COURSE DETAILS

M. Sc. PHYSICS First SEMESTER (July - December 2017)

Note: Each course shall be of 100 Marks out of which 15 marks are allotted to internal assessment and 85 marks for University examination. Minimum pass marks are 05 for the internal assessment and 29 for the University examination.

THEORY COURSES

PT – 101 METHODS IN MATHEMATICAL PHYSICS

Unit – I	Tensor Analysis
Unit – II	Elements of Complex Variable
Unit – III	Theory of Fourier and Laplace Transforms
Unit – IV	Special Functions
Unit – V	Partial Differential Equations

PT – 102 CLASSICAL MECHANICS

Unit – I	Lagrangian Mechanics
Unit – II	Variational Principle
Unit – III	Two body central force problem and scattering
Unit – IV	ll oscillations
Unit – V	Transformation and equation of motion

PT – 103 ELECTROMAGNETISM AND LASER OPTICS

Unit – I	Application of Maxwell Equations
Unit – II	Electromagnetic Wave an Isotropic Medium
Unit - III	Electromagnetic Wave Interactions
Unit - IV	Elements of Laser Physics
Unit -V	Nonlinear Optics

PT – 104 SEMICONDUCTOR ELECTRONICS

Unit - I	Biasing Techniques And Linear Amplifier
Unit - II	Power Amplifier And Oscillators
Unit - III	Wave Shaping Circuits
Unit - IV	Basics of Differential and Operational Amplifiers
Unit - V	Application of Operational Amplifier

LABORATORY COURSES

PL – 105	General Laboratory
PL – 106	Electronics Laboratory

PT – 101 METHODS IN MATHEMATICAL PHYSICS

Max. Marks: 85 Pass Marks: 29

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Tensor Analysis

Definition of Tensor and its rank, Transformation laws of covariant, contravariant and mixed tensors, Fundamental Operations with tensors (addition, subtraction and multiplication), Inner and outer product, Contraction of tensors, Associated tensors, Christoffel symbols, covariant differentiation of tensor

Unit – II Elements of Complex Variable

Functions of a complex variable, the derivative and the Cauchy-Riemann differential equations, line integrals of complex functions, Cauchy's integral theorem, Cauchy's integral formula, Taylor's series, Laurent's series, residues; Cauchy's residue theorem, singular points of an analytic function, evaluation of residues, Jordon-Lemma, evaluation of definite integrals,.

Unit – III Theory of Fourier and Laplace Transforms

Fourier series analysis, evaluation of constants, Fourier sine, cosine and complex transforms, transforms of derivatives, Convolution theorem, Parseval's relation, Momentum representation: Examples from optics, Electromagnetism and quantum mechanics, Laplace transforms(LT) of simple function and derivatives, LT and solution of simple differential equations, convolution theorem.

Unit – IV Special Functions

Singularity structure of a general second order homogeneous differential equation : ordinary points, regular and irregular points, indicial equation, The point at infinity, Series expansion method for solving differential equations, series solutions, Generating functions and recurrence relations and orthogonality of Legendre and Hermite polynomials

Unit – V Partial Differential Equations

Laplace equation, 2-D study flow of heat, circular harmonics, conducting cylinder in a uniform field, The potential of a ring, The potential about a spherical surface, the equation of heat, conduction or diffusion, variable linear flow, two-dimensional heat conduction, temperature inside a circular plate.

BOOKS RECOMMENDED

1) Applied Mathematics for Engineers and Physicist: Pipes
2) Mathematical Physics: Harper
3) Advanced Engineering Mathematics: Kreyszig
4) Schaum Series for Transforms, Complex Variables and Tensors
5) Mathematical Methods: Arfken
6) Elements of Complex variables: Churchill

PT – 102 CLASSICAL MECHANICS

Max. Marks: 85 Pass Marks: 29

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Lagrangian Mechanics

Mechanics of a particle, Mechanics of a system of particles, Constraints, Generalised coordinates, De Alembert's principle and Lagrangian equations, Lagrangian for a charged partcle in an electromagnetic field, application of Lagrangian formulation to (a) single particle in space, (b) Atwood's machine.

Unit – II Variational Principle

Hamilton's principle, some techniques of the calculus of variation, application to (a) geodesics in a plane (b) minimum surface of revolution, Derivation of Lagrange's equation from Hamilton's principle, Conservation laws and corresponding symmetry principles

Unit – III Two body central force problem and scattering

Reduction of two body central force problem to the equivalent one body problem, The equation of motion and the first integrals, Classification of orbits, the virial theorem, the Kepler problem, scattering in a central force field, Rutherford scattering, transformation of the scattering problem to laboratory coordinates.

Unit – IV Small oscillations

Formulation of the problem, the eigen value equation, frequencies of free vibration, free vibration of a linear tri atomic molecule, transition from a discrete to a continuous system, the Lagrangian formulation for continuous system.

Unit – V Transformation and equation of motion

Lagendre transformations and the Hamilton equations of motion, cyclic coordinates and conservation theorem, Hamilton's equation from variational principle, equation of canonical transformation, Poisson brackets: Definition and identity relation, equation of motion and conservation theorem in the Poisson bracket formulation, the Hamilton-Jacobi equation for Hamilton's principal function, the Harmonic oscillator problem as an example of Hamilton-Jacobi method.

BOOKS RECOMMENDED

1. Classical Mechanics: Goldstein.
2. Classical Mechanics: Takwale

PT – 103 ELECTROMAGNETISM AND LASER OPTICS

Max. Marks: 85 Pass Marks: 29

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Application of Maxwell Equations

Maxwell's equation, Field energy, Poynting theorem, plane wave solution of Maxwell's equations, Reflection and Refraction at a plane boundary of dielectrics, Polarization by reflection and total internal reflection, Waves in a conducting medium, Reflection and refraction by the ionosphere.

Unit – II Electromagnetic Waves in Anisotropic Medium

The dielectric tensor of an anisotropic medium, structure of a monochromatic plane wave in an anisotropic medium: The phase velocity and the ray velocity, Fresnel's formulae for the propagation of E.M. wave in crystals, Geometrical constructions for determining the velocities of propagation and directions of vibrations, optical properties of uniaxial and biaxial crystals: The optical classification of crystals, E.M. wave propagation in uniaxial crystals.

Unit - III Electromagnetic Wave Interactions

E.M. wave propagation in biaxial crystals Refraction in crystals: double refraction, internal and external conical refraction, experimental demonstration of double refraction and conical refraction, Acoustic-optic interaction: Raman-Nath theory of ultrasonic diffraction of E.M. waves, magneto-optic interaction: Faraday effect, Electro-optic interaction: Kerr effect, interaction with matter: (a) normal and anomalous dispersion (b) Rayleigh scattering.

Unit - IV Elements of Laser Physics

The Laser amplifier: Amplifier gain, amplifier phase shift, Amplifier power source: Rate equation, four and three level pumping schemes, Examples of laser amplifiers, Characteristics of the laser output: Power, spectral distribution, Spatial distribution and polarization, Mode selection, Characteristics of common lasers.

Unit -V Nonlinear Optics

Nonlinear optical media, Second order nonlinear optics Second harmonic and rectification, The electro-optics effect, Three-wave mixing, Third order nonlinear optics, Third harmonic generation and self pulse modulation, four wave mixing, optical pulse conjugation.

Books Recommended

1. Introduction of electrodynamics: Griftith
2. Foundation of electromagnetic Theory: Reitz, Millford and Christy.
3. Plasma physics by F.F. Chen
4. Electromagnetic waves and radiation systems: Jordan and ball man
5. Classical electrodynamics: Jackson

PT – 104 SEMICONDUCTOR ELECTRONICS

Max. Marks: 85 Pass Marks: 29

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit-I Biasing Techniques and Linear Amplifier

Continuity equation and its application to p-n junction under forward and reverse bias, Solution of Continuity equation for reversed and forward biased abrupt p-n junctions, Derivation of Einstein's equation, Load line for a transistor, Location of Q-point for the bipolar transistor, variation of bias current, Fixed and emitter feedback bias, Design idea of emitter feed back bias, Stability index, Stabilization against variation in I_{CO}, V_{BE} and b, The band pass amplifier, High frequency equivalent circuit, RC coupled CE amplifier, its frequency response and gain frequency plot, Gain band product, cascading of amplifiers, common source FET amplifier.

Unit – II Power Amplifier and Oscillators

Operating conditions for power amplifier, power relations, The ideal transformer, voltage limitations of the transformer, non-linear distortion, Idea of intermodulation distortion, The class A power amplifier, The push-pull amplifier, Feedback requirements of oscillations, Basic oscillator analysis, Hartley and Colpitt oscillators, Piezo-electric, frequency control , RC oscillators.

Unit – III Wave Shaping Circuits

Linear wave shaping, High pass RC circuit, High pass RC circuit as a differentiator, Low pass RC circuit, Low pass RC circuit as a integrator, Non-linear wave shaping, Shunt diode clipper and series diode clippers, Double ended p-n junction and Zener diode clipper circuits, Clamping circuits, Zero level and given level clamping, Fundamentals of voltage and current sweep generators, sweep wave forms, Miller integrating sweep circuits, Blocking and Triggered transistor blocking oscillator

Unit – IV Basics of Differential and Operational Amplifiers

Differential amplifier, Differential amplifier circuit configuration, Dual input balanced output differential amplifier, Voltage gain, differential input resistance, inverting and non-inverting inputs, common mode rejection ratio, Operational amplifier, input offset voltage, input offset currents, input bias currents, differential input resistance, input capacitance, offset voltage supply, rejection ratio, Ideal OP Amp, equivalent circuit of an OP Amp, ideal voltage transfer curve, inverting, dual and non-inverting amplifier, measurement of OP Amp parameters, frequency response

Unit – V Application of Operational Amplifier

Use of OP Amp as sign changer, scale changer, phase shifter, voltage to current converter differential dc amplifier, bridge amplifier, ac voltage follower, analog integration and differentiation, electronic analog computation, Non-linear function generator, series and shunt regulator

BOOKS RECOMMENDED

1. Electronics Fundamentals and Application: J.D. Ryder
2. Solid State Electronic Devices: B.G.Streetman
3. Electronic Principals: Malvino
4. Principals of Microwave: Atwarter
5. Electromagnetic Wave and Radiating System: Jorden and Ballmon
6. Electronic Devices and Circuits: Millman and Halkius

COURSE DETAILS *II SEMESTER (January - June 2018)*

PHYSICS

Note : Each course shall be of 100 Marks out of which 15 marks are allotted to internal assessment and 85 marks for University examination. Minimum pass marks are 05 for the internal assessment and 29 for the University examination.

THEORY COURSES

PT – 201 CLASSICAL ELECTRODYNAMICS, PLASMA AND ANTENNAE PHYSICS
UNIT - I Dipole Radiation
UNIT - II Radiation From A Point Charge
UNIT - III Plasma Physics
UNIT - IV Single Particle Theory and Wave Propagation
UNIT - V Antenna Arrays

PT – 202 NONRELATIVISTIC QUANTUM MECHANICS – I
Unit – I Fundamentals
Unit - II Three-dimensional Systems
Unit - III Matrix Theory
Unit - IV Approximation Methods
Unit - V Approximation Methods for Bound States - I

PT – 203 BASIC ELEMENTS OF SOLID STATE PHYSICS

Unit – I Crystal Structure
Unit – II Lattice Dynamics and Thermal Properties
Unit – III Electronic Energy Bands
Unit – IV Elements of Semiconductor Physics
Unit – V Optical Properties of Solids

PT – 204 DIGITAL ELECTRONICS, NUMERICAL ANALYSIS AND COMPUTER PROGRAMMING
Unit – I Binary Logic, Digital Switching Circuits, Counters
Unit – II Numerical Solutions, Least Square Fits and Error Analysis
Unit – III Interpolation, Numerical Integration and Solution of Differential Equations
Unit – IV Computer Programming
Unit–V Programming in 'C'

LABORATORY COURSES
PL – 205 General Laboratories
PL – 206 Electronics Laboratory

PT–201 CLASSICAL ELECTRODYNAMICS, PLASMA ANDANTENNAE PHYSICS

Max. Marks: 85 Pass Marks: 29

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

UNIT - I Dipole Radiation

Maxwell's equations in terms of scalar and vector potential, Gauge transformations: Lorentz gauge and Coulomb gauge, Retarded potentials, Radiation from oscillating electric and magnetic dipoles with simple applications.

UNIT - II Radiation from a Point Charge

Lienard - Wiechart potentials, Fields due to point charge in uniform and accelerated motions, Power radiated by a point charge (in non relativistic limit), Radiation reaction: Abraham Lorentz formula, Physical origin of the radiation reaction.

UNIT - III Plasma Physics

Occurrence of Plasma in nature, Definition of plasma, Concept of temperature, Debye shielding, The Plasma Parameter, Criteria for plasma, plasma diagnostics by Langmuir probe and by microwave techniques, Plasma oscillations, adiabatic invariants, Plasma confinement by magnetic mirrors and by pinch effect condition for reflection by mirrors.

UNIT - IV Single Particle Theory & Wave Propagation

Hydro magnetic description of plasma, Hydro magnetic waves, Magneto sonic and Alfven waves, Motion of charged particle in Electric Magnetic E and B fields, Gravitational field, time varying fields, Phase velocity, Group velocity, Cutoff and resonance for electromagnetic wave propagating parallel and perpendicular to the magnetic field.

UNIT - V Antenna Arrays

Two element array, Horizontal pattern in broadcast array, Linear array, Multiplication of patterns, Binomial arrays, Antenna gain, Effective area, Antenna terminal Impedance, Idea of super directive arrays, Radiation from current sheet.

Books Recommended:

1. Classical Electrodynamics by J.D. Jakson
2. Introduction to plasma physics by F.F. Chen
3. E.M. Waves and Radiating systems by Jorden and Ballman
4. Introduction to Classical Electrodynamics by Griffth

PT – 202 NONRELATIVISTIC QUANTUM MECHANICS – I
Max. Marks: 85 Pass Marks : 29

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Fundamentals

Correspondence principle, Complementarity, Uncertainty, Schrödinger wave equation, Separation of the time dependent wave equation, Eigenfunctions and eigenvalues, Stationary states, Probability density, Normalisation, Expectation value, Ehrenfest's theorem, Free particle solution, Boundary and Continuity conditions, One-dimensional step potential (finite and infinite), Particle in a one-dimensional square potential well (finite and infinite), The rectangular potential barrier, parity of wave function, Orthonormality, Schmidt orthogonalization, Schwarz inequality, Linear harmonic oscillator. Dynamical variables as operators, Hermitian operators and their properties,

Unit - II Three-dimensional Systems

Particle in a three-dimensional box, The Dirac delta-function, , Central force problem in three dimensions, Separation of the wave equation, Bound states in a three-dimensional square potential well, Solution for *1=0*, Interior and exterior solutions for arbitrary *'l'*, The hydrogen atom wave functions, Energy levels, Degeneracy Energy eigenvