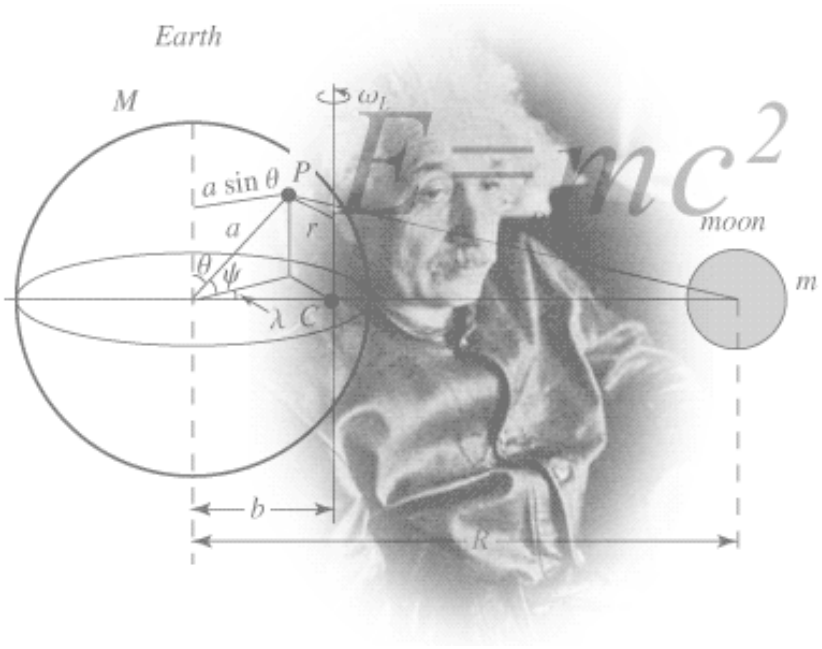
BABA FARID GROUP OF INSTITUTIONS



"Physics is the most fundamental of the sciences. It is concerned with the study of matter and energy on all scales from the sub-atomic to the size of the visible Universe. As a physics student at BFIT you will acquire an appreciation of the scope and impact of modern physics and the use of mathematics, computing and experimentation to solve real-world problems.

The boom in the tourism industry has resulted in the immense growth of hotel industry in India. The hotel industry promises a bright future for anyone who wishes to take up a career in this segment. The students opting for hotel management career courses must have an affinity towards socializing and understanding the needs of the people. As hotels fall under the service industry, the motive of hotel management courses in India is to prepare the students to face the challenges of this competitive world. As far as tourism industry in India is concerned, it is attracting tourists from across the world and this definitely calls for quality hospitality."

--Dr. Subhash Pokhriyal
In-Charge
Department of Physics

DEPARTMENT OF PHYSICS

MSc (Physics)-1st Year

PAPER-I MATHEMATICAL PHYSICS (CODE NO. 790)

Matrices : Basic ideas of special matrices and their properties, the characteristics matrix and characteristic equation, Caleigh Hamilton theorem, transformation, differentiation and integration of matrices, diagonalization of matrices, trace of matrix and cyclic theorem, solution of equations and eigen value problem, similarity transformations.

Special Functions:- Legendre's polynomial, Rodrigues formula, generating functions recurrence relations, orthogonally, associated Legendre's polynomials, Bessel's functions, Gamma and Beta functions.

Fourier Series and Partial differential equations:- Drichelets conditions, fourier series, sine, cosine, and complex fourier series, Applications to square wave, triangular wave, saw tooth wave and out-put of full wave rectifier, solution of Laplace equation in Cartesian and polar co-ordinates, three dimensional steady state het flow in an infinite and semi-infinite rod rectangular and circular plate, potential of a ring and spherical surface, wave equation in two and three dimensions, D'alemert's solution, vibrations of a rectangular and circular membrane.

Tensor:- Co-ordinate transformation, summation conversion, classification of tensor, symmetric and anti-symmetric tensors, contraction and differentiation, Pseudo tensors, Kronecker and alternating tensors, chritofel symbols of first and second kind, intrinsic and covariant derivatives, simple applications.

Complex Variables:- functions of complex variables, Cauchy Riemen differential equations, line integral of a complex function, analytic function. Cauchy's integral theorem, Cauchy's integral formula, Taylor series. Laurents series, Residues and Cauchy's residues theorem, singularities, evaluation of residues and definite integrals, Jordan's Lemma.

Group Theory:- Basic theorems of groups, cyclic groups permutations groups, subgroups and cosets, isomorphism ans homo=morphism, class, rank and orthogonality, character of representation, character tables, reducible and irreducible representation.

PAPER –II: QUANTUM MECHANICS

UNIT – I: Three Dimensional Problems:

Spherically symmetric problems in three dimension, three dimensional oscillator, rigid rotator, three dimensional square well potential and boundary value problems box normalization

UNIT – II: Potential Problems:

Motion of a particle past a rectangular potential barrier, square potential well with finite and infinite depth, reflection and transmission corfficient and tunneling, linear harmonic oscillator, solution of angular and radial part of particle motion in central field, eigen function and eigen values for hydrogen atom.

UNIT – III: Formulation of Quantum Mechanics:

Fundamental postulates of quantum mechanics eighen values and eigen function of operators. Continues eigen values and normalization in terms of eigen functions. Schroedinger, Heisenberg and interaction picture, Hermitian, Unitary and projection operator's commutators and eigen values problems, Matrix representations of operators, change of basis and unitary transformations, Heisenberg ucertainty relations derived from operators.

UNIT – IV: Theory of Angular Momentum:

Angular momentum operators and their eigen values and eigen vectors, angular momentum and it's commutation relations, Pauli's theory of electron spin, transformation properties of spin and total angular momentum, coupling of two angular momenta classification of states in central force problems, Clebsch-Gorden coefficients, selection rules.

UNIT – V: Approximation Method:

Time independent: First order and second order perturbation theory, perturbation theory of degenerate level and it's application to Zeeman and Stark effects, variational method for bound states and it's application to ground state of He- atom, WKB approximation and it's application to linear harmonic oscillator.

PAPER III :- SOLID STATE DEVICE AND ELECTRONICS

Solid State Devices :-

Basic structures, operations, equivalent and I-V characteristics of DIAC and TRIAC, basic operation, characteristics and parameters of JFET, basic operation of N-channel enhance and depletion MOSFET, construction, characteristics and applications of UJT, integrated circuit fabrication, techniques, power and switching transistors.

Junction, Interface and Thin Film Diodes :-

Basic technology of junction, point contact , hetrojunction, interface and thin film devices, characteristics of backward diode, impact avalanche transit time diode, MIS diode, Shockley diode and varacter diode, Shottky effect, current transport theory in shottky barriers, Mott barrier diode, point contact rectifier and ohmic contact, space charge limited diode.

Power Amplifiers :-

Class B power, amplifier, Class B push-pull amplifier, transformer coupled audio amplifier, feed back (Voltage and Current) amplifiers.

Special Amplifiers :-

Uncompensated wide band amplifier, high and low frequency compensation, operational amplifier, emitter coupled differential amplifier, differential d-c amplifier and chopper amplifier.

Wave Form Generators :-

Wein-bridge oscillator, phase shift oscillator, astable, bistable and monostable multivibrators, clipping and clamping circuits, blocking oscillator, trigger and miller integrators.

Regulators and switched mode supply :-

Series and shunt regulators, emitter follower regulation, switched mode power supply, power inverters and converters, different types of D-C to D-C converters, flyback converters, self oscillating and externally driven push converters, switching regulators-Buck, Boost and Buck Boost type of switching regulators, forward converters.

PAPER-IV ASTROPHYSICS AND ELECTRODYNAMICS

Unit: 1

The Planets: The Heliocentric system, Laws of Gravitation and planetary motion, Determination of Distance, Physical size, Mass, Density and Spectrum of planets, The Atmosphere, Satellite and Rings of the planets, Small planets –asteroids, Meteors, Meteorites and Comet, Brief idea of the Solar system.

Unit: 2

The Sun: Constitution size, visible surface, Atmosphere, Sun spots and Magnetic activities in the Sun, The interior of the Sun, the Chromospheres and Corona.

Unit: 3

The Stars: Brief idea of identification of Stars, Stellar distances, Apparent and absolute magnitudes, Luminosity, Effective temperature and their measurement, Stellar spectra, Spectral classification, Saha's equation, Luminosity classes, H-R diagrams.

Unit: 4

Variable and binary stars: Classification of variable stars, H-R diagram of open and globular clusters, The cepheid group, Light curves and period-luminosity relation, Pulsating, Erupting and exploding stars, Novae, Binary stars: Observational classification, Visual, Spectroscopic and eclipsing binaries, Roche model of close binaries.

Unit: 5

Internal structure and evolution of stars: The Hydrostatic equilibrium and stability of the stars, the virial theorem, The source and methods of energy transport, p-p chain, CNO cycle and triple alpha reaction, Evolution of law mass stars-supernova, The end state of stars-Formulation and basic properties of White Dwarfs, Neutron star, Pulsars and Black holes.

Unit: 6

Galactic system: Classification and general properties of Galaxies, Milky way-size, Shape, Stellar, Population, Rotation and spiral structure.

Unit: 7

Gravitation and cosmology: Fundamentals of general relativity-Basic postulates, Space-time curvature, Test for general relativity, Einstein energy momentum tensor and general solution of Einstein's field equations, The theories of the Universe, Hubble's law and expansion of the Universe, The study state theory and the Big Bang model.

Unit: 8

Electromagnetic field and wave equation: Scalar and vector fields, the wave equation for the potential, Solution of inhomogeneous wave equation, Fourier solution, Hertz potential, Electric Dipole and Multipole radiation.

Unit: 9

Charge in the fields and the field equation: Four-vectors, Equation of continuity, Maxwell's equations and their physical significance, Electromagnetic energy and Pointing vector, Electromagnetic field tensor, Covariance of EM field, Lorentz force, Lineard-Wiechert potential, The field of charge in uniform motion, The virtual Photon concept.

Unit: 10

Radiation from an accelerated charge: Field of accelerated charges in general, radiation at low velocity, the case of acceleration parallel and perpendicular to velocity, Bremstrahlung and Cerenkov radiation, Electromagnetic wave.

PAPER 5 SOLID STATE PHYSICS

UNIT-1: Crystal Structure

Periodic array of atoms, primitive lattice cell, fundamental types of lattice, index system for crystal planes, Simple crystal structure, Sodium Chloride Structure, Cesium chloride Structure, Hexagonal closed pack structure, Diamond Structure, Cubic zinc sulphide structure, elementary idea of point group of symmetry.

UNIT-2: Reciprocal Lattice

Diffraction of waves by crystal, Bragg's law, scattered wave amplitude, Fourier analysis, reciprocal lattice vectors, diffraction conditions, Laue equation, Brillouin Zones, reciprocal lattice to sc lattice, reciprocal lattice, fourier analysis of the basis, structure factor of the bcc, fcc lattice, atomic form factor.

UNIT-3: Crystal Binding and Elastic Constants

Crystal of inert gases, ionic crystals, covalent crystals, metals, hydrogen bonds, atomic radii, analysis of elastic strains, elastic compliance and stiffness constants, elastics waves in cubic crystal, experimental determination of elastic constants.

UNIT-4: Phonons

Crystal vibration, vibration of crystal with mono atomic basis, first brillouin zone, group velocity, long wave length limits, two atoms per primitive basis, quantization of elastics waves, phonon momentum, inelastic scattering by phonos

UNIT-5: Defects in Crystal

Point defect, impurities, vacancies, frenkel defects, Schottky defect, concentration of frenkel defects, extrinsic vacancies, Diffusion, Colour centre, F-centre, v-centre, edge dislocations, screw dislocations, burger vectors.

UNIT-6: Magnetism

Dia, Para, and ferromagnetism, Langevin's theory of paramagnetism, ferromagnetism, weiss moleculer field theory, domains, antiferromagnetism, neel's temperature, two sublattic model of antiferro magnetism, exchange interaction of ferrities.

UNIT-7: Energy Bands

Nearly free electron model, origin of energy gap, magnitude of energy gap, Bloch functions, Kronig-Penny model, wave equation of electron of electron in periodic potential, restatement of Bloch theorem, crystal momentum of electron, solution of central equation, kronig penny model in reciprocal process. Empty lattice approximation, Approximate solution near a zone boundry.

PAPER –6: STATISTICAL MECHANICS

UNIT – I: Basic Postulates:

Phase space, relation between eigen states and phase space volume, Liouville's theorem, ensembles, mecrocanonical, canonical and grand canonical ensembles, Maxwell's Boltzmann's distribution and Gibb's formulation for canonical and grand canonical ensembles, partition function, their thermodynamic properties, laws of thermodynamics.

