PHYSICS

[SPECILISATION CODE: 17]

Sl. No.	Paper – I (Choose any one subject)	Code
1	**AERONOMY OF THE MIDDLE ATMOSPHERE-STRUCTURE, DYNAMICS AND CHEMISTRY**	**R101701**
2	**CLASSICAL MECHANICS**	**R101702**
3	**COMMUNICATION THEORY**	**R101703**
4	**COMPUTATIONAL METHODS AND PROGRAMMING**	**R101704**
5	**ELECTROMAGNETIC THEORY**	**R101705**
6	**ELECTRONICS DEVICES**	**R101706**
7	**GENERAL PHYSICS**	**R101707**
8	**INSTRUMENTATION**	**R101708**
9	**LASER AND HOLOGRAPHY**	**R101709**
10	**MATHEMATICAL PHYSICS**	**R101710**
11	**MEDICAL PHYSICS**	**R101711**
12	**MODERN PHYSICS**	**R101712**
13	**PHYSICS OF AMORPHOUS, DIELECTRIC AND FERROELETRICS MATERIALS**	**R101713**
14	**PHYSICS OF SOLIDS**	**R101714**
15	**QUANTUM MECHANICS**	**R101715**
16	**SPACE PHYSICS**	**R101716**
17	**STATISTICAL MECHANICS**	**R101717**
18	**X-RAY CRYSTALLOGRAPHY**	**R101718**

Sl. No.	Paper – II (Choose any one subject)	Code
1	**BIOPHYSICS**	**R101751**
2	**CONDENSED MATTER PHYSICS**	**R101752**
3	**CRYSTAL STRUCTURES**	**R101753**
4	**FIBER OPTICS**	**R101754**
5	**FIBRE OPTIC SENSORS**	**R101755**
6	**HIGH VOLTAGE PHYSICS**	**R101756**
7	**INTRODUCTION TO IONOSPHERIC PHYSICS**	**R101757**
8	**LASER PHYSICS**	**R101758**
9	**MATERIALS SCIENCE**	**R101759**
10	**MICROPROCESSORS**	**R101760**
11	**NMR SPECTROSCOPY & MOLECULAR STRUCTURE**	**R101761**
12	**NUCLEAR AND PARTICLE PHYSICS**	**R101762**
13	**NUMERICAL METHODS**	**R101763**
14	**OPTICAL COMMUNICATION**	**R101764**
15	**PHYSICS OF POLYMERS**	**R101765**
16	**RADIATION PHYSICS**	**R101766**
17	**SPACE SCIENCE**	**R101767**
18	**STUDIES IN MAGNETO FERRO ELECTRIC MATERIALS**	**R101768**

Subject Code R101701

AERONOMY OF THE MIDDLE ATMOSPHERE-STRUCTURE, DYNAMICS AND CHEMISTRY

CHAPTER 1:
Structure and Dynamics

Introduction-vertical structure and some observed dynamical characteristics-Fundamental description of atmospheric dynamics. The primitive equations, The quasi-geostrophic potential vorticity equation – Effects of dynamics on chemical species-General circulation models-Dynamics of the stratosphere in two dimensions: a conceptual view: zonal mean and eddies – Descriptions of the mean meridional stratospheric circulation-The importance of wave transience and dissipation- One dimensional representations of the atmosphere

CHAPTER-2:
Radiation

Introduction-Solar radiation at the top of the atmosphere: The Sun as a black body, The observed solar spectrum-The attenuation of solar radiation in the atmosphere: Absorption, Scattering by molecules and aerosol particles- Radiative transfer: General equations, Solution of the equation of radiative transfer for wavelengths less than 4μm Multiple scattering, Solution of the radiative transfer for wavelengths longer than 4μm Absorption and emission of infrared radiation.

The thermal effects of radiation: Heatings due to absorption of radiation, Cooling by radiative emission-Photochemical effects of radiation: General- Absorption cross Sections of the principal atmospheric molecules-Numerical calculation of photo dissociation coefficients.

CHAPTER-3:
Composition and Chemistry

General-Oxygen compounds-Pure oxygen chemistry –The odd oxygen family and some observation.

Nitrogen compounds: Sources of stratospheric nitrogen oxides, Chemistry of odd nitrogen and nitric acid in the stratosphere, The odd nitrogen family: lifetimes and observations-Chemistry of odd nitrogen in the lower thermosphere and mesosphere The odd nitrogen family in the lower thermosphere and mesosphere-Chlorine compounds: General, Chlorine chemistry, The odd chlorine family: lifetimes and observation-Other halogens.

Sulphur compounds and formation of aerosis-Generalized ozone balance.

CHAPTER 4:
Possible Perturbations and Atmospheric Responses

Introduction-The importance of coupling in the study of perturbations-The effect of changes in the solar irradiance-Particle precipitation-Volcanic emissions Anthropogenic emissions- Carbon dioxide, -Methane, Nitrous oxide, Aircraft in the troposphere and lower stratosphere, The chlorofluorocarbons (CFC's), Simultaneous perturbations.

Text Book: Aeronomy of the middle Atmosphere (Chemistry and Physics of the stratosphere and Mesosphere) by Guy Brasseur and Susan Solomon) Chapter 3,4,5 and 7.

Subject Code R101702

CLASSICAL MECHANICS

UNIT I:
Preliminaries; Newtonian mechanics of one and many particle systems; Conservation laws, work-10-05energy theorem; open systems(with variable mass).
Constraints; their classifications; D'Alembert's priciple' generalized coordinates.

UNIT II:
Lagrange's equations; gyroscopic forces; dissipative systems; Jacobi integral; gauge invariance; generalized coordinates and moments; integrals of motion; symmetries of space and time with conservation laws; invariance under Galilean transformation.
Rotating frames; inertial forces; terrestrial and astronomical applications of coriolis force.

UNIT III:
Central force; definition and characteristics; Two-body problem; closure and stability of circular orbits; general analysis of orbits; Kepler's laws and equations; artificial satellites; Rutherford scattering.
Principle of least action; derivation of equations of motion; variation and end points; Hamilton's principle and characteristic functions; Hamilton-Jacobi equation.

UNIT IV:
Canonical transformation; generating functions; properties; group property examples; Infinitesimal generators; Poisson bracket; Poisson theorems; angular momentum PBs; small oscillations; normal modes and coordinates.

TEXT AND REFERENCE BOOKS:

- Classical Mechanics, by H Goldstein (Addison Wesley, 1980)
- Classical Mechanics, by N C Rana and P S Joag (Tata McGraw-Hill, 1991)
- Mechanics, by A Somerfeld (Academic Press**, 1952)**

Subject Code R101703

COMMUNICATION THEORY

UNIT – I: Signal Analysis: Fourier Transform, Elementary ideas of auto correlation and cross correlation. Time averages and periodicity.

UNIT – II:
Analogue Modulation Systems: Frequency translation Normal AM, DSB and SSN transmission methods. Envelope detection and synchronous detection. Multiplexing, Vestigial side band transmission. Angle modulation. FM demodulators. Phasor diagram representations. Phase modulation.

UNIT – III:
Pulse Modulation Systems: Sampling theorem. Types of sampling. Principles of PAM, PWM methods. Pulse code modulation. Delta modulation, PSK and FSK methods.

UNIT – IV:
Noise: Thermal noise, shot noise, noise power spectral density, Noise figure and noise temperature. Available gain. Noise figure of a single amplifier. Narrow band noise, representation.

TEXT BOOKS:

1. S.S. Haykins communication System, Wiley Ester.
2. A.B. Carlson, Communication Systems (ISE)
3. Taub and Schilling – Principles of Communication – T.M.H

Subject Code R101704

COMPUTATIONAL METHODS AND PROGRAMMING

Computational Methods

UNIT I:
Methods for determination of zeroes of linear and non linear algebraic equations and transcendental equations, convergence of solutions.

UNIT II:
Solutions of simultaneous linear equations, Gaussian elimination, pivoting, iterative Method, matrix inversion.

UNIT III:
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 IV:
Numerical differentiation and integration, Newton-Cotes formulae, eror estimates, Gauss method. Random variate, Monte Carlo evaluation of Integrals, Mthods of importance sampling, Random walk and Metropolis method.

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

Programming in'c'

UNIT VI:
GETTING STARTED
1) Background 2) Sample Program 3) Components of a C program 4) Data types 5) Naming conventions for variables 6) Printing and initializing variables 7) Defining arrays.
FUNCTIONS + OPERATORS
1) Functions 2) Sample program 3) Components of a C program 4) The conditional operator 5) Increment and decrement operators.

UNIT VII:
CONTROL FLOW CONSTRUCTS
1) if statement 2) if else statement 3) while loop 4) for loop 5) do while loop 6) break and continue statements 8) switch statement 9) else if.
THE C PREPROCESSOR
1) #define 2) Writing macros 3) #include 4) #ifdef 5) #indef

UNIT VIII:

MORE ON FUNCTIONS

1) General 2) Functions declarations 3) Returning a value or not 4) Function prototypes 5) Arguments and parameters

POINTERS

1) Fundamental concepts 2) Pointer operators and operations 3) Changing an argument with a function call 4) Pointer arithmetic 5) Traversing arrays with a pointer 6) Relationship between array and pointer 7) The pointer notation *p++.

TEXT AND REFERENCE BOOKS:

- Sastry: Introductory Methods of Numerical Alanlysis
- Rajaraman: Numerical Analysis
- C Programming using turbo C++, 2nd edition, Robart Lafore
- Numerical Recipes in 'C' 2nd edition, W.H. Press, S.A. Teukolsky, W.T.Wellering, B.P.Flannery.

Subject Code R101705

ELECTROMAGNETIC THEORY

UNIT – I:

Maxwell's Equations: The equation of continuity for Time-Varying Fields – Inconsistency of Ampere's Law – Maxwell's equations – Conditions at a Boundary surface.

UNIT – II:

Electromagnetic Waves: Solution for free-space conditions – Uniform plane – Wave propagation – Uniform plane waves – The Wave Equation for a conducting medium – Sinusoidal Time Variations – Conductors and Dielectrics – Polarization – Directions cosines – Reflection by a perfect conductors normal incidence – Reflection by a perfect conductor – Oblique Incidence – Reflection by a perfect Dielectric – Normal Incidence – Reflection by a perfect Insulator – Oblique Incidence – Reflection at the surface of a conductive medium – Surface impedance – The Transmission – line Analogy.

UNIT – III:

Poynting Vector and the flow of power: Poynting's theorem – Note on the Interpretation of E x H – Instantaneous, Average and Complex Poynting Vector – Power Loss in a plane conductor.

Guided Waves: Waves between parallel planes – Transverse Electric Waves – Transverse Magnetic Waves – Characteristics of TE and TM Waves – Transverse Electromagnetic Waves – Velocities of propagation – Attenuation in parallel – place Guides – Wave Impedances – Electric Field and current Flow within the conductors – Transmission lines – Circuit Representation of the parallel –plane transmission line – parallel – plane Transmission lines with loss – E and H about Long parallel cylindrical conductors of Arbitrary cross section.

UNIT – IV:

Wave Guides: Rectangular guides – Transverse Magnetic waves in Rectangular guides – Transverse electric waves in rectangular guides – Impossibility of TEM wave in wave guides – Bessel functions – Solution of the Field equation – Cylindrical co-ordinates – TM and TE waves in circular guides – wave impedances and characteristics impedance – Attenuation factor of wave guides.

TEXT BOOKS:

1. Electromagnetic wave and Radiating Systems, 2nd Edition, Edward C, Jordan, Keith G. Balman.
2. 2000 solved problems in Electromagnetics, Syed Nasar, Schaum Series.

Subject Code R101706

ELECTRONICS DEVICES

Unit I:
Physics and properties of semiconductors: energy bands – carrier concentration-thermal equilibrium - carrier transport phenomenon – phonon spectra and optical, thermal and high field properties of semiconductors – Basic equations for semiconductor device operation; p-n junction diode: structure – depletion region and depletion capacitance - I-V characteristics – junction break down – hetero-junction basic device model;

Unit II:
BJT, JFET, MESFET and MOSFET: Structure, Working, Derivations of the equations for I-V characteristics under different conditions.

Unit III:
Photonic Devices: Radiative and non - radiative transitions. LED - effect of surface and indirect recombination, operation of LED; Diode lasers - conditions for population inversion, in active region, light confinement factor. Optical gain and threshold current for lasing, Optical Absorption; Bulk and Thin film Photoconductive devices, diode photo detectors, p-i-n photo detectors, Avalanche photo detectors, Solar cell-open circuit voltage and short circuit current, fill factor.

Unit IV:
Microwave Devices: Tunnel diode, transferred electron device (Gunn diode). Avalanche Transit time device (IMPATT diode). **Memory devices:** Static and dynamic random access memories SRAM and DRAM, CMOS and NMOS, non-volatile – NMOS.

TEXT AND REFERANCE BOOKS

- Semiconductor Devices- Physics and Technology, by SM Sze Wiley (1985)
- Introduction to Semiconductor devices, M.S. Tyagi, John Wiley & Sons
- Optical electronics by Ajoy Ghatak and K. Thygarajan, Cambridge Univ.Press.

Subject Code R101707

GENERAL PHYSICS

Unit 1: Molecular Spectroscopy

1.1. Rotation spectra of diatomic molecules: Rigid rotor-spectrum of rigid rotor; Effect of isotopic substitution. Non rigid rotor-spectrum of non rigid rotor.

1.2. Vibrational spectra of diatomic molecules: The energy o f diatomic Molecule; Simple harmonic oscillator and anhormonic oscillator and anhormonic oscillator, The diatomic vibrating rotor. The p and r branches.

1.3. Raman effect: Scattering of Raman effect; Molecular polarisability; Pure rotational Raman spectra of linear diatomic molecules.

1.4. Electronic spectra of diatomic molecules: vibrational coarse structure; Frank-Condon principle; Dissociation energy and dissociation products. Rotational fine structure.

Unit-II: Resonance Spectroscopy

2.1 Nuclear Magnetic Resonance Spectroscopy; Basic principle of NMR. Chemical shift and spin-spin coupling. NMR spectrometer Analysis of NMR spectra, Applications.

2.2 Electron Spin Resonance spectroscopy Basic principles of ESR; Nuclear hyperfine interaction; ESR spectrometer. Analysis of ESR spectra; Applications.

2.3 Mossbaur spectroscopy; Principles of Mossbaur spectroscopy. Mossbaur spectrometer; Analysis of Mossbaur spectra. Applications.

Unit-III: Computational techniques

Errors: Principle of Least squares; Errors and Residuals; Precision Measures an Residuals; Experiments of unequal weight Probable errors of functions; Rejection of observations; Empirical formule. Regression Analysis: Introduction; Linear regression, Polynomial regression; Fitting exponential; Trigonometric functions.

Unit-IV: Optical fibres

4.1 Transmission Characteristics: Attenuation, absorption, scattering and bending losses in fibres. Core and cladding losses; Signal distortion in wave guides; Different types of dispersion; Pulse broadening.

4.2 Optical Sources and detectors: Basic semiconductor properties; LEDS-structures; light source materials; Physical principle of PIN photodetectors; Avalanche photodiodes.

Recommended Books:

1. Molecular spectroscopy - Banwell & Banwell & McCash
2. Molecular spectroscopy - Graybeal
3. Molecular spectroscopy – P S Sindhu.
4. Computer Oriented Numerical methods - Rajaraman
5. Fundamentals of Mathematical statistics - S C Gupta and V K Kapoor
6. Numerical methods - S Balachandra Rao and C K Shantha
7. Optical Fibers- T Gowar
8. Solid State physics – B S Bellubbi and Adeel Ahmad.

Subject Code R101708

INSTRUMENTATION

UNIT 1:
ELECTRICAL BREAKDOWN IN GASES

1. The Townsend criterion for spark
2. The sparking potential
3. Effect of space charge on breakdown voltage
4. The steamer mechanism of spark
5. BDV characteristics in uniform fields
6. Corona Discharges
7. BDV in non-uniform fields

UNIT 2:
THE BREAKDOWN IN SOLIDS

1. Intrinsic breakdown
2. Electrochemical breakdown
3. Steamer breakdown
4. Thermal breakdown
5. Erosion breakdown

UNIT 3:
BREAKDOWN IN LIQUIDS

1. Electronic breakdown
2. Cavitation breakdown
3. Suspended particle breakdown

UNIT 4:
THE INSULATION OF HV TRANSFORMERS

1. Transformer insulation
2. Dielectric strength
3. Voltage conditions
4. Dielectric field analysis
5. Partial discharges
6. Development testing
7. Field analysis approach

AUTHORS:

1. HIGH VOLTAGE ENGINEERING E. KUFFEL AND M. ABDULLA
2. HIGH VOLTAGE TECHNOLOGY L. L. ALSTON

Subject Code R101709

LASER AND HOLOGRAPHY

1. SPATIAL FREQUENCY FILTERING

The Fourier transforming property of thin applications of spatial frequency filtering phase contrast micro scope. Image debturing.

2. LASER -I

The Einstein coefficient light amplification. The threshold condition. Laser equations. Variation of laser power around threshold. Optimum output coupling.

3. LASER-II

Modes of a rectangular cavity and the open planer resonator. The quality factor. The ultimate line worth of the laser. Mode selection Q Switching Mode of locking in inters.

4. SOME LASER SYSTEMS:

Ruby lasers. Neodymium based lasers, The He-Ne laser. The Co_g laser. Dye lasers, Sony conductor lasers.

5. HOLOGRAPHY

Introduction. The basic principle. Coherence requirements. Resolution. Fourier transforms. Volume holograms. Somme applications.

REFERENCE BOOKS:

1. Optical Electronics- Ghotak and Thyagarajan

Subject Code R101710

MATHEMATICAL PHYSICS

Unit – I:
Elementary complex analysis; Complex numbers, variables and functions – singularity – Analytic function.

Unit – II:
Cauchy Riemann equation – Cauchy's Integral theorem – Cauchy's Residual theorem.

Unit – III:
Matrices; Matrix algebra – Transpose, Inverse, Adjoint, Unitary Matrices – Eigen values and Eigen vectors – Diagonalisation.

Unit – IV:
Differential Equations; Second order linear ODE's with variable coefficients; Solution by series expansion

Unit – V:
Special function; Legendre, Bessel, Generating function; recursion relations

Unit – VI:
Hermite and Lagurre equations; Generating functions; recursion relations.

Unit – VII:
Fourier series; Fourier sine and cosine series; Fourier integral and transforms. FT of delta function.

Unit – VIII:
Integral transforms; Laplace transforms; first and second shifting theorems; Inverse LT by partial fractions; LT of derivative and integral of a function;

TEXT AND REFERENCE BOOKS:

1. Mathematical Physics, Rajput
2. Complex analysis by Churchill
3. Mathematical Methods for Physics, by G. Arfken

Subject Code R101711

MEDICAL PHYSICS

UNIT I:

PHYSICS OF THE SKELETEN

What is the Bone made of?, How strong are your bones?, Lubrication of Bone Joints, Measurement of Bone Mineral in the Body.

PHYSICS OF THE LUNGS AND BREATHING

The airways, How the Blood and Lungs interact, Measurement of Lung volujes,. Pressure-airflow-volume relationships of the lungs, physics of the Alveoli, the breathing mechanism, airway resistance, work of breathing, physics of some common lung diseases.

UNIT II:

Physics of the Cardiovascular system

Major components of the cardiovascular system, O2 and CO2 exchange in the capillary system, work done by the heart, blood pressure and its measurement, pressure across the blood vessel wall (transmural pressure) Bernoulli's principle applied to the cardiovascular system, how fast does your blood flow?, blood flow-laminar and turbulent, heart sounds, physics of some cardiovascular diseases, some other functions of blood.

Cardiovascular instrumentation

Biopotentials of the heart, electrodes, amplifiers, patient monitoring, defibrillators, pacemakers**.**

UNIT III:

Sound in Medicine

General properties of sound, the body as a drum (percussion in medicine) the stethoscope, ultrasound pictures of the body,. Ultrasound to measure notion, lphysiological effects of ultrasound in therapy the production of speech (phonation).

Physics of the ear and hearing

The outer ear, middle ear, inner ear, sensitivity of the ears, testing your hearing deafmess and hearing aids.

UNIT IV:

Light in Medicine

Measurement of light and its units, applications of visible light in medicine, applications of ultr5aviolet and infrared light in medicine, lasers in medicine, applications of microscopes in medicine.

Physics of eyes and vision

Focusing elements of the eye, some other elements of the eye, the retina-10-05the light detector of the eye, hw little light can you see? Diffraction effects on the eye, how sharp are your eyes? optical illusions ad related phenomena defective vision abd its correcto9n, color vision and chromatic aberration, instruments used in ophthalmology.

RECOMMENDED TEXT BOOKS:

Medical Physics by John R. Cameron and James G. Skofromel

Subject Code R101712

MODERN PHYSICS

Unit – I:

Electromagnetic Waves: Equation of continuity, Maxwell's equations, Maxwell's equations in integral and differential forms, Physical Significance, Pointing theorem, Poynting vector, The wave equation, plane Electro magnetic wave in free space, plane Electro magnetic wave in anisotropic non conducting medium, plane Electro magnetic wave in isotropic non conducting medium, plane Electro magnetic wave in conducting medium.

Unit – II:

Diffects in Solids: Introduction, classification of imperfections, point defects; vacancies, impurities, interstitials, color centues, Schottkey defects, Frenkel defects. Estimation of concentration of Schottkey defects and Frenkel defects at a given temperature. Line Defects: Edge dislocation, Screw dislocation, Burger's circuit and Burger's vector.

Unit – III:

Super conductors: Super conducting phenomenon, Zero electrical resistance, Meissner's effects, magnetic phase diagram, energy gap, isotope effect, flux quantization, Josephson effect and tunneling, SOULD, London equations, BCS theory, application of superconductors.

Unit – IV:

Photonic devices: Light emitting diodes, photo diode, solar sells, photo transistor.

Books:

1. EM Waves and Radiating Systems by Edward C.Jordon Keith G. Balmain
2. Electro magnetic theory and Electrodynamics by Satya Prasad
3. Introduction to solid state physics by C.Kittel
4. Physics of Semiconductor Devices by S.M.Sze.

Subject Code R101713

PHYSICS OF AMORPHOUS, DIELECTRIC AND FERROELETRICS MATERIALS

Unit-I: IONICS AND SUPERIONICS:

Superionic solids, classification of superionic solids, materials and structures, structural characterization, thermodynamic properties, Ionic transport (microscopic nature), Ion dynamic, applications superionic solids with special reference to solid state batteries.

Unit-II: PHYSICS OF AMORPHOUS MATERIALS

Introduction and preparation techniques, Glasses and glass transition, Structure of glass, atomic ordering in amorphous materials, Optical properties amorphous materials**,** Applications of amorphous materials.

Unit-III: DIELECTRICS:

Single relaxation times, Debye's equations and Cole-Cole plots, Distribution of relaxation times, Cole-Davidson plots, Random approximation, Variation of dielectric properties with frequency, temperature, pressure, and composition. (dielectric properties of mixtures), Dielectric properties of glasses and polymers.

Measurement of dielectric properties, Scherring bridges, Q-meters and LCR meters and impedance analysiers. Review of piezoelectric and piezoelectric materials, lead based piezoelectric and applications.

Unit-IV: FERROELETRICS:

Review of types of ferroelectrics and their important features methods of preparation of bulk ceramic ferroelectrics. Characterization of ferroelectrics, small signal dielectric measurements, method of measuring spontaneous polarization, pyrolectricity, polarization reversal. Theories of ferrolectricity, Dipole theory, Devonshire thory and pseudospin theory. Application of ferroelectric materials, piezoelectric transducers, pyroelectric detectors, electro-optic application. Second harmonic generators, SAW devices and memory devices.

Reference:

1. Materials science and engineering by V.Raghavan
2. Solid state physics by Kittel
3. Materials science and Engineering by W.D.Cellister
4. Materials science and Engg by S.M.Srivasthava.

Subject Code R101714

PHYSICS OF SOLIDS

1. Bonding in solids, Cohesive Energy – Calculation of Cohesive Energy of Ionic Solids, Lattice energy of Ionic Crystals, Madelung constant. Lattice points and space lattice – Basic and Crystal structure – Unit cells and Lattice parameters – Unit cells and primitive cells crystal systems – Bravais lattices – Structures of Diamond, Zns, NaCl and CsO systems.

2. Crystal Directions, planes and Miller Indices – Important features of Miller Indices of crystal planes – Important planes in a cubic crystal – Distribution of atoms in the atoms, plane of a Simple Cubic crystal – Relation between inter planar spacing and lattice parameter – Allotropy and Polymorphism.
Imperfections in Crystals : Point Defects – Frenkel and Schottky defects Energy of formation of a Vacancy – Number of vacancies at any given temperature Line Defects, edge and screw dislocations – Burger's Vector.

3. Electron Theory of Metal – Classical Theory – Drawbacks of Classical theory Relaxation time, Collision time and mean free path – Quantum theory of free electron Fermi-Dirac statistics and Electronic distribution in solids – Density of Energy states an Fermi Distribution Function
Band theory of solids – Kronig –Penney Model – Motion of electron in a one dimensional periodic potential – Distinction between Metals consulators an Semiconductors.

4. Dielectric Properties: Microscopic Concept of Polarization, Sources of polarization Internal field – Clausius – Mosotti relation – Ferro electricity and Piezo-electricity Complex dielectric Constant and Dielectric Loss – Dielectrics in Alternating Fields important requirements of good insulating materials – Some important insulating material.

5. Semiconductors: Conductivity and temperatures Statistics electrons and holes in intrinsic semiconductors – Statistics of electrons and holes extrinsic semiconductors – electrical conductivity – Extrinsic semiconductors – Mechanic of conduction in semiconductors – Generation and recombination electrons and holes Mobility of Current Carriers – Hall effect.

6. Superconductivity: A survey of Superconductivity – Properties of superconductors – effect of magnetic Field – Meissner effect – penetration depth – Type I and Type J superconductors-BCS theory-Josephson's Tunneling –Theory of Josephson effect AC and DC josephson effects. Applications of superconductivity.

Books for study:

1. Solid state physics, A.J.Dekher Macmillion, London
2. Solid state and Semiconductor Physics, J.P.Mc Kelvey, Harper and Row, New York.
3. Introduction to Solid state physics, C.Kittel, VII Ed, John Willey & Sons, New York
4. Solid state physics, R.L.Singhal, Kedarnath and Ramnath Co., Meerut
5. Introduction to Solids, L.Azaroff, New Age International (P) Publishers, New Delhi.
6. Solid State Physics, M. Keer, New Age International (P) Publishers, New Delhi.

Subject Code R101715

QUANTUM MECHANICS

UNIT – I:
Why QM? Revision; Inadequacy of classical mechanics; Schordinger equation, continuity equation; Ehrenfest theorem; Admissible wave functions; Stationary states. One-dimensional problems, wells and barriers; Harmonic oscillator by Schrodinger equation and by operator method.

UNIT – II:
Uncertainty relation of x and p, states with minimum uncertainty product; General formalism of wave mechanism; Commutation relations; Representation of states and dynamical variables; Dirac delta function; bra and ket notation; Matrix representation of an operator.

UNIT – III:
Angular momentum in QM; Central force problem: Solution of Schordinger equation for spherically symmetric potentials; Hydrogen atom.

UNIT – IV:
Time-independent perturbation theory; Non-degenerate and degenerate cases; Applications such as Stark effect.
Variational method: WKB approximation and time dependent perturbation theory

TEXT AND REFERANCE BOOKS:

- L I Schiff, Quantum Mechanics (McGraw-Hill)
- B Craseman and J D Powell, Quantum Mechanics (Addison Wesley)
- Mathews and Venkateshan Quantum Mechanics

Subject Code R101716

SPACE PHYSICS

Unit-1

Essential Characteristics of the Upper Atmosphere: A tenuous gas-ionization-photochemistry-heating – composition – geomagnetic field solar activity.

Nomenclature of upper Atmosphere: Classification of Upper atmosphere based on Temperature-Chemistry-Ionization.

Some properties of Magneto plasma: Energy density of electric and magnetic fields jyrofrequency betatron acceleration plasma frequency Debye length frozen in fiels Fermi acceleration.

Waves in a plasma: Electromagnetic waves in an ionized medium Appleton-I larttree equation Hydro magnetic and magneto sonic waves.

Unit-II

Formation of Ionized layers: Chapman Theory –Vertical Transport – Ionospheric D-region-Ionospheric E-region- Recombination jin the D and E regions-Collisional frequencies in the D and E regions.

Ionospheric region-Morphology of F layer- Formation of ionized layers in the quiet F-region-Spread F Irregularities.

Unit-III

Electrical Conductivity of the upper Atmosphere: Motion of a chargesd particle magnetic foeld effects of a neural wind effects of an electric field total conductivity.

Lattitudinal Variations: Equational Ionosphere and Polar Ionosphere.

Motions of Neural Atmosphere: Winds ans Tides-Acoustic gravity waves whistlers-Alfven's waves currents and plasma drifts-Dynamo theory-sq current system-F-region drifts.

Unit-IV

Structure of the Magnetosphere: Geomagnetic field Model solar cycle-Solar flares-Theory of the Solar Wind-Geomagnetic Cavity-Geomagnetic field near the Earth formation of the Cavity-Magnetopause-Van Alien Particles.

Circualation of Magnetosphere: The Axford and Hynes Model-Reconnection with Interplantary Field – MHD Generator-Dynamics of the plasmaphere-Electrojects and Ring Currents- Auroras.

Books recommended:

I. The Upper Atmosphere and solar Terrestrial Relations-J K Hargreaves-Van Nostrand Reinfold Company.

II. Physics of the Earth's Upper Atmosphere –C O lines-Ipaghis-I R Hartz-J A Fejer-Pretice Hill-Ijine.

Subject Code R101717

STATISTICAL MECHANICS

UNIT – I:
Basics of classical statistical mechanics: Introduction, Phase space, Ensemble, Ensemble average, Liouville theorem, Conservation of extension in phase, Equation of motion and Liouville theorem, Equal a priori probability, statistical equilibrium, Microcanonical ensemble, Ideal gas.

UNIT – II:
Quantum picture: Microcanonical ensemble, Quantization of phase space, Basic postulates, Classical limit, Symmetry of wave functions, Effect of symmetry on counting, Various distributions using microcanonical ensemble (ideal gases).

UNIT – III:
Statistical mechanics and thermodynamics: Entropy, Equilibrium conditions, Quasistatic processes, Entropy of an ideal Boltzmann gas using the micro canonical ensemble, Gibbs paradox, Sackur-Tetrode equation, Entropy and probability.

UNIT – IV:
Canonical and grand canonical ensembles: Canonical ensemble, Entropy of a system in contact with a heat reservoir, Ideal gas in canonical ensemble, Maxwell velocity distribution, Equipartition of energy.

UNIT – V:
Grand canonical ensemble, Ideal gas in grand canonical ensemble, comparison of various ensembles.

UNIT – VI:
Partition function: Canonical partition function, Molecular partition functions, Translational partition function, Rotational partition function, Vibrational partition function, Electronic and Nuclear partition function.

UNIT –VII:
Ideal Bose-Einstein gas: Bose-Einstein distribution, Bose-Einstein condensation, Thermodynamic properties of an ideal Bose-Einstein gas, liquid helium, Two-fluid model of liquid helium II.

UNIT – VIII:
Ideal Fermi-Dirac gas: Fermi-Dirac distribution, Degeneracy, electrons in metals, Thermionic emission, Magnetic susceptibility of free electrons, White dwarfs, Nuclear matter.

TEXT BOOK:
Statistical Mechanics By B.K. Agarwal & Melvin Eisner.

Subject Code R101718

X-RAY CRYSTALLOGRAPHY

UNIT-1 - PROPERTIES OF X-RAYS:

Electromagnetic radiation. The continuous spectrum, The characteristic spectrum, Absorption, Filters, Production of X-rays, Detection of X-rays, Safety precautions.
The Geometry of crystals:
Lattices, Crystal systems, Symmetry, Primitive and non primitive cells, Lattice directions and planes, Crystal structure, Atom sizes and coordination, crystal shape, Twinned crystals, The stereographic peojection.

UNIT-2 – THE DIRECTION OF DIFFERENTED BEAMS

Diffraction, The Bragglaw, X-ray Spectroscopy, Diffraction directions, Diffraction methods, Diffraction under non-linear conditions.

UNIT-3 – THE INTENSITY OF DIFFRACTED BEAMS

Scattering by an electron, Scattering by au atom, Scatterinh by a unit cell, Structure-factor calculations, Application to powder method, Multiplicity factor, Lorentz factor, Absorption factor, Temperature factor, Intensities of powder pattern lines, Examples of intensity calculations. Measurement of X-ray intensity.

UNIT-4 – POWDER PHOTOGRAPHS

Debye-Scherrer method, Specimen preparation, Film loading, Cameras for high and low temperatures, Focusing cameras, Seemann- Bohlin cameras, Pinhole photographs, Choice of radiation, Back ground radiation, Crystal monochromators, Measurments of line position, Measurement of line intensity

DIFFRACTOMETER MEASUREMENTS

X-ray optics, Intensity calculation. Proportional counters, Geiger counters, Scintillation counters, Scalers, Ratemeters, Use of monochromators.

References:

1. “Elements of X-ray Diffraction”, by B.D,Cullity Addison-Wesley publishing company.
2. “X-ray Diffraction”, by B.E.warren, Addison –wesley publishing company.
3. “X-ray diffraction Proceducers for poly crystalline and amorphous Mateerials, John Willey & sons. Inc
4. “Applied X-ray”, By George L.Clark, Macgraw-Hill Book company.
5. “Elements of X-ray crystallography”, Leonid V.Azaroff, Macgraw Hill Book Company.

Subject Code R101751

BIOPHYSICS

Unit 1:

Structure and functions of macromolecules

Structure and function of disaccharides and polysaccharides. Classification of proteins. Primary and secondary structures of proteins. Chemistry of nucleic acids DNA duplication. Protein synthesis Structure and functions of lipids.

Unit 2:

Enzymes and Biocatalysis

Classification of enzymes. Michaelis-Menten model for enzyme catalysed reactions. Lineweaver- Burke plots. Inhibitors- specific and non- specific. Modified Michaelis-Menten model for fully competitive and non- competitive enzyme catalysed reactions. Enzyme specificity. Enzyme structure and function relation.

Unit 3:

Biological dielectrics and Biological Dielectrophoresis

Theory of homogeneous dielectrics. Theory of heterogeneous dielectrics. Types of electrical polarization; Frequency dependence of dielectrics. Dielectric dispersions and Cole-Cole plots Experimental techniques for the study of dielectric parameters of cells, and soft and hard calcified tissues.

Simple description of dielectrophoresis. Behaviour of charged and neutral matter in (a) uniform and (b) non-uniform electric fields. Bunching effects or pearl chain formation of cells Field geometries- spherical. Cylindrical and isomotive. Dieletrophoretic force in radial field. Dielectrophoretic collection rate (DCR) of cells in radial field. Experimental technique for DCR of biological cells. Calculation of excess permitivity of cells.

Single cell dielectrophoresis. Experimental technique for the determination of retention voltage. Calculation of excess permitivity of lone cells using retention voltage.

Unit 4:

Bio-instrumentation

Bioelectric signals and electrodes- Electrode and electrolytic interface; surface and metal plate electrodes; Needle and wire electrodes; Microelectrodes. Physiological transducers- Variable resistance transducers;Variable inductance transducers. Variable capacitance transducers; thermo resistive transducers; Photoelectric transducers. Piezoelectric transducers. Biomedical amplifiers- Basic requirements. Differential amplifiers. Carrier amplifier; Chopper amplifier, phase sensitive detector. Recording systems- Characteristics of recording systems; Moving coil recorder ; moving iron recorder Recording techniques- Heat stylus; optical light and ink jet.

Recommended Books:

1. Essentials of biological chemistry – Fairely & Kilgour
2. Dielectrophoresis – H A Pohl
3. Hand Book of biomedical instrumentation – R Skhandpur
4. Principles of medical electronics and Biomedical instrumentation – C Raja Rao & S K Guha, Universities Press.
5. Solid state Physics – B S Bellubbi and Adeel Ahmad.

Subject Code R101752

CONDENSED MATTER PHYSICS

UNIT I:

Crystal Physics and Defects in Crystals: Crystalline solids, unit cells and direct lattice, two and three dimensional Bravais lattice, 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.

UNIT II:

The Laue, powder and rotating crystal methods, crystal methods, crystal structure factor and intensity of diffraction maxima. Extinctions due to lattice centering. Point defects, line defects line defects and planner (stacking) faults. The role of dislocations in plastic deformation and crystal growth. The observation of imperfections in crystals, X-ray and electron microscopic techniques.

UNIT III:

Electronic Properties of Solids: Electrons in a periodic lattice: Bloch theorem, band theory, classification of solids, effective mass. Tight-bonding, cellular and pseudo potential methods. Fermi surface, de Hass von Alfen effect, cyclotron resonance, magneto-resistance, quantum Hall effect. Superconductivity: Critical temperature, persistent current, Meissner effect.

UNIT IV:

Weiss theory of ferromagnetism. Heisenberg model and molecular field theory. Spin waves and magnons. Curie-Weiss law for susceptibility, Ferri-and anti ferromagnetic order. Domains and Bloch-wall energy.

TEXT AND REFERENCE BOOKS

- Verma and Srivastava: crystallography for solid state physics
- Kittel: Solid State physics
- Azroff: Introduction to Solids
- Omar: Elementary Solid State Physics
- Aschroff & Mermin: Solid State physics.
- Chalkin and Lubensky : Principles of Condensed Matter physics.

Subject Code R101753

CRYSTAL STRUCTURES

UNIT I:

CRYSTAL SIZE AND PERFECTION

Grain size, Particle size, Crystal perfection and Depth of X-ray penetration

Determination Crystal Structure:

Preliminary treatment of data, indexing pattern of cubic crystals, Effect of cell distortion on the powder pattern, Determination of atom position, Example of structure determination.

UNIT II:

Precise Parameter measurement

Debye-Scherrer cameras, Back-reflection Focusing cameras, Pinhole cameras, diffractometers, Method of least squares, Coben's methods, calibration method.

UNIT III:

Phase Diagram Determination

General principles, Solid solutions, Determination of solvus curves (disappearing phase method), Determination of solvus curves (parametric method).

UNIT IV:

Order-Disorder Transformations

Long range order in $AUCu_3$, Other examples of long range order, detection of Super lattice, Short-range order and clustering.

Chemical analysis by Diffraction

Qualitative analysis and Quantitative analysis (Multi phase).

UNIT V:

Scanning Electron Microscopy and X-ray Micro analysis

SEM instrumentation, Specimen/Electron interactions, Detectors, Resolution and magnification, operating conditions, Specimen preparation and elemental analysis by EDS(Energy Dispersive Spectroscopy) and WDS (wavelength Dispersive Spectroscopy)

REFERENCES:

1. Industrial X-ray interpretation by Justin G. Schneeman, Published by Intex publishing Company, Evanston, Illinois
2. "Elements of X-ray Diffraction", by B.D. Cullity, Addison-Wesley publishing company.
3. "X-ray and Neutron diffraction", by G.E.Bacon, Pergamon press
4. "Industrial applications of X-ray Diffraction", Frank H. Chungand Deane K.Smith, Marcel Dekker, Ine.
5. Scanning Elecctron Microscopy and X-ray Microanalysis Grahame Lawes,Editor Aarthur M. James published by Jhon Wiley & Sons.
6. Scanning Elecctron Microscopy of polymers and Coatings by L.H.princel John Wiley and Sons
7. Electron and Ion Microscopy and Microanalysis Principles and Applications by Lawrence E.Murr, Mareel dekker Ine.

Subject Code R101754

FIBER OPTICS

UNIT I :
Elementary Discussion of Propagation in Fiber : Introduction to Fiber propagation using a Ray Model. Material Dispersion. The combined effect of Material & Multipath Dispersion. RMS pulse widths abd frequency, Response. Attenuation on Optical Fibers : Attenuation Mechanisms. Damage by Ionizing Radiation. The Optimum Wavelength for silica Fibers. All plastic and polymer clad-silica (PCS) Fibers.

UNIT II:
The Manufactures & Assessment of Silica Fibers: Fiber production Methods. Cables. Splices & connectors. Fiber Assessment. Comparisons between Optical Fibers and conventional Electrical Transmission Lines.

UNIT III:
Electromagnetic Wave-Propagation In Graded-Index Fibers: Modes in graded-Index Fibers. The equivalence of the WKB Approximation & Ray Model. Intermode Dispersion in graded-Index Fibers. Intermode Dispersion in graded-Index Fibers. Total Dispersion in Graded Index Fibers. Intramode Dispersion in graded-Index Fibers. Total Dispersion in Graded Index Fibers. Mode coupling.

TEXT BOOKS:

- OPTICAL COMMUNICATION SYSTEM –JOHN GOWER.
- OPTICAL FIBER COMMUNICATIONS, JOHN M SENIOR

Subject Code R101755

FIBRE OPTIC SENSORS

UNIT I:

Intensity Modulated Optical Fibre sensors:

General features, intensity modulation through interruption, shutter/sehliren multimode fibre Optic sensors, Reflective fibre optic sensors, Evanescent-wave fibre sensors, microband sensors, Fibre optic refractometers, intensity modulated fibre optic thermometers, chemical analysis, Distributed sensing with fibre optics.

UNIT II:

Interferometric Optical fibre sensors:

Basic principles of interferometric optical fibre sensors, Applications of interferometric optical fibre sensors, components for interferometric sensors, future trends in interferometric sensors.

UNIT III:

Fused single mode optical fibre couplers:

Introduction, physical principles, polarization effects, Experimental properties-Wavelength dependence, dependence on external refractive index, Theoretical modeling-Qualitative behavior, first approximation, second approximation, comparison with experiment, dependence on external refractive index.

UNIT IV:

single-Mode All fibre components:

Directional; couplers, fused single mode couplers, polished single mode couplers, polarization splitters, polarization controllers, optical isolators, single mode fibre filters, switches and intensity modulators, phase modulators, frequency modulators.

BOOKS:

Fundamentals of Fibre Optics in Telecommunications and sensor systems-Edited by **B. P. Paul.**

Subject Code R101756

HIGH VOLTAGE PHYSICS

CHAPTER-1
GENERATION OF HIGH VOLTAGE

1. Alterating Of High Voltage
    a. Transformers and cascaded connections of transformers
    b. resonant circuit for generation of high voltage
2. Impulse Voltage
    a. Definition
    b. Application
    c. Single stage impulse generator
    d. Multistage impulse generator
3. Direct Oltages
    a. Voltage doubler and cascade circuit
    b. Electrosttaic machines

CHAPTER-2

1. Measurment Of Ac,Dc And Impulse Voltages
    a. Voltage dividers
    b. Voltage time curve
    c. Experimental methods and test connections
2. Test Sytandards For Ac And Impulse For Testing Of Power Transformers And Circuit Breakers

CHAPTER-3

1. Non-Destructive HV Tests
    a. partial discharge phenomena
    b. types of partial discharges
    c. Effect of partial discharges
    d. Instrument used for measurement and analysisi of partial discharges
2. Dielectric Tests
    a. loss in insulating materials
    b. Dissipation factor
    c. Capacitence
    d. resistivity

CHAPTER 4

1. Impulse Behaviour Of Ppower Transformer
    a. Equivalent electrical network of the transformer windings including series & shunt capacitances, self and mutual inductances
    b. Neutral current calculations
    c. Neutral current measurement
    d. Fault simulation in winding
2. Fft Analysis Of Neutral Current
3. Applicationof Wavelet Technique For Neutral Current Analysis

BOOKS:

HIGH VOLTAGE ENGINEERING BY E.KIFFEL AND M.ABDULLA
HIGH VOLTAGE TECHNOLOGY BY L.L ALSTON

Subject Code R101757

INTRODUCTION TO IONOSPHERIC PHYSICS

UNIT I

Ionospheric Measurements

The Neutral Atmosphere-Experimental Techniques

Ionospheric Measurements-Introduction-vertical Incidence Sounding-ground-Based Radio Investigation of the Lower Ionosphere-Propagation experiments Using Rockets and Satellites-Direct Measurements Using Rockets and Satellites-Incoherent Scatter.

Morphology of the Ionosphere

The **D** Region-The **E** and **F**1 layers – **F**-region Rates-**F**-Region Anomalies. The Topside Ionosphere.

UNIT II

Some Ionospheric Phenomena

Solar Flare Effects-Eclipse Phenomena-Sporadic **E** – Ionospheric Irregularities Electron and Ion Temperatures.

Storms and Their Ionospheric Effects:

Synopsis of Storm Effects- Storm Current System- Storm Effects in the Lower Ionosphere- Storm Effects in the **F** region

UNIT III

The Terrestrial Atmosphere & Photochemistry

The structure of the earth's atmosphere; the thermal structure – the Compositional structure – The origin and evolution of the earth's atmosphere- Solar radiations and the Upper atmosphere: The theory of Photo ionization – Photo ionization Processes: (a) The Photo ionization cross-section(b) The Photo ionization rate (e) Photoelectrons Ion-atom and ion-molecule reactions O^+ reactions(b)$N2^+$ reactions(c) O_2 reactions(d) N^+ reactions(e) He^+ reactions-Electron-molecule process (a) Dissiciative recombination Processes (b) Negative ions.

UNIIT IV

Basic Kinetic properties of the upper atmospheric gases-Collission energy transfer (a) Electron-neutral gas and ion collisions (b) Ion-neutral gas collisions (c) Ion-Ion collisions, Thermal conductivity, Electron, ion and neutral gas temperatures Diffusion(a) Molecular Diffusion(b) Eddy Diffusion, Ion Chemistry in the upper atmosphere Ozonosphere, the Ionosphere-General, The E and F Regions and the D Region, The topside of the ionosphere and exosphere-Helium, Hydtogen, positive ions(H^+ He^+,O^+)-Electrostatic Equilibrium, Chemical reaction of the diffusing gases, Diffusive equilibrium in the presence of the geo-magnetic field, Plasmasphere, Temperature in the Plasmasphere and beyond, The polar ionosphere and polar wind, Incoherent scattering technique-Airglow.

BOOKS

1. Introduction to Ionospheric Physics by Henry Rishbeth Owen K Gorriott
2. Solar terrestrial physics by Akasofu and Chapman ss

Subject Code R101758

LASER PHYSICS

UNIT I:

THE EINSTEIN COEFFECIENTS AND LIGHT AMPLIFICATION:

Introduction the Einstein Coefficients, Quantum theory for the evaluation of the Transition Rates and Einstein Coefficients. More Accurate delution for the Two-Level system, Line Broadened Mechanisms, Saturation behavior of Homogeneously and in homogeneously Broadened transitions.

UNIT II:

LASER RATE EQUATION AND SEMICLASSICAL THEORY OF THE LASER:

The Tree-level system, Four-level system, variation of Laser power around Threshold. Optimum output coupling, Laser spiking, cavity modes polarization of the cavity medium First-order Theory and Higher-order Theory.

Modes of rectangular cavity and the open planar resonator, the Quality Factor, Ultimate line width of the Laser, Transverse and Longitudinal mode selection, Q switching, mode looking in lasers, Confocal Resonator, Geometrical Optic Analysis of Optical Resonators.

UNIT III:

QUANTUM THEORY OF INTERACTION OF RADIATION FIELD WITH MATTER AND PROPERTIES AND TYPESO LASERS:

Quantization of the electromagnetic field, Eigenkets of the Hamiltonian, The coherent states, Transition Rates, the phase-Operator, Coherence properties of Laser Light, The Ruby, Helium Neon Laser, Four Level solid state, Carbon Dioxide, Dye Lasers, Semiconductor Lasers.

UNIT IV:

APPLICATION: Spatial Frequency Filtering, Holography, Fusion process, Laser Energy Requirements. Laser-Induced Fusion Reaction. Large Information-Carrying capacity of light waves, Light wave Communication System (Optical Fiber, Modulators and Detectors). Harmonic **Generation Stimulated Raman Emission, Self-Focusing.**

BOOKS:

1. Lasers by K. Thygarajan and A.K. Ghatak.
2. Optical Electronics by Thygarajan and A.K. Ghatak.
3. Optical Electronics by Yariv.
4. Opto Electronics by Milson.
5. Laser Physics by Mir Publishers.

Subject Code R101759

MATERIALS SCIENCE

Unit 1: Dielectrics and Ferroelectrics

Macroscopic description of the static dieletric constant, the electronic and ionic polorizabilities of molecules. Orientational Polarization, Measurement or dielectric constant of a solid, the internal field of Lorentz, Clausius-Mosotti relation, elementary ideas on dipole relaxation.

Classification of ferroelectric crystals- Ba TiO_3 and KDP, Dielectric theory of ferro electricity, spontaneous polarization and ferroelectric hysteresis.

Unit 2: Magnetic properties

Quantum theory of diamagnetism, origin of permanent magnetic moment, Theories of paramagnetism, paramagnetic cooling, spontaneous magnetization, Weiss theory of spontaneous magnetization, Nature and origin of the Weiss molecular field, Heisenberg exchange interaction, Hysteresis. The Block wall, Neel's theory of Antiferromagnetism. Ferromagnetism, Ferrite's and their applications (basic concepts on**ly).**

Unit 3: Superconductivity

Occurrence of Superconductivity, Experimental observations, Persistent currents, Effect of magnetic fields, Meissner effect, Type I and Type II super conductors, Intermediate states, Entropy and heat capacity, energy gap, Isotope effect, Thermal conductivity.

Theoretical explanations, London's equation, Penetration depth, Coherence length Cooper Pairs, Elements of BCS theory, Giaver tunneling Josophson effects (basic ideas)

Unit 4: Fiber optics and Lasers

Introduction , ray theory Transmission, Types of fibers, Photo conductor, fiber optic sensors.

Lasers basic concepts condition for lasing action, Ruby laser, Helium – Neon laser Semi – Conductor lasers applications.

BOOKS :

1. Applied physics by Dr.M. Chandra shekher & Dr. P. Appala Naidu
2. Materials science by M.Arumugam
3. Materials science & Engineering by W.D.Callister (Jr)

Subject Code R101760

MICROPROCESSORS

UNIT I:
Introduction to Intel family 8 & 16 bit microprocessors Features of 8085, Functional block diagram, registers, instructions and addressing modes. Simple programs using the instruction set of 8085.
Features of 16- bit microprocessors, Signal description and pin configuration of 8086 microprocessors, Internal architecture of 8086/8088, Difference between 8086 and 8088. Demultiplexed 8086.

UNIT II:
Instruction set of 8086 microprocessor, Addressing modes, Interrupt structure of 8086, stack and subroutine concepts. Timing diagrams of a few simple instructions.

UNIT III:
ASSEMBLY LANGUAGE PROGRAMMING: Simple programs, programs using MASM611- assembler, implementation of features like IF-THEN-ELSE, WHILE-DO LOOP, REPEAT-UNTIL LOOP & FOR LOOP.

UNIT IV:
INTERFACING-1 : 8086 system bus structure: memory and I/O interfacing with 8086, Interfacing 8086 with 8255, 8254, interfacing stepper motor.

REFERENCE:

1. D.V. Hall: Microprocessing & Interfacing Programming And Hardware-Tmh-Ii Edition.
2. Barry. B. Brey: The Intel Microprocessors; (4TH EDITION), Prentice Hall Of India.
3. D.V.Hall: Microprocesors And Digital Systems; 2ND Edition (for 8085)

Subject Code R101761

NMR SPECTROSCOPY & MOLECULAR STRUCTURE

UNIT-I

Principle of Nuclear Magnetic resonance, classical treatment, block equations, susceptibilities, relaxation mechanism. NMR chemical shifts, Factors influencing chemical shift, spin-spin coupling, Pulse techniques and measurements of T1 and T2. Nuclear quadrapole resonance and EPR spectroscopy**.**

UNIT-II

Basic theory of two dimensional NMR spectroscopy, nuclear overhauser effect (nOe) polarization transfer, insentive nuclei enhanced by polarization transfer (INEPT) Distortionless Enhancement polarization transfer (DEPT) 2-D NMR correlation spectroscopy (COSY) , Nuclear Overhauser Effect Spectroscopy (NOESY), Heteronuclear correlation soectroscopy (HETCOR**)**

UNIT-III

Molecular structure applications of PMR spectroscopy in structure determination Electronegativity, keto-enol tautomerism ,hydrogen bonding C-N rotation, cis-trans isomerism, proton exchange.

The source of broad lines in solids samples magic angle spinning cross polarization shielding anisotropy quadrupolar effects.

UNIT-IV

Amino acids structures, nomenclature, primary structure the peptide bond, secondary structure alpha helices, beta sheets, turns Ramachandran plot, three dimensional structure of proteins Methods for protein structure determination by NMR tertiary structure protein motifs & structure classification quartenary structure.

RECOMMENDED BOOKS:

1. Nuclear Magnetic Resonance By E D Andrew
2. Organic Soectroscopy By Willam Kemp
3. Biomoleculr Spectroscopy By Jeeremy N S Evans
4. Bio Chemistry By Lehninger

Subject Code R101762

NUCLEAR AND PARTICLE PHYSICS

UNIT I:

Nuclear Interactions and Nuclear Reactions

Nucleon- nucleon interaction- Exchange forces and tensor forces- Meson theory of nuclear forces- Nucleon – nucleon scattering – Effective range theory – Spin dependence of nuclear forces – Charge independence and charge symmetry of nuclear forces –Isospin formalism – Yukawa interaction.

Direct and compound nuclear reaction mechanisms- cross sections in terms of partial wave amplitudes–compound nucleus–Scattering Matrix–Reciprocity theorem–Breit-Wigner one – level formula- Resonance scattering.

UNIT II:

Nuclear Models

Liquid drop model–Bohr-Wheeler theory of fission–Experimental evidence for shell effects-Shell model-Spin-Orbit coupling-Magic number-Angular momenta and parties of nuclear ground states-Qualitative discussion and estimates of transition rates-magnetic moments and Schmidt lines-Collective model of Bohr and Mottelson.

UNIT III:

Nuclear Decay

Beta decay-Fermi theory of beta decay- Shape of the beta spectrum-Total decay rate-Angular momentum and parity selection rules- Comparative half-lives-Allowed and forbidden transitions- Selection rules- parity violation-Two component theory of neutrino decay-Detection and properties of neutrino –Gamma decay-Multiple transitions in nuclei-Angular momentum and parity selection rules-internal conversion-Nuclear isomerism.

UNIT IV:

Elementary Particle Physics

Types of interaction between elementary particles-Hadrons and leptons-Symmetry and conservation laws-Elementary ideas of CP and CPT invariance-Classification of hadrons-Lie algebra, SU(2)-SU(3) multiplets-Quark model-Gell-Mann-Okubo mass formula for octet and decuplet hadrons-Charm, bottom and top quarks.

TEXT AND REFERANCE BOOKS

- Nuclear physics, Tayal
- I.Kaplan, Nuclear physics, 2nd Ed., Narosa, Madras, 1989.

Subject Code R101763

NUMERICAL METHODS

Unit-I

Numerical Methods for Determining Roots of Equations: Open Methods-Simple fixed point iteration-convergence-algorithm for fixed point iteration. Newton-Raphson method-Algorithm for Newton Raphson-The Secant Method-Algorithm for the Secant Method.

Unit-II

Linear Algebraic Equations: Iterative Methods: Gauss Seidel Method- Convergence Criterion for the Gauss-Seidel Method-Improvement of Convergence using Relaxation method-Successive Overrelaxation Method-Algorithm for Gauss-Seidel Method.

Unit-III

Numerical Integration: Newton- Cotes Integration Formulas- The Trapezoidal Rule-Algorithm for Trapezoidal rule-Simpson's rules-Simpson's 1/3 rule-Simpson's 38/ rule-algorithms for Simpson's 1/3 rule-and /8 rule.

Unit-IV

Ordinary differential equations: Runge Kutta Methods-Euler Method-Algorithm for Euler's Method-Second order Runge Kutta Method-Algorithms for Runge-Kutta methods.

Partial Differential Equations: Classification of Partial differential equations-Finite Difference-Elliptic Partial Differential Equations- Laplace Equation-Poisson Equation-Laplacian Difference Equation.

Books Recommended:

1. Numerical Methods for Engineers-Fourth Edition-Steven C Chapra-Raymond P Canale-Tata McGraw-Hill Publishing Company Limited.
2. Computer Oriented Numerical Methods, Third Edition- Rajaraman-Prentice Hall of India pvt. Limited.

Subject Code R101764

OPTICAL COMMUNICATION

UNIT I: A general Introductory Discussions:-
Historical perspective-The Measurement of Information and the capacity of a Tele-communication Channel-Communication system Architecture.-The Basic Optical communication system.

UNIT II: Semiconductor Lasers for optical communication:
The Development of Stripe –geometry Lasers.-Optical & electrical characteristic of Stripe geometry and Buried -Hetero structure Lasers.-Sources for longer wavelengths.
The reliability of DH Semiconductor LED's and LASERS.

UNIT III: Semiconductor p-i-n Photodiode Detectors:
General principles.-Intrinsic Absorption.-Quantum efficiency.-Materials and Designs for p-i-n photodiodes.-Impulse and frequency response of a p-i-n photodiodes.-Noise in p-I-n photodiodes.

UNIT IV: Avalanche Photo Diode Detectors:
The Multiplication process.-APD Designs.-APD Band widths.-APD Noise.-

UNIT V: The Receiver Amplifier:
Introduction.-Sources of Receiver Noise.-Circuits, Devices & Definitions.-The voltage Amplifier circuits.-The trans Impedance Feedback Amplifier.

UNIT VI: The Regeneration of Digital signals:
Causes of Regeneration error:- The Quantum Limit to Detection.-The effect of Amplifier & Thermal Noise on the Error probability.-Noise penalties in Practical systems.

UNIT VII: Unguided optical communication systems:
Introduction.- Transmission parameters.-Sources.-Detectors.-Examples of unguided optical communication systems.

UNIT VIII: Optical Fibre Communication system:
Introduction.-The Economic Merits of optical fibre system.-Optical Fibre Digital ecommunication systems.- Analogue systems.-Applications in Local Data Communication Systems.-The wired city.

TEXT BOOKS:
Optical Communicaation System, **John. Gower.**
Optical Fiber communication, **John M Senior.**

Subject Code R101765

PHYSICS OF POLYMERS

UNIT I:
Introduction to polymers, classification of polymers thermoplastics and Thermosets, glass transition temperature (Tg) melting temperature (Tm), control of Tm and Tg and relation between them, Dependence of Tm and Tg on copolymer composition.

UNIT II:
Polymer additices: Plastioizers, and reinforce other important additives: Stabilizers, flame retardants, Biocious colorants, Polymer blends, polymer composites, properties, toughened plastics and phase separated blends.

UNIT III:
Analysis and testing of polymer by spectroscopic memory Infrared spectroscopy, nuclear magnetic resonance, X-ray diffrention Thermal analysis of polymer: Differential scanning calorimetry, Differential Thermal Analysis and Thermo gravimetric method.

UNIT IV:
Super Ionic solids, classification, Ionic Transport, Ion Dynamics, Polymer electrolytes and their advantages, Applications with special reference to batteries.

REFERENCE BOOKS:

1 An Introduction to polymer physics-I by Perepechko
2 Polymer science and technology-by Joel.R.Fried
3 Text Book of polymer Science by Fred W Billmeyer,
4 Super ionic solids by S. Chandra

Subject Code R101766

RADIATION PHYSICS

UNIT I

Physics of Diagnostic X-rays

Production of X-ray beams, how X-rays are absorbed/, Making an X-ray image, radiation to patients fram X-rays, producing live X-ray images-fluoroscopy, X-ray slices of the body, radiographs taken without film.

Physics of Nuclear Medicine (Radioisotopes in Medicine)

Review of basic characteristics and units of radioactivity, sources of radioactivity for nuclear medicine, statistical aspects of nuclear medicine, basic instrumentation and its clinical applications, nuclear medicine imaging devices, physical principles of nuclear medicine imaging procedures, therapy with radioactivity. Radiation doses in nuclear medicine.

UNIT II

Physics of Radiation Therapy

The doe units used in Radiotherapy the rad and the gray, principles of radiation therapy, a short course in radiotherapy treatment pleanning, mega voltage therapy, short distance radiotherapy or brachytherapy, other radiation sources, closing thought on radiotherapy.

UNIT III

Radiation Protection in Medicine

Biological effects of ionizing radiation, radiation protection units and limits, radiation protection instrumentation, radiation protection in diagnostic radiology, radiation protection in radiation therapy, radiation protection in nuclear medicine, radiation accidents, electrocardiogram interpretation, prescribing drug dosage, pulmonary function testing.

UNIT IV

Advances in radiation therapy

Conformal therapy, proton therapy, neutron brachytherapy, neutroncapture therapy, Monte Carlo techniques in radiotherapy.

RECOMNENDED TEXT BOOKS:

1. Medical Physics by John R. Cameron and James G. Skofionnk
2. Radiation Therapy Physics by W.R.Hendee and Geoffrey S. Ibbott
3. Monte Carlo Techniques in radiotherapy by D.W.O. Rogers, Ionizing

radiation standards. NRC, Ottawa, KIA 0R6.

Subject Code R101767

SPACE SCIENCE

UNIT I

The Earth's Atmosphere

Evolution of the planetary atmosphere variations of atmospheric densities and temperature. Formation and structure of Ionosphere. The radiation belts. Auroras. Lyman glow of the night sky. The geo-corona and airglow studies.

UNIT II

Sun and Interplanetary Medium

Structure of solar atmosphere. Solar granulation and super granulation. Sunspots. Solar flares. Solar radiation. Scattering, reflection and Absorption within the Atmosphere of the Earth. Heat budget.

Solar wind. Interaction with planetary atmosphere. Radiation belts and interplanetary magnetic field. Interplanetary dust.

UNIT III

Theory of Radiation

Review of electromagnetic theory. Maxwell's equations and electromagnetic waves. Polarization. Elementary theory of radiation. Bremstrahlung, Gyromagnetic, Synchrotron and Cerenkow radiations. Propagation of radio waves in ionized medium.

UNIT IV

Radio Techniques for Ionosphere studies

Basic parameters of an antenna. Various types of antennas. Non-stearable, partially streable and fully stearable radio telescopes. Receiver systems and their calibration. Studies of ionosphere by ground based and space techniques. MST Radar. MST Radar for Ionospheric studies. Two-element and multi-element Interferometers.

Books Recommended:

1. J.A. Ratcliffe: An Introduction to the Ionosphere and Magnetosphere.
2. Harold Zirin: Astrophysics of the Sun.
3. W.N.Hess and G.Mead(Ed): Introduction to Space Science.
4. Sagan C. Owen T.C. and Smith. H.J.: Planetary Atmospheres.
5. K.D. Abhayankar: Astrophysics of the solar system.
6. Jackson: Classical Theory of Radiation
7. Radio Astronomy: J.D.Kraus
8. Solar Radio Astronomy: M.R.K. Kundu
9. C.R.Kitchin: Astrophysical Techniques. University press).
10. Astrophysics-Stars and galaxies by K.D. Abhyankar.
11. C.R. Miczaika and W.M. Sinton: Tools of the Astronomers
12. W.A. Hiltner (Ed): Astronomical Techniques.

Subject Code R101768

STUDIES IN MAGNETO FERRO ELECTRIC MATERIALS

1. STRUCTURE DETERMINATION OF MATERIALS

X-ray Diffraction, Laue Diffraction, Indexing Laue spots for cubic crystals using Gnemonie projection, Bragg's Law, Reciprocal lattice, Structure factor, Intensity of diffraction lines. Laws of extinction, Power diffraction – Determination of unit cell of cubic crystals

2. MAGNETIC PROPERTIES OF MATERIALS

Heisenberg model, Super exchange interaction, Antiferromagnetism – Two-sublattice model, Ferrimagnetic order-Ferrites-Structure and properties of ferites, Quantization of spin waves-Magnons-Dispersion relations.

3. FERROELECTRICS

Ferroelectricity, Classification of ferroelectric material-Dipole theory of ferroelectricity Theory of spontaneous polarization of $BaTio_3$ – Polarization catastrophe Nature of phase transitions-second order transitions, first order transition-Ferroelectric domains Anti ferroelectrictity.

4. ELASTIC PROPERTY OF MATERIALS

Stress and strain tensors, Analysis of elastic strains, Elastic compliance and stiffness constants-Elastic energy density, Stiffness constants of cubic crystala. Propagation of elastic waves in cubic crystals-Experimental determination of elastic constants using composite oscillator technique.

5. THERMAL PROPERTIES OF MATERIALS

Vibrations of monoatomic and diatomic linear lattices, Dispersion behaviors. Quantization of lattice Vibrations, Anharmonicity of crystalline lattice, thermal expansion and Gruneisen relation-thermal conductivity-Normal and Umklapp processes.

Books for Study

1. Solid state physics, A.J. Dekkar Macmillan, London
2. Solid state and Semiconductor Physics, J.P.Mc Kelvey, Harper and Row, New york.
3. Introduction to Solid state Physics, C. Kittel, VII, John Willey & Sons, New York.
4. Solid state Physics, R.L.Singhal, Kedarnath and Ramnath Co.,Meerut.