw Hill, 1955
7. Introduction to Experiments, R.M.Singru, Wiley Eastern Pvt. Ltd.

SPECIAL PAPER

PAPER: VII (A)

ADVANCED QUANTUM MECHANICS & INTRODUCTORY QUANTUM FIELD THEORY

Time: 3 hrs Max Marks- 100

NOTE - Question paper will have three part viz. Part A (20 marks), Part B (20 Marks) and Part C (60 Marks). Students are required to answer all ten very short type question (20 words each) in Part A. Each question carry equal marks.

In Part B, answer all five short type question (50 word each). Internal choice has been given to each question. Each question carry equal marks.

In Part C, candidates are required to attempt all three essay type question (400 word each). Internal choice has been given to each question. Each question carry equal marks.

Unit-I

Scattering (non-relativistic) : Differential and total scattering cross section, transformation from CM frame to Lab frame, solution of scattering problem by the method of partial wave analysis, expansion of a plane wave in to a spherical wave and scattering amplitude, the optical theorem, Applications - scattering from a delta potential, square well potential and the hard sphere scattering of identical particles, energy dependence and resonances scattering. Breit - Wigner formula, quasi stationary states.

The Lippman -Schwinger equation and the Green's function approach for scattering problem, Born approximation and its validity for scattering problem, Coulomb scattering problem under first Born approximation in elastic scattering.

Relativistic Formulation and Dirac Equation: Attempt *for* relativistic formulation of quantum theory. The Klein-Gordon equation, Probability density and probability Current density, solution of free particle K. G. equation in momentum representation, interpretation of negative probability density and negative energy solutions.

Dirac equation for a free particle, properties of Dirac matrices and algebra of gamma matrices, non-relativistic correspondence of the pauli equation (inclusive of electromagnetic interaction). solution of the free particle Dirac equation, orthogonality and completeness relations *for* Dirac spinors, interpretation of negative energy solution and hole theory.

Unit - II

Symmetries of Dirac Equation: Lorentz covariance of Dirac equation. proof of covariance and derivation of Lorentz boost and rotation matrice_ for Dirac spinors. Projection operators involving four momentum and spin, Parity (P). charge conjugation (C), time reversal *(T)* and CPT operators for Dirac spinors, Bilinear covariants. and their transformations behaviour under Lorentz transformation, P.C,T. and CPT. expectation values of co-ordinate and velocity involving only positive energy solutions and the associated problems,inclusion of negative energy solution, Zitterbewegung, Klien paradox.

The Quantum Theory of Radiation: Classical radiation field, transversality condition, Fourier decomposition and radiation oscillators, Quantization of radiation oscillator. creation, anihilation and number operators, photon states, photon as a quantum mechanical excitations of the radiation field, fluctuations and the uncertainty relation, validity of the classical description, matrix element for emission and absorption spontaneous emission in the dipole approximation, Rayleigh scattering. Thomson scattering and the Raman effect, Radiation damping and Resonance fluorescence.

Unit - III

Scalar and vector fields, Classical Lagrangian field theory, Euler Lagrange's equation, Largangian density for electromagnetic field. Occupation number representation for simple harmonic oscillator, linear array of coupled oscillators, second quantizaiton of identical boson, second quantization of the real Klein Gordan field and complex Klein-Gordan feld, the meson propagator.

The occupation number representation for fermions, second quantization of the Dirac field, the fermion propagator, the e.m. interaction and gauge in variance, covariant quantization of the free electromagnetic field, the photon propagator.

S-matrix, the S-matrix expansion, Wick's theorem, Diagrammatic representation in configuration space, the momentum representation, Feynman diagrams of basic processes, Feynman rules of QED.

Applications of S-matrix formalism: the Coulomb scattering, Bhabha scattering, Moller scattering, Compton scattering and pair production.

Text and Reference Books :

1. Ashok Das and AC Milissiones : Quantum Mechanics - A Modern
2. Approach (Garden and Breach Science Publishers)
3. E. Merzbaker; Quantum Mechanics, Second.Edition (John wiley and Sons)
4. Bijorken and Drall : Relalivistic Quantium MechanicsMcGraw Hill)
5. J.J Sakurai: Advance Quantum Mechanics (John Wiley and Sons)
6. Quantum FieJd Theory by F. Mandal & G. Shaw (John - Wiley)
7. Elements of Advanced Quantum Theory by J. M. Ziman(Cambridge University Press).

PAPER VII (B)

ATOMIC AND MOLECULAR PHYSICS

Time :- 3 Hours Max. Marks :- 100

NOTE - Question paper will have three part viz. Part A (20 marks), Part B (20 Marks) and Part C (60 Marks). Students are required to answer all ten very short type question (20 words each) in Part A. Each question carry equal marks.

In Part B, answer all five short type question (50 word each). Internal choice has been given to each question. Each question carry equal marks.

In Part C, candidates are required to attempt all three essay type question (400 word each). Internal choice has been given to each question. Each question carry equal marks.

Unit - I

Basic principles of interaction of spin and applied magnetic field-Concepts of NMR spectroscopy-Concepts of spin spin lattice relaxation-

Chemical shift Spin spin coupling between two and more nucier (quantitative) experimental setup CW NMR Spectrometer Chemical analysis using NMR

Mossbauer effect-Recoilless emission of gamma rays-chemical shift-Magnetic hyperline interaction-Experimental setup

Electron spin resonance-Effects of LS coupling fine and hyperline structure-G Values-Simple experimental setup

Unit-II

Time dependence in quantum mechanics-Time dependent perturbation theory-Rale expression for emission-Perturbation theory calculation of polarisability-Quantum mechanical expression for emision rate-Time correlation function and spectral Fourier transform pair-Properties of time correlation functions and spectral time shape-Fluctuation dissipation theorem-Rotational correlation function and pure rotational spectra-Re orientational spectroscopy of liquids

Raman effect-Quantum theory-Molecular polarisability-Pure rotational Raman spectra of diatomic molecules-Vibration rotation Raman spectrum of diatomic molecules-intensity alterations in Raman spectra of diatomic molecules Experimental setup for Raman spectroscopy-Application of IR and Raman spectroscopy in the structure determination of simple molecules

Unit-III

Electronic spectra of diatomic molecules-Born Oppenheimer approximation, Vibrational coarse structure of electronic bands-Progression and sequences-intensity of electronic bands-Franck Condon principle-Dissociation and pre dissociation-Dissociation energy-Rotational fine structure of electronic bands Electronic structure of diatomic (base ideas only)

Text and Reference Books

1. Molecular spectroscopy-Jeane L McHale
2. Molecular quantum mechanics-P.W. Aikins & R.S.-Friedman
3. Mossbauer spectroscopy-M.R. Bhide
4. NMR and chemistry-J.W.Akitt
5. Structuralll lethods in inorganic chel l listry-E.A.V.Ebsworth, D. W.H. Rankin & S. Cradock.
6. Introduction to Atomic Spectra-H.E. White(T)
7. Fundamentals of molecular spectroscopy.-O.B. Banwell (T)
8. Spectroscopy Vol I, II & III-Walker & Straugnen
9. Introduction to Molecular spectroscopy-G.M.Barrow
10. Spectra of diatomic molecules-Herzberg
11. Molecular spectroscopy-J.M. Brown

and molecules-P.F. Bernath

i Modern spectroscopy-J.M. Holkas

PAPER VII (C)

QUANTUM ELECTRODYNAMICS AND QUANTUM MANY BODY PHYSICS

Time :- 3 Hours Max Marks :- 100

NOTE - Question paper will have three part viz. Part A (20 marks), Part B (20 Marks) and Part C (60 Marks). Students are required to answer all ten very short type question (20 words each) in Part A. Each question carry equal marks.

In Part B, answer all five short type question (50 word each). Internal choice has been given to each question. Each question carry equal marks.

In Part C, candidates are required to attempt all three essay type question (400 word each). Internal choice has been given to each question. Each question carry equal marks.

Unit-I

Dirac equation, properties of Dirac matrices. Projection operators. Traces. Feynman's theory of positron. Second quantization of Klein. Gordon Field, Creation and Annihilation operators, Commutation relations. Quantization of electromagnetic field, creation and annihilation operators, Commutation relations. Fock space representation, interacting fields, Dirac (interaction) picture, S-Matrix and its expansion. Ordering theorems, Feynman graph and Feynman rules. Application to some problems like Rutherford scattering and compton scattering, calculation of cross sections using Feynman graphs.

Unit- II

Formation of Second Quantization Wave functions for identical particles, Symmetrized basis for Fermions and Bosons, one particle & two-particle operators and their matrix elements in symmetrized basis. Number space representations of the basis, creation and annihilation operators. Commutation relations, Representation of operators in terms of creation and annihilation operators. Equation of motion for operators in number space.

Simple Applications Electron gas: Hartree Fock approximation. Ground state energy and single particle in Paramagnetic and Ferromagnetic states. Role of exchange term, Ground State of Interacting Bosons, Bose-Einstein Condensate, Spectrum of elementary excitations. Super fluidity.

Unit-III

Green's Functions and Linear Response Theory One particle and Two particle Green's functions. Ground State energy and Linear response in terms of Green's functions. Analytic properties of Green's functions. Equations of Motion for Green's function.

Perturbation Theory Interaction representation. Gall-Mann-Low Theorem for Ground State Energy, Perturbation Expansion for Green's functions, Wick's Theorem, diagram matic representation, Dyson's equation, self energy, polarization. Application to Interacting Fermi Gas

Dilute Fenni gas, Landau Theory, Screening of Coulomb interaction, random Phase approximation for electron gas.

Text and Reference Books

1. Bjorken & Drell: Relativistic Quantunl fields
2. Muirhead: The Physics of Elementary Particles
3. Schweber, Bethe and Hoffinann: Mesons and Fields Sakurai: Advanced Quantum Mechanics
4. Mandal: Introduction to Field Theory
5. Lee: Particle Physics and Introduction to Field

ELECTIVE PAPERS

PAPER VIII (A)

MICROWAVE ELECTRONICS

Time :- 3 Hrs Max. Marks :- 100

NOTE - Question paper will have three part viz. Part A (20 marks), Part B (20 Marks) and Part C (60 Marks). Students are required to answer all ten very short type question (20 words each) in Part A. Each question carry equal marks.

In Part B, answer all five short type question (50 word each). Internal choice has been given to each question. Each question carry equal marks.

In Part C, candidates are required to attempt all three essay type question (400 word each). Internal choice has been given to each question. Each question carry equal marks.

Unit - I

Introduction to microwaves and its frequency spectrum,. Application of microwaves.

Wave guides:

(a) Rectangular wave guides: Wave Equation & its solutions, TE&TM modes. Dominant, mode and choice of wave guide Dimensions Methods of excitation of wave guide.

(b) Circular wave guide-wave equation and its solutions, TE, TM & TEM modes.

(c) Attenuation-Cause of attenuation in wave guides, wall current & derivation of attenuation constant, Q of the wave guide.

Microwave Devices:

Klystrons, Magnetrons and Travelling Wave Tubes, Velocity modulation, Basic principles of two cavity Klystrons and Reflex Klystrons. principles of operation of magnetrons. Helix Travelling Wave Tubes, Wave Modes. Transferred electron devices, Gunn Effect, Principles of operation. Modes of operation, Read diode, IMPATT diode, TRAPATT Diode.

Unit- II

Microwave Communications

Advantages and disadvantages of microwave transmission loss in free space, propagation of microwaves, atmospheric effects on propagation, Fresnel zone problem, ground reflection. fading sources. detectors, components, antennas used in MW communication systems.

Satellite Communications :

Satellite communications: orbital satellites. geostationary satellites. orbital patterns, look angles, orbital spacing, satellite systems. Link modules.

Parametric Amplifier: varactor, Equation of capacitance in linearly graded & abrupt p-n junction, Manely Rowe relations, parametric up convertor and Negative resistance parametric amplifier, use of circulator, Noise in parametric amplifiers.

Microwave Antennas: Introduction to antenna parameters, Magnetic Currents, Electric and magnetic current sheet, Field of Huygen's source, Radiation from a slot antenna, open end of a wave guide and Electromagnetic - Horns. Parabolic reflectors, Lens antennas.

Unit-III

Ferrites: Microwave Propagation in ferrites, Faraday rotation, Devices employing Faraday rotation (isolator, Gyrator, Circulator). Introduction to single Crystal ferromagnetic resonators, YIG tuned solid state resonators.

Microwave Measurements:

(a) Microwave Detectors: Power, Frequency, Attenuation, Impedance using Smith chart, VSWR, Reflectometer, Directivity, coupling using direction coupler. (b) Complex permittivity of material & its measurement: definition of complex, permittivity, loss tangent, measurement of E of Solids, liquids and powders using shift of minima method.

Radar Systems Radar block diagram, operation radar .frequencies pulse considerations. Radar range equation. Minimum detectable signal receiver noise signal to noise ratio. Integration of radar pulses Radar cross section. Pulse repetition frequency. Antenna parameters, system losses and propagation losses, Radar transmitters, receivers Antennas, Displays.

Text and Reference Books

1. "Microelectronics" by Jacob Millman, Mc Graw-Hill International Book Co. New Delhi. 1990
2. "Optoelectronics Theory and Practice Edited byAlien thabbal Mc GrawHill Book Co. New York.
3. "Microwaves by K.C. Gupta. Wiley Eastern Ltd. New Delhi 1983
4. "Advanced Electroncs Communications Systems" by Wayne Tomasi. Phi.Edn.
5. Electromagnetic & Radiating Systems: Jorden & Balmain.
6. Theory and application of microwaves by A.B.Brownweli & R.E. Beam (McGrawHill).
7. Introduction to microwave the or Y by Atwater (McGraw Hill).
8. Microwaves by M.L. Sisodia & Vijay LaxmiGupta.
9. Microwave Electoronics by R.F. Soohoo (Addisen Wesley Pub. Camp.).
   ... Foundation of microwave engineering by R.E. Collin. (Mc Graw I'EII).
   .. Solid State physical electronics by A. Vanderziel, (PHI. India).
10. Solid State physical electronics by BG Streetman (PHI, India).
11. Microwave Principles by H. J. Reich (CBS).
12. Principles of Microwave circuits by G.C. Montogmel)' (McGraw Hill)
13. Microwave Circuits & Passive Devices by M.L. Sisodia and G.S. Raghuvanshi (Willey Eastern, New Delhi)
14. Microwave Semiconductor Devices and their Circuit aplications by H.A. Watson
15. Antenna Theory, Part,-I by R.E. Collin & F.J. Zucker (McGraw Hill, New York)
16. Antenna Theory,Analysis by E.A. Wolff (J.Willey &Sons)
17. Antenna Theory Analysis by C.A. Balanis Harper & Row, Pub. & Inc. New York.
18. Antenna Theory & Design by RS Elliott (LPHI Ltd. New Delhi)

PAPER- VIII (B)

SOLID STATE ELECTRONICS

Duration: 3hrs. Max. Marks: 100

NOTE - Question paper will have three part viz. Part A (20 marks), Part B (20 Marks) and Part C (60 Marks). Students are required to answer all ten very short type question (20 words each) in Part A. Each question carry equal marks.

In Part B, answer all five short type question (50 word each). Internal choice has been given to each question. Each question carry equal marks. In Part C, candidates are required to attempt all three essay type question (400 word each). Internal choice has been given to each question. Each question carry equal marks.

Unit-I

Semiconductor Materials and Carriers Transport in Semiconductors: Energy Bands, intrinsic carrier concentration. Donors and Acceptors. Direct and Indirect band semiconductors. Elemental (Si) and compound semiconductors (GaAs). Doping of Si (Group III (n) and Group V (p) Compounds) and GaAs (group II (p), IV(n.p.)and VI (n)compounds). Calculation of Fermi level and conductivity of semiconductors. Carrier Drift, Carrier Diffusion, continuity equation. Ambipolar Transport Carrier Injection, Generation Recombination Processes-Direct, Indirect band gap semiconductors. Band to band, trap assited and auger recombination, low and high injection. Quasi Fermi levels. Minority Carrier Life Time, Drift and Diffusion of Minority Carriers (Haynes-Shockley Experiment) Determination of Conductivity (a) four *probe* and (b) van der paw techniques.

Semiconductor surfaces: surface charge barriers, surface recombination. Amorphous semiconductors, Mobility edge band tails and dangling band states.

Unit-II

Junction Devices: Basic fabrication steps. Diffusion of impurities, thermal diffusion, constant total Dopant diffusion, ion implantation. Need for junctions. Junction Devices (i) p-n junction-Energy Band diagrams for homo and hetro junctions. Current flow mechanism in p-n junction,effect of indirect and surface recombination currents on the forward biased diffusion current, diode ideality factor, Breakdown mechanisms. p-n junction diodes-rectifiers (high frequency limit), ac response, diffusion capacitance, switching properties, P-I-N diode.

Metal-semiconductor (Schottky) Junction: Energy band diagram, current flow mechanisms in forward and reverse bias, thermionic and diffusion currents. effect of interface states. Applications of Schottky diodes, (ii) Metal-Oxide-Semiconductor (MOS)diodes. Energy band diagram, depletion and inversion layer. High and low frequency Capacitance Voltage (C- V) characteristics. Smearing ofC-V curve, flat band shift. Applications of MOS diode.

Unit-III

Bipolar Transistors and Thyristors

General characteristics of BJT, Factors controlling current gain, frequency performance, switching of bipolar transistors. Basic concepts of PNPN structures, thyristor turn on. turn off and power considerations, triacs

Microwave Devices

Tunnel diode, High field effect in two valley semiconductors transfer electron devices (Gunn diode), Avalanche Transit time devices (Read, Impatt diodes)

JFETS, MESFFTS and MOSFETS:. JFET Modeling including saturation velocity effects, GaAs MESFET, MOSFET, surface space. charge region under non equilibrium condition, channel conductance, basic characteristics current, voltage and device parameters.

(Over view and Basic principle of the following)

Integrated Circuit Technology: Crystal growth and water preparation, vapour phase epitaxy, Molecular beam epitaxy, oxidation, lithography, etching, dielectric poly silicoln film deposition, diffusion. ion implantation,. anaetallization assembly packaging. LSI and VLSI: Fundamental consideration for IC processing.

Text and Reference Books

1. K. Seeger : Semiconductor Physics, Springer Verlag.
2. John, P. Mckelvy: Solid State and Semiconductor Physics, Harper and Row.
3. A.G.Milnes: Semi-conductor Devices and Integrated Electronics, Von Non
4. S.M.Sze : Physic of Semiconductor Devices Wiley.
5. S. M. Sze VLSI Technology.

PAPER VIII (C)

PLASMA PHYSICS

Time: 3 hrs — Max Marks - 100

NOTE - Question paper will have three part viz. Part A (20 marks), Part B (20 Marks) and Part C (60 Marks). Students are required to answer all ten very short type question (20 words each) in Part A. Each question carry equal marks.

In Part B, answer all five short type question (50 word each). Internal choice has been given to each question. Each question carry equal marks. In Part C, candidates are required to attempt all three essay type question (400 word each). Internal choice has been given to each question. Each question carry equal marks.

Unit- I

Basic properties and occurrence. Definition of plasma. Criteria for plasma behavior, Plasma oscillation. Quasineutrality and Debye shielding. The plasma parameter. natural occurence *of* plasmas. Astrophysical plasmas. Plasma in Magnetosphere and ionosphere. Plasma production and diagnostics. Thermal ionization, Saha equation. Brief discussion of methods of laboratory plasma production. Steady state glow discharge, microwave breakdown and induction discharge, Double Plasma Machine. Elementary ideas about plasma diagnostics. electrostatic and magnetic probes.

Charged particle motion and drifts, Guiding centre motion *of* a charged particle. Motion in (i) uniform electric and magnetic fields (ii) gravitational and magnetic fields. Motion in non-uniform magnetic field (i) grad B perpendicular to B, grad B drift and curvature drift (ii) grad B.parallel *to* B and principle of magnetic mirror. Motion in non-uniform electric field for small larmour mdius. Time varying eclectic field and polarization drift. Time varying magnetic field adiabatic invariance *of* magnetic moment.

Unit-II

Plasma fluid equations fluid equations: Convective derivative, Two fluid and single fluid equations. Fluid drifts perpendicular *to* B, diamagnetic drift.

Diffiusion and resistivity: Collision and diffusion parameters. Decay *of* a plasma by diffusion, ambipolar diffusion. Diffusion across a magnetic field. Collision in fully ionized plasma,. Plasma resistivity. Diffusion in fully ionized plasmas. Solution *of* Diffusion equation.

Equilibrium and stability: Hydromagnetic equilibrium. Concept *of* magnetic pressure. Equilibrium *of* a cylindrical pinch. The Bennet pinch. Diffusion *of* magnetic field into a plasma. Classification *of* instabilities. Two stream instability. The gravitational instability. Resistive drift waves.

Waves in plasma: electron plasma waves. *Ion* Waves, Elecn'osatatic electron oscillations' perpendicular *to* B, upper hybrid oscillations.

Electrostatic ion waves perpendicular *to* B, ion cyclotron waves, Lower hybrid oscillations. Electromagnetic waves in field free plasma. Electromagnetic waves perpendicular *to* B. Cut offs and resonances, Electromagnetic waves parallel *to* magnetic field, Hydro magnetic waves. Magneto sonic waves.

Unit - III

Kinetic theory, Boltzmann and Vlasov equations, Derivation of Illultifluid equations, Vlasov equation, Linearization *of* Valsov Maxwell equalions High frequency plasma waves, Landau damping, A Physical derivation of Landau damping, Low frequency ion acoustic waves, Ion Landau damping.

Non-linear effects: Non-linear effects in plasmas. The Sagdeov potential, Derivation of KdV equation for ion acoustic waves. Soliton solution in one dimension Elementary ideas about the ponderomotive force and parametric instability. Oscillating two stream instability, Non-linear Landau damping. Controlled thermonuclear fusion and Other plasma applications:

Potentials and problems of controlled thermonuclear fusion. Ignition temperature and Lawson criteria. Magnetic confinement. Simple discussion of Tokrmak, stellarators, multipoles and Z pinch. Idea about interstial confinement and laser fusion. Methods of plasma heating and problems of fusion. Basic principle and working of MHO power generator, Plasma applications in industry, Plasma torches.

Text and Reference books

1. F.F. Chen: An Introduction to Plasma Physics (Plenum Press) 1974.
2. R.C. Davidson: Methods in Non-linear Plasma theory (Academic Press)1972.
3. W.B. Kunkel: Plasma Physics in Theory and Application (McGraw Hill)1966.
4. J.A. Bittencoms : Fundamentals of Plasma Physics (Pergamons Press)1986.
5. Cuberoi : Introduction to un magnetized plasma (Prentice Hill) 1988

PAPER VIII (D)

ATMOSPHERIC SCIENCE AND ENVIRONMENTAL PHYSICS

Time: 3 hrs | Max Marks 100

NOTE - Question paper will have three part viz. Part A (20 marks), Part B (20 Marks) and Part C (60 Marks). Students are required to answer all ten very short type question (20 words each) in Part A. Each question carry equal marks.

In Part B, answer all five short type question (50 word each). Internal choice has been given to each question. Each question carry equal marks. In Part C, candidates are required to attempt all three essay type question (400 word each). Internal choice has been given to each question. Each question carry equal marks.

Unit-I

Physical Meteorology

Atmospheric composition, laws of thermodynamics of the atmosphere. Adiabatic process. Potential temperature. The clausis clapyeron equation, laws of black body radiation, solar and terrestrial radiation, Albedo, Green house effect. Heat balance of earth- atmosphere system. Dynamic Meteorology Fundamental forces, non-inertial reference frames and apparent forces, structure of static atmosphere. Momentum, continuity and energy equations, Thermodynamics of the dry atmosphere. elementary applications of the basic equations. The circulation theorem, voracity, potential vorticity, vorticity and potential vorticity equations.

Monsoon Dynamics.

Wind, temperature and pressure distribution over India in the lower, middle and upper atmosphere during pre, post and mid-monsoon season, monsoon circulation in the meridonal (Y -Z) and zonal (X- Y) planes, energy cycle of monsoon. Dynamics of mon soon depressions and easterly waves. Intra seasonal and interannual variability of monsoon. Quasi by-weekly and 30-60 day oscillations. ENSO and dynamical mechanism for their existence.

Numerical Methods for atmospheric Models Filtering of sound and gravity waves, filtered forecast equations, basic, concepts of quasigeostrqphic and primitive equation models, one level and multilevel models. Basic concepts of initialization and objective analysis for wave equation, advectiofii equation and diffusion equation.

Unit-II

Atmospheric Pollution

Role of meteorology on atmospheric pollution, Atmospheric boundary layer, air stability, local wind structure, Ekman spiral, turbulence boundary layer scaling. Residence time and reaction rates of pollutants, sulphur compounds, nitrogen compounds, carbon compounds, organic compounds, aerosols, toxic gases and radioactive particles trace gases. Atmospheric Instrumentation Systems Ground based instruments for the measurement of Temperature, Pressure, Humidity, Wind and Rainfall Rate. Air borne instruments Radisonde. Rawinsonde, Rocketsonde-satellite instrumentation space borne instruments).

Essentials of Environmental Physics

Structure and thermodynamics of the atmosphere. Composition of air. Greenhouse effect. Transport of matter, energy and momentum in nature. Stratification and stability of atmosphere. Laws of motion, hydrostatic equilibrium. General circulation of the tropics. Elements of weather and climate of India.

Unit-III

Solar and Terrestrial Radiation

Physics of radiation. Interaction of light with matter. Rayleigh and Mie scattering. Laws of radiation (Kirchoffs law, Planck's law, Beers law, Wiens displacement law, etc.). Solar and terrestrial spectra. UV radiation. Ozone depletion problem. IR absorption energy balance of the earth atmosphere system. Environmental Pollution and Degradation Elementary fluid dynamics. Diffusion. Turbulence and turbulent diffusion. Factors governing air, water and noise pollution. Air and water quality

standards. Waste disposal. Heat island effect. Land and sea breeze. Puffs and plumes. Gaseous and particulate matters. Wet and dry deposition

Environmental Changes and Remote Sensing

Energy sources and combustion processes. Renewable sources of energy. Solar energy, wind energy, bio energy, hydropower, fuel cells, nuclear energy. Forestry and bio energy. Global and Regional Climate Elements of weather and climate. Stability and vertical motion of air. Horizontal motion of air and water. Pressure gradient forces. Viscous forces. Inertia forces. Reynolds number. Enhanced Greenhouse Effect. Energy balances a zero dimensional Greenhouse model. Global climate models.

Text and Reference Books

1. The Atmosphere by Frederick K. Lutgens and Edward 1. Tarbuk (for chapter I and VI)
2. Dynamic Meteorology by Holton. 1.R 3 edition, Academic Press N. Yf. (1992). ThePl1ysics of Monsons. By R.N. Keshvamurthy and M.Shankar Ra. Allied Publishers. 1992 (for chapter3)
3. Numerical Weather Predicition by G. 1. Haitiner and R. T. Villians. John
4. Wiley and sons. 980
5. Principles of Air pollution meteorology by Tom Lyons and Prillscott,
6. CBS publishers & Distrbutors (p) Ltd.
7. Radar Meterology by f:ienry Saugageot
8. Egbert Boeker & Rienk Van Groundelle: Environmental Physics (John Wiley).
9. I.T. Hougtion: The Physics of Atmosphere (Cambridge University Press,1977)
10. J.T. Widell and. J. Weir: Renewable Energy Resources (Elbs, 1988)
11. Sol Wieder: An introduction to Soil Energy for Scientists and Engineers (John Wiley, 1982).
12. R.N. Keshiwamurthy and M. Shanker Rao: The Physics of Monsoons (Allied Publishers, 1992).
13. G J. Haltiner and R.T. Williams: Numerical Weather Prediction (John Wiley, 1980)

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PAPER VIII (E)

HIGH ENERGY PHYSICS

Time: 3 hrs — Max Marks - 100

NOTE - Question paper will have three part viz. Part A (20 marks), Part B (20 Marks) and Part C (60 Marks). Students are required to answer all ten very short type question (20 words each) in Part A. Each question carry equal marks.

In Part B, answer all five short type question (50 word each). Internal choice has been given to each question. Each question carry equal marks. In Part C, candidates are required to attempt all three essay type question (400 word each). Internal choice has been given to each question. Each question carry equal marks.

Unit-I

Historical Development, classification of particles-Fermions and Bosons, particles and antiparticles. Basic "Fermion constituents, Quarks and leptons, Hadrons-composites of Quarks and anti quarks. Interactions and Fields in Particle Physics, Electromagnetic, Gravitational, weak and strong interactions. Hadron-Hadron Interactions, Conservation Rules in Fundamental Interactions. Colliding ,!3eam Machines and related Kinematics, electromagnetic shower detectors. Hadron-Shower calorimeters, life-time of Neutral pion.

Invariance in Quantum mechanics, Translations and rotations. Parity, Spin and Parity of the Pion. Parity of Particles and Anti particles, Tests of parity conservations, charge conservation. Gaugc Invariance, and Photons. Charge conjugation Invariance. Eigen states of charge conjugation Operator, Positronium decay, Experimental text of C- invariance, time several invariance, C-P violation and CPT Theorem, Electric dipole moment of the neutron. Isospin. Isospin in the Two Nucleon system, Isospin in the Pion-Nucleon System. Strangeness and Isospin.

Unit-II

Dalitz Plots: Three body, Phase space, Ke1t decay, Dalitz Plots involving three Dissimilar Particles, Total and Elastic Cross-Sections at this Energy, Pm1iclc Production at High Energies. The Baryon Decuplet, Quark spin and Color, the Baryon octet, Quark Antiquark combinations: The Paeudoscalar Mesons. The Vector Mesons, Lept9nic decays of Vector mesons. Heavy-Meson Spectroscopy and the Quark modeL Charmonium levels. Epsilon states.

Classification of Weak Interactions. Fermi theory of Nuclear *B* decay, Interaction of Free Neutrinos; Inverse *B* decay, Helicity of the neutrino. Parity Violation in Λ decay, Parity Non conservation in B-decay, Pion and Muon decos,

1t_J.1 Decay, and J.1_c Branching ratios. Weak decays of Strange Particles, Cabibbo Theory. K" decay. Strangeness Oscillations, the K" Regeneration Phenomenon, CP violation in K" decay.

Unit-III

The scattering Cross Section in terms of Invariant Amplitude M, Decay Rate in tcrms of M, Invariant (Mandelstan) Variables.

An Electron Interacting with an Electromagnetic Field Am' Molar Scattering e e eC, the process Cnr C' nr and the process ecpr, Helicity Conservation at high energies. Photons and their Polarization Vectors, Summary of Feynmann rules for QED (no derivation).

Thc Process elep in thc Laboratory Framc, Kinematics relevant to the Parton Model, Scattering of Electrons from a Static chargc, probing a chargc Distribution with Electrons, form Factors, Electron-proton Scattering, Proton Form Factors, Inclastic Electron-Proton Scattering cpe X, Summary, of formalism for analyzing e p scattering. Inelastic Electron Scattering as a Virtual, Photon -Proton total Cross Section.

Bjorken Sealing, Panons and Bjorken Scaling, the Quarks with in the proton, Gluons and their evidence.

Parity violation and the V-A form of the weak current.

Lifetime calc ulation for muon decay and pion decay.

Charged culTI;nt Neutrino-Electron Scattering, Neutrino Quark Scattering, First observation of weak neutral currents, Neutral currents and Neutrino quark scattering, the Cabbibbo Angle, weak mixing angles.

Text and Referena books

1. Donald H. Perkins: Introduction to high energy physics (Addison wesley) . E. Halgen and A.D. Martin: Quarks and Leptons
2. The scope of the syllabus is based upon the Book' Quarks and Leptons' by E Halzen and A.D. Martin. The problems related to the topics are included in the syllabus.

PAPER VIII (F)

INFORMATICS (MATERIALS AND DATACOMMUNICATION)

Time: 3 hrs. **Max. Marks 100**

NOTE - Question paper will have three part viz. Part A (20 marks), Part B (20 Marks) and Part C (60 Marks). Students are required to answer all ten very short type question (20 words each) in Part A. Each question carry equal marks.

In Part B, answer all five short type question (50 word each). Internal choice has been given to each question. Each question carry equal marks. In Part C, candidates are required to attempt all three essay type question (400 word each). Internal choice has been given to each question. Each question carry equal marks.

Unit-I

Semiconductor Quantum structures, Hetero structures, Mismatch Hetero structures, Coherently strained Structures, Partially Relaxed Strained' Layer Structure, Methods of Formation Hetero structures some of the examples. of hetero structures. Band gap engineering, Strained Layer Epitaxy, Light emitting Diodes, Etched Well surface emitting LED, Continuous operation lasers, Hetero quantum Lasers, CW Hetero quantum Laser, Stripe Geometry.

2.Follrier series and transforms and their applications to data communication.

Introduction to Probability and Random Variables. Introduction to information Theory and Queuing Theory.

Introduction and Evolution of Telecommunication, Fundamentals of electronic communication: Wired, Wireless, Satel l ite and optical Fiber, Analog digital, Serial/parallel, Simplex/half and full duplex, Synchronous/ Asynchronous, Bitlbaud rates, Parity and error control (CRC, LRC, ARQ, etc.) Signal to Noise Ratio,

Transmission types, codes modes, speed and throughput. Modulation types, techniques, and standards. Base band and carrier communication, Detection, Interference, Noise signals and their characterization. Phase Locked Loops. Modems, Transmission media (guided and unguided) common interface standards.

Introduction to Unix Linux and shell scripting. conceptual framework of computer languages. Introduction to *Gc++*. Data Types and operators. Statements and Controls Flow, Function and Program Structure, Strings, The Preprocessor, Pointers, Memory Allocation, Input and Output, sub program, Recursion, File Access.

Unit-II

Obiect orientation concepts: Classes, objects, methods and messages, encapsulation and inheritance, interface and implementation, reuse and extension of classes, inheritance and polymorphism; analysis and design; Notations for object-oriented analysis and design; Case studies and applications using some object oriented programming languages. Introduction to web enabling technologies and authoring tools/languages (webcasting, database integration, CGI, perli, Java, HTML; C#,) Network types and architecture (broadcast, multicast, LAN, MAN, WAN, topology. token ring FDDI, Cabling). Protocols, interfaces and services, x'25, ISDN, ATM, VPN, frame relay, wireless transmission, bridges. TCP/ IP and ISOOSI Models. Routing. congestion and flow control, tunnelling, internetwork routing. Datalink protocols, Multipie access protocols, TCP, UDP, Transport layer error recovery, Application layer services and protocols. IP addressing Network security.

Unit-III

Evolution of Internet, Internet architecture; goals and key issues related to Internet working technologies; Internet connectivity (dial-up, dedicated Jines, broadband, DSL, radio, VSA T,) Domain Name Scheme, Technology and tools relevant for web access (FTP, email, search tools,)

Internet security.

Multimedia, techniques of data compression, voice, video, Mhone, and interactive video-on demand over the 'Internet. Mobile computing Fundamentals of Net work Management (NM), Need for NM, Elements of NM system (Manage Agent and a protocol, SNMP), Functional areas of NM defined by ISO Fault) Management Configuration Magangel l lent, Performance Management, Security Management, Accounting Management, NM standards, TMN, Web based NM (Introduction), case studies: HP Open-View IBM Net-view, SUN Solaris Enterprise Manager.

Text and Reference Books.

1. Data communication by Reid and Dartskor. Data Networks by Gallager.
2. Data Communication by William Stalling .
3. Commu,!ication networks hy Leon-Garcia and Widjaja.
4. Introduction to communication systems by S. Haykins
5. Analog and Digital Communication by S. Haykins
6. Jesse Literty, Beginning object oriented Analysis & design using C++ Wrox Pro 1998

PAPER-VIII (G)

SCIENCE AND TECHNOLOGY OF SOLAR, HYDROGEN, SOLAR ENERGY AND OTHER RENEWABLE ENERGIES

Duration: 3 hrs. Max. Marks: 100

NOTE - Question paper will have three part viz. Part A (20 marks), Part B (20 Marks) and Part C (60 Marks). Students are required to answer all ten very short type question (20 words each) in Part A. Each question carry equal marks.

In Part B, answer all five short type question (50 word each). Internal choice has been given to each question. Each question carry equal marks.

In Part C, candidates are required to attempt all three essay type question (400 word each). Internal choice has been given to each question. Each question carry equal marks.

Unit-I

Solar Energy: Fundamentals of photovoltaic Energy Conversion Physics and Materials Properties Basic to Photovoltaic Energy Conversion: Optical properties of Solids. Direct and indirect transition semiconductors, interrelationship between absorption coefficients and band gap recombination of carriers.

Types of Solar Cells, p n junction solar cell, Transport Equation, Current Density, Open circuit voltage and short circuit current, Brief de-s· iptions of single crystal silicon and amorphous sjljcon solar cells, ementary ideas of advanced solar cells e.g. Tandem Solar Cells. Solid Liquid Junction Solar Cells, Nature of Semiconductor. Electrolytic Junction. Principles of Photo electrochemical solar cells.

Unit-II

Hydrogen Energy: Relevance in relation to depletion of fossil fuels and environmental considerations.

Hydrogen Production: Solar Hydrogen through Photo electrolysis and Photo catalytic process. Physics of material characteristics for production of Solar Hydrogen. Storage of Hydrogen: Brief discussion of various storage processes, special features of solid state hydrogen storage materials, structural and electronic characteristics of storage materials. New St rage Modes. Safety and Utilisation of Hydrogen: Various factors relevant to safety, use of Hydrogen as Fuel, Use in Vehicular transport, Hydrogen for Electricity Generation, Fuel Cells, Elementary concepts of other Hydrogen Based devices such as Air Conditioners and 'Hydride Batteries. Other Renewable Clean Energies: Elements of Solar Thermal Energy, Wind Energy and Occan Themal Energy Conversion. Heat conduction: Differential equation of heat conduction, Initial and boundary conditions. Methods of solving heat conduction problems: separation of variable method for one dimension, The Green's function method, Integral transform method for finite and infinite ranges. Problems with and without internal heat generation. Numerical analysis of transient and periodic state of heat conduction, Measurement techniques for thermal conductivity and their comparative study (static and dynamic), Guarded hot plate method, Thermal probe parallel wire.

Unit-III

Convective and Radiative Heat Transfer: Theory of convective heat transfer, Laminar and turbulent flow, Boundary layer theory. Heat transfer in duct, Heat exchangers: basic thermal sign methods. Theory of heat pipes, Design considerations, Applications of heat pipes. Direct and diffused thermal radiation. Radiative properties of real surfaces, Radiation exchange between surfaces. Atmospheric attenuation, solar radiation measurements Solar radiation geometry.

Solar Energy Collectors: Flat Plate solar energy collectors. Selective absorber surfaces. Transparent plates. Collector energy losses. Thermal analysis of collectors. Air heating collectors. Collector performance testing. Concentrating collectors. Thermal analysis of concentrating collectors. Tracking requirements.

Thermal Energy Storage and Solar Thermal Devices: Storage of solar energy. Water storage. Stratification of water storage, Packed bed storage. Phase change storage. Solar pond. Chemical storage. Solar space conditioning- Energy requirement in buildings, Passive system architecture, Performance and design; coiling processes-vapour compression refrigeration cycle, Absorption refrigeration cycle, Performance of solar absorption air conditioning. Solar energy process economics.

Text and Reference books

1. Hydrogen as an Energy c_llTier Technologies, system economy: Eds-Winte and Nitch.Heat Conduction: M. Necati Ozisik-John Wiley&Sons. .. Hand Book of Heat transfer Application: Edited by Warren M. Rohsenow, James P. Harnou and Fjup N. Ganic.
2. Conduction of Heat in Solids: H.S. Carslas and .T.c. Jsegar, Oxford-Clarendon
3. Press 1959. .. Heat and Mass Transfer: A Luikov, Mir Public hers Moscow .. Thermal conductivity of Solids: IE. parrot and Audrey D. Stuckes: Pion
4. Limited, London. .. Sobr Energy Engg: Jui Sheng Haieh, Prentic Hall, New jersey. .. Solar energy Thermal Processes: Dluffie and Backman. Wiley & Sons. New York.
5. Solar energy: S.P. Tata McGraw Hill, New Delhi.

PAPER- VIII (H)

PHYSICS OF LASERS AND PROPERTIES OF BIOMOLECULES

Duration: 3 hrs. Max. Marks: 100

NOTE - Question paper will have three part viz. Part A (20 marks), Part B (20 Marks) and Part C (60 Marks). Students are required to answer all ten very short type question (20 words each) in Part A. Each question carry equal marks.

In Part B, answer all five short type question (50 word each). Internal choice has been given to each question. Each question carry equal marks.

In Part C, candidates are required to attempt all three essay type question (400 word each). Internal choice has been given to each question. Each question carry equal marks.

Unit-I

Laser characteristics

Gaussian beam and its properties. Stable Two-Minor Optical Resonators. Longitudinal and Transverse Modes of Laser Cavity. Mode Selection, Gain in a Regenerative Laser Cavity. Threshold for 3 and 4 level Laser System. Mode Locking Pulse Shortening- Pico second& femto second operation, Spectral Narrowing and Stabilization.

Laser Systems

Ruby Laser, Nd-YAG Laser, Semi Conductor Lasers, Diode-Pumped Solid state Lasers, Nitrogen Laser, Carbon-dioxide Laser, Excimer Laser Dye Laser, High Power Laser Systems.

Unit-II

Laser Spectroscopic Techniques and Other Applications. Laser Fluorescence and Raman Scattering and their use in pollution studies. Non-Linear interaction of Light with matter, Laser induced multi photon processes and their applications. Ultrahigh resolution Spectroscopy with lasers and its applications, Propagation of light in a medium with variable refractive index. Optical Fibers. Light wave. Communication. Qualitative treatment of Medical and Engineering applications of Lasers.

Structural Aspects of Bio molecules

Conformational Principles, Conformation and Configuration Isomers and Derivatives. Structure of PoJy nucleotides, Structure of polypeptides, Primary, Secondary, Tertiary and Quaternary Structures of Proteins Structure of Polysaccharides.

Unit-III

Theoretical Techniques and Their Application to Bio molecules Hard Sphere Approximation. Ramachandran Plot, Potential Energy Surfaces outline of Molecular Mechanics method, Brief Ideas about Semi-empirical and Ab Initio Quantum Theoretical Methods, Molecular Charge Distribution, Molecular Electrostatic Potential and Field and their Uses. Spectroscopic Techniques and Their Application to Bio molecules Use of NMR in Elucidation of Molecular Structure, Absorption and Fluorescence Spectroscopy, Circular Dichroism, Laser Raman Spectroscopy, IR Spectroscopy, Photo acoustic Spectroscopy, Photo-biological Aspects of Nucleic Acids.

Structure Function Relationship and Modeling

Molecular Recognition. Hydrogen Bonding, Lipophilic Pockets on Receptors. Drugs and their Principles of Action. Lock and Key Model and Induced fit Model.

Text and Reference Book

1. Svelto: Lasers
2. Yariv: Optical Electronics
3. Demtroder: Laser Spectroscopy
4. Letekhov: Non-Linear Laser Spectroscopy
5. Srinivasan & Pattabhi: Structural Aspects of Bio molecules
6. Govil & Housur : Conformations of Biological Molecules
7. Price: Basic Molecular Biology
8. Pullman: Quantum Mechanics of Molecular Conformations
9. Lehninger: Biochemistry

10. Mehler & Cordes: Biological Chemistry
11. Smith and Hanawalt: Molecular Photobiology, Inactivation & Recovery. Fonash Solar Cell Devices-Physics
12. Fahrenbruch & Bube Fundamantal of Solar-Cells Photo voltaic
13. Chandra Photo electrochemical Solar Cells

LIST OF EXPERIMENTS

Note :-Students are required to perform at least eight experiments from the general laboratory and eight-experiments from microwave / Electronic Devices laboratory. Total number of experiments to be performed by the students during the academic session should be at least 16. Few experiments other than listed below, may be set at the college level, but at par with the standard of M.Sc. (Final) class.

GROUP A (General Laboratory Course)

1. Determine fine structure constant using sodium doublet
2. Verify Cauchy's relation & determination of constants.
3. To determine e/m for an electron by Zeeman effect.
4. Determine the dissociation energy of Iodine molecule.
5. Determine of energy of a given ray from Re-De source.
6. Find out the percentage resolution of given scintillation spectrometer using Csm
7. Find out the energy of a given X-ray source with the help of a scintillation spectrometer.
8. Plot the Gaussian distribution curve for a radioactive source.
9. To study the frequency and phase characteristics of band pass filter.
10. Study the wave from characteristics of transistorised astable symmetrical multi vibrator using CRO & determine its frequency by various C & R.
11. Artificial transmission line.
12. Determine the dielectric constant of turpentine oil with the help of Leacher wire system.
13. To determine the velocity of waves in water using ultrasonic interferometer.
14. To determine the magnetic susceptibility of two given samples by Gouy's method.
15. Determinations of Lande's 'g' factor for IRRH crystal using electron spin resonance spectrometer. Any other experiments of the equivalent standard can be set

GROUP B (Microwave Laboratory Course)

1. To study the characteristics curve of Klystron.
2. To study the mode characteristics of reflex Klystron and hence to determine mode number. Transmit time, Electronics, tunning range, elec-

tronic tunning sensitivity

3. To study the E-Plane radiation pattern of pyramidal horn antenna and compute the beam width 0'[Antenna.
4. To study the H plane radiation pattern of pyramidal horn antenna and compute the Directional gain of the Antenna.
5. To determine the dielectric constant of a given sample at Microwave frequency. .
6. To determine the dielectric constant of Benzene using plunger technique at room temperature. .
7. To determine the unknown impedance using slotted line section Smith chart in the K-band.
8. To study the microwave absorption in dielectric sheets.

Any other experiments of the equivalent standard can be set

OR

Electronic Devices Laboratory Course

1. To determine e/m of an electron by magnetron valve method
2. To determine e/k using transistor characteristics.
3. To study dark and illumination characteristic of p-n- junction solar cell and to determine
   (i) Its internal series resistance
   (ii) Diode ideality factor
4. To study the characteristics of following semiconductor devices
   (i) VDR
   (ii) Photo transistor
   (iii) LDR
   (iv) LED
5. To study the characteristics of MOSTET and MOSFET amplifier.
6. To study dark and illumination characteristics of p-n- junction solar cell and to determine its
   (i) Maximum power available
   (ii) Fill factor
7. To study capacitance variation of p-n junction with bias voltage in reverse bias and determination of built in potential and other related parameters.
8. To study temperature characteristics of a thermistor and determination of activation energy.
9. Studies on life-time measurements in p-n junctions by various methods.(VOC decay method/reverse recovery method)
10. Resistivity measurements by Vander-Paw method and magneto resistance.
11. Any other Experiments of the equivalent standard can be set.