UNIT – II: Application of classical distribution to the ideal gases:

Degrees of freedom, translational motion, Helmholts free energy, Gibb's free energy, entropy and thermodynamic properties, Gibb's paradox, Sakur tetrode equation.

UNIT – III: Rotaional and vibrational motion:

Specific Heat of Liquids, Einstein's model, Debye model, electronic motion, Maxwell Boltzmann velocity distribution, equipartion theorem.

UNIT – IV: Imperfect Gases:

Difference between ideal and real gas, imperfect gases, Vander Waal's equation, virial coefficients, condensation gases, general properties of liquids, Fermi Theory, liquids Helium, Phase rule.

UNIT – V: Quantum statistics:

Drawbacks of M B distribution, Bose Einstein's and Fermi Dirac distribution, symmetric and antisymmetric particles, partion functions, non degenerate, weakly degenerate and strongly degenerate cases, B E condensation, application to He, pressure energy relationship, electronic specific heat and paramagnetism.

UNIT – VI: Black Body Radiation:

Plank's distribution, pressure and energy relationship of photons, black body radiation, Rayleigh Jean's formula, Wein's law, Wein's Displacement formula, absorption and emission of fadiation, Stefan's law, high temperature measurements.

MSc (Physics)-2nd Year

PAPER – VII ADVANCE QUANTUM MECHANICS

UNIT – I: Approximation Methods:

Time dependent perturbation theory, transition probability, harmonic perturbation, selection rules, application to coulombs excitation of nuclei and atomic radiations. Fermi Golden rule for constant transition rate, adiabatic and sudden approximation.

UNIT – II: Scattering Theory:

Classical theory of scattering. Scattering and differential scattering cross section. Centre of mass and laboratory coordinates system. Partial wave analysis, phase shift, differential scattering, cross section in terms of phase shifts. Optical theorem. Applications to spherically symmetric potential, square, well and perfectly hard sphere.

UNIT – III: Born Approximation:

It's solution by Green's function method. Validity of this approximation, application to a square well and coulombs potential, Rutherfod scattering. Comparison of scattering cross-section with potential wave analysis.

UNIT – IV: Radiation:

Interaction of electromagnetic wave with matter, Maxwell's equations. Plane electromagnetic wave and its solution by perturbation theory, transition probability, interpretation or absorption and emission. Dipole approximation, forbidden transitions.

UNIT – V: Identical Particles and spins:

Symmetric and antisymmetric wave function, theory of identical particles, construction of unsymmetrized functions. Pauli's exclusion principle, exchange degeneracy of indistinguishable particles.

UNIT – VI: Relatistic Quantum Mechanics:

Relativistic wave equation, free particle solution of K-G equations. Electromagnetic potential, Coulomb field, difficulties of K-G equations

UNIT – VII: Dirac Relativistic equation for free Particle:

Free particle solution. Dirac matrices, negative energy state concept of hole, dirac particle in electromagnetic field. Hydrogen atom, spin and magnetic moment, Lorentz invariance of dirac equation.

UNIT – VII: Quantization of Field:

Lagrangian equation, functional time, Hamiltonian equations, quantum equations for field, N-repersentation harmonic oscillator, many particle Schroedinger equations.

UNIT – IX: Second quatization of Bosons and Fermions:

Small creation and annihilation operator, comutation and anticommutation of operators, quatization of radiation.

UNIT – X: Quantization of Dirac Equation:

Magnetic energy states and positrons, quantum theory of radiation.

PAPER – VIII NUCLEAR AND PARTICLE PHYSICS

UNIT – I: Interaction of nuclear radiation with matter:

Stopping power of charged nuclear particles, range and strangling, stopping power and range for electrons, absorption of Gamma rays.

UNIT – II: General properties of Nuclei:

Nuclear mass, charge, angular momentum, magnetic dipole moment and electric quadrupole moment, parity, statistics, isotopic spin, binding energy.

UNIT – III: Nuclear Forces:

General characteristics of nuclear forces, ground level of the deuteron, neutron proton scattering at 0-10 Mev, phase shift analysis for a rectangular potential well, spin dependence of nuclear forces, simple discussion about exchange and tensor forces

UNIT – IV: Nuclear Structure:

Liquid drop model, independent particle model and shell model, magic number prediction of independent particle model, regarding spin and parity of ground states, magnetic moment, nuclear radii and excited states of nuclear, and collective model

UNIT – V: Radioactive Decay:

Decay of single radioactive series decay, accumulation of daughter atoms, ideal, secular and transient radioactive aquillibria, growth of a ground daughter product, theory of alpha decay, Geigher- Muttal law, Fermi's theory of Beta decay, parity nonconservation in beta decay, Gamma decay.

UNIT – VI: Nuclear Reactions:

Conservation law of nuclear reactions, Q- value relations, cross section of reaction, Bohr's theory of compound nucleus, reaction cross section (phase shift analysis) Breit Wigner single level formule.

UNIT – VII: Charged Particle Acceleration:

Van de Graaf accelerator, Linear accelerator, cyclotron phase oscillations and stability, electron synchrotron and proton synchrotron.

UNIT – VIII: Nuclear Detectors:

Ionization chamber, proportional counter, Geinger Muller counter, Scintillation detector, solid state nuclear trace detectors.

UNIT – IX: Elementary Particles:

Empirical facts about elementary particle, classification of the basis of mass and spin, mass charge, life time and decay modes of elementary particles, classification of fundamental interactions.

UNIT – X: Symmetric and conservation laws:

Quark model of hadrons, elementary idea of Gauge invariance and standard model.

PAPER IX -ATOMIC AND MOLECULAR SPECTROSCOPY

UNIT:-1 Atomic Spectra

Spectra of complex atoms, Thomas Fermi Dirac Statistical model, Hartee fock Method, Pauli's exclusion principle, Helium Atom Spectra, Calculation of Fine Structure in one and many, electron cases, L-S & J-J coupling Landes interval rule, Hunds Rule, Zeeman Effect-Paschan back effect, hyperfine structure

UNIT:-2 Molecular Models

Born-Oppenhemer Approximation, Simple electronic eigen function, Heitler-Landon theory of hydrogen moleculer ion and hydrogen molecule, theory of moleculer orbitals, classification of moleculer electronic states, symmetry classification, selection rule.

UNIT:-3 Details of Infrared and Raman Spectra

The anharmonic oscillator, the non rigid rotator, the vibrating rotator, infrared spectra, diatomic molecule as a symmetry top, intestinic of rotation, vibration spectra, symmetry properties of rotational level, influence of nuclear spin, ortho and para modification, isotope effect, Raman Spectra, Application of Infrared and Raman spectroscopy in tri and poly atomic molecules.

UNIT:-4 Electronic Spectra of Molecules

Electronics state and electronic transition, resolution of total energy, vibrational structure of electronic levels, rotational structure of electronics levels, intersities in electronics levels, Frank- Condon' principle, intersity distribution in rotational structure, intensity alternation.

UNIT:-5 Elements Of Laser

Ensteins coefficients. Population inversion, line broadening mechanism, threshold condition Laser three and four level rate equation. Helium-nion laser, ruby laser CO_2 laser dye lasers. Semiconductors laser application in spectroscopy, medicine and distance measurements. Holography.

PAPER X: COMPUTER SCIENCE

History of development of computer: Micro, mini, mainframe, and super computers. Gerneral awareness of computer hardware, i.e., CPU and other peripheral devices (I/O and other auxiliary devices).

Distinction between system software and application software, layered organization of system software. Assembly language and higher level languages.

Representation of information: Number System ,integer and floating point representation, character codes (ASCII ; EBCDIC),error detection and correction codes ,Generation awareness of popular commercial software package like Excel ,DBASE, Word ,Window, Other scientific applications.

Basic data structure: Such as stacks, queue, Linked lists and tree. Typical operating system such as MS-DOS & UNIX, their uses.

Flowchart and Algorithms: Problem analysis, flowchart of some basic problems, the concept and properties of algorithmic language, elementary; algorithm involving decision and loops.

C Programming: Skelton of C Program loops and control. Constructs, arithmetic and logic operators, string, array , Pointers, Floats and other types , input ,output, control, recursion structures.

SPECIALIZATION

MICROELECTRONICS

Optoelectronic devices

Execess carries in semiconductors,absorption,luminiescence photonductivity,photodectector,LDR,Photodiode, pin photodiode avalanche photodiode, photo transistor solar cell LED,direct and indirect band gap semiconductor, optoelectronic coupler ,LCD

Integrated circuit

Monolithic ic,hybrid ic,fabrication of monolithic ic,ic component,ic diode construction,integrated zenor diode,SBD,schottky transistor,integrated resistor,integrated inductor and capacitor, monolithic integrated FET,JFET,integrated MOSFET,depletion MOSFET,ion implanted MOS transistor ,silicon gate MOS transistor,VMOS,charge coupled devices,basic operation of charge coupled device.

Algebra for digital system

Variable and function ,Boolean identies,standard forms logic functions,standard sum of product form,standard product of sum form,numbering mean terms and maxterms,simplification of functions using Karnough maps(K-maps),development of K-maps,simplification of Boolean functions.

Basic logic counters

Registers,shift register,counters,asynchronous & synchronous counters,shift register counter,Jhonson counter,cascade counters.

Fiber,optic sensors

Fiber optic sensor,intensity modulated sensors,microband strain intensity modulated sensor,liquid level hybrid sensors,internal effect intensity modulated sensor,phase sensor,diffraction grating sensor,sensor,sensors using single mode fiber interferometric sensors,interferometric pressure sensors,interferometric temperature sensor,medical applications of fiber optic sensors,military and aerospace applications.

COMMUNICATION SYSTEM

Modulation: amplitude modulation, plate modulated class, c- amplifier, balanced modulator, single side band modulator, frequency modulation, reactance tube modulator, Armstrong modulator.

Detection: Linear diode detector, super regenerative detection, Foster-seely(phase) discriminator, amplitude limiter, frequency mixer and converter.

Transmitters and receivers: Am- transmitter F-M transmitters tuned radio frequency receiver, superheterodyne receiver, automatic gain control & automatic volume control.

Transmission lines : basic transmission line equations, their solution characteristic impedence, lossless open & short circuited lines, reflection coefficient, standing wave ration, line terminations by some resistance, complex impedence, and sub matching, quarter and half wavelength lines.

Antennas: radiative field strength, power and radiation, patterns of elementary electric doublet and linear antenna, effects of ground reflection resonant and non resonant antenna, Marconi antenna , hertz antenna, yagi antenna , loop antenna, antenna array, tv aerials, night effect direction finding.

Propagation of radio waves : ecclos larmor theory and Appleton harpor theory of shy wave propagation, critical frequency , skip distance and maximum usable frequency, chapman's theory of layer formation is ionosphere, pulse method for measuring the height of ionospheric region.

Microwaves: limitations of conventional electron tubes at UHF and VHF, principle of velocity modulation, reflex klystron and magnetron.

Television system : general principle of image transmission and reception of signals, pick up instruments(iconoscope, image orthicon and Videocon) image sequence and scanning synchronization, composite video signals, resolution and band width in tv system and color tv.

Radar system : principle of radar, basic arrangement of radar system, azimuth and range measurement operating characteristics of systems, radar transmitters and receivers, duplexer and indicator unit, maximum range of a radar set, modern radars.

Optical Fibre Communication System: Optical fibres, structure and wave guiding fundamentals, fibre types, mode theory for circular wave guides, wave guide equations for step index fibres signal degration in optical fibres, absorption, scattering and dispersion, power launching, and coupling. Optical fibres receivers operation, description of optical fibre communication system.

LASER AND OPTO-ELECTRONICS

UNIT:-1 LASER

Basic principles and theory, emission and absorption of radiations, spontaneous and stimulated emission. Einsteins's coefficients, line broadening, rate equations, three and four level laser, theory of optical resonators, laser modes, spatial and temporal coherence

UNIT:-2 Types of Laser

Gas Laser: HE-Ne, argon ion, N_2 and CO_2 laser, dye laser, solid state laser: Ruby, Nd: Glass and Nc:YAG, semiconductor laser GaAs. Fabrication technology of He-Ne, Ruby and semiconductor laser, diode laser, colour centre, spinflip laser, spikes, mode locking. Q switching, CW and pulse laser.

UNIT:-3 Laser Techniques

Laser fluorescence spectroscopy using CW and Pulsed Laser, single photon, counting, Laser Raman spectroscopy, multi photon process, photon acoustic, photo electron spectroscopy, non linear optical, second and third harmonic generation, phase matching, self focusing.

UNIT:-4 Laser Application

Distance measurement, atmospheric pollution, monitoring, laser interferometry, laser in industry in drilling matching, wielding, etc. Medical application.

UNIT:-5 Holography

Basic principles, construction, and reconstruction, Holograms, application of holography, laser in communication, Power laser for fusion research and isotope separation.

OPTOELECTRONICS

UNIT:-1 Electro Optic Effect

Longitudinal mode phase modulation and amplitude modulation, transverse mode general consideration of modulator design circuit aspects of modulators, Acousto optic effect, Raman Nath and Braggs regimes, Acousto Optic devices, Mangeto Optic effect.

UNIT: - 2 Integrated Optics

Modes in an asymmetric planner waveguide, ray analysis, WKB analysis of inhomogeneous planer wave guides, strip wave guide, guided wave, devices, phase modulators, Mach Zehnder interferometer and switch. Optical directional coupler, comparisons of bulk and integrated optic modulator.

UNIT: - 3 Optical Sources

Laser device, structure and threshold conditions, output sectrum, radiation pattern and modulation. Led structure, light sources materials, internal quantum efficiency modulation capability, liquid crystal diodes.

UNIT: - 4 Detectors

Photoelectric, Photoconduction effects; physical principle of photodiodes PIN photo detectors, avalanche photodiodes, photodectors noise responsivity and quantum efficiency, speed of response, photodiode materials photomultipliers, micro channel plate, image intersifier tubes, Videocon CCD.

UNIT : - 5 Fibre Optics

Basic characteristic of optical fibres, optical fibre structure and wave guiding fundamentals, signal degradation in optical fibres, absorption scattering, radiation and core cladding losses.

UNIT : - 6 Material Dispersion and wave guide dispersion

Design considerations of a fiber optic communication system, analogy and digital modulation, optical fibre amplifiers.

NUCLEAR ENGINEERING.

UNIT:-1 Basic Nuclear Electronic Circuits

Power supplies, shaping circuits, linear pulse amplifiers, distributed amplifiers. Emitter followers or cathode followers, coincidence and anticoincidence circuits, counting and scaling circuits, pulse discriminators and analysers, mechanical analysers.

UNIT:-2 Radiation Detection Instruments

Ionisation chamber, G.M. counter scientillation counter, spark chamber, trigger techniques for spark chamber, nuclear emulsion technique, bubble and cloud chambers Cerenkov radiations and Cerenkov counter, neutron spectrometers, crystal conduction counters.

UNIT:-3 Digital System

Postulates of Boolean alzebra, OR, AND, NOT, NAND, Exclusive OR Logic gates, half adder, full adder, parallel binary adders, RS Flip Flops, the JK Flip Flop, the Schmidt Trigger, Multivibrators.

UNIT:-4 Counters and Registers

Four bit binary counter, the decade counter, gating and counter, binary ripple counter, binary decade counter with decoding gates, digital clock, shift register, operations, magnetic core shift register, SSI and MSI integrated circuits.

PARTICLE PHYSICS.

UNIT:-1 Classical Field Theory

Lagrangian density, field equations, scalar K.G. field, proca field, electromagnetic field and Dirac field, solution of the field equations and the singular functions of field theory.

UNIT:-2 Autumn Field Theory

Canonical field quantization, Schwinger's action principle and its consequences, quantal structure of free fields and the particle concept, second quantization, creation and destruction operators, field operators of free field, interaction of electrons with electromagnetic field(minimal electromagnetic coupling)

UNIT:-3 Electromagnetic and weak interactions

Electromagnetic interactions of Leptons, Compton scattering, electron positron annihilation, Moller and Bhaba scattering, proton form factors, the V-A current interaction theory, C.P. Violation.

UNIT:-4 Strong Interactions

SU(2) group, and its irrudicible representations, SU(3) group, defining representations shift operators, multiplets, the eightfold ways, limitation of SU(3) and SU(6), quark model hypothesis, few application of quark model.

UNIT:-5 Gauge Fields

Gauge transformation, gauge invariance, electromagnetic field as a gauge field, non-Abelian gauge fields, The Yang mills fields, Gauge interaction of field, Spontaneous symmetry breaking, The massive yang Mills field.

UNIT:-6 Weinherg Salam Model

Unified model of weak and trimagnetic interactions, the main properties, the structure of Boolean sector, the Fermi sector, the lagrangian and quantization, Physical content, and experimental status

SOLID STATE PHYSICS

UNIT –I: Fermi surfaces and metals:

Reduced zone scheme, periodic zone scheme, construction of Fermi surfaces nearly free electrons, electron orbits, hole orbits, and open orbits, calculation of energy bands, tight binding method for energy bands, Wingner Seitz mehod, experimental methods in fermi surface studies, quantization of orbit in a magnetic field, DeHaas- van Alphen effect, extremal orbit, Fermi Surface of copper, Magnetic break down.

UNIT –II: Plasmons, Polaritons and Polarons:

Dielectric function of the electron gas, plasma optics, dispersion relation for electromagnetic waves, transverse optical modes in a plasma, electrostatic of alkali metal in the ultraviolet, longitudinal plasma oscillations, Plasmons, electrostatic screened coulomb potential, pseudopotential comonet, Mott, metal insulator transition, screening and phonons in metals, Polaritons, LST relation, electron-electron interaction, Fermi liquid, Electron Phonnon interaction, Polarons.

UNIT –III: Magnetic resonance:

Nuclear magnetic resonance, equation, line width, motional narrowing, hyperfine, splitting, Knight shift, nuclear quadrupole resonance, ferromagnetic resonance, shap effects in FMR, spin wave resonance, antiferromagnetic resonance, electron paramagnetic resonance, exchange narrowing, zero field splitting, principle of maser action.

UNIT –IV: Alloys:

General considerations substitutional solid solution Hume rothery rules, order disordered transformation, elementary theory of order, phase diagram. Eutectics, transition metal alloys, electrical conductivity, kondo effect.

UNIT –V:

Macroscopic description of static dielectric constant, static electrocin and ionic polarizability of molecules, orientational polarization, internal Lorentz field. Static dielectric constant of solids, complex, dielectric constant, dielectric loss and relaxation time, electrocni polarization ad optical absorption.

SOLID STATE PHYSICS

UNIT –I: Surface and Interface physics:

Reconstruction and relaxation, surface crystallography, reflection high energy, electron diffraction, surface electronic structure, work function, thermoionic emission surface states, tangential surface transport , magnetoresonace in a two dimensional channel integral quantized hall effect , IQHE in real system, functional quantizational hall effect, pn junction rectification solar cell and photovoltaic detector, schottky barrier, hetrostructure n-N hetrojunction, semiconductor laser, LED scanning tunneling microscopy.

UNIT –II: Superconductivity

Experimental survery, occurance of superconductivity, destruction of superconductivity by magnetic fields, Meissener effect, heat capacity, energy gap, microwave and infrared properties, isotope effect, theoretical survey, thermodynamics of the superconducting transisition, London equation, coherence length, BCS theory,

BCS groundstate, type second superconductors Josephson superconductor tunnel DC Josephson effect, AC-Josephson effect, high temperature superconductor, critical fields and critical currents.

UNIT –III: Non crystalline solids

Diffraction pattern, monoatomic amorphous materials, radial distribution function, structure of vitreous silica, glasses, viscosity and the hopping rate, amorphous ferromagnets, amorphous semiconductors, low energy excitation in amorphous solids, heat capacity calculation, thermal conductivity, fiber optics Rayleigh attenuation.

UNIT –IV: Dielectrics and Ferro Electrics

Maxwells equations, polarization, macroscopic electric field, local electric field at an atom, Lorentz field, fields of dipoles inside cavity, dielectric constant and polarizability, electronic polarizability, structural phase transition, ferro electric crystal, classification of ferroelectric crystal, displacive transition, soft optical phonons, landau theory of the phase transition, 2^{nd} and 1^{st} order transition, antiferro electricity. Ferro electric domains, plezo electricity, ferro elasticity, optical ceramics

UNIT –V Transport Properties

The Boltzmann's equation, normal and umklapp process, lattice thermal conduction in insulators and metals, calculation of relaxation times and ideal resistivity, electronic conduction metals, thermo electric effects, residual resistivity, temperature dependent resistivity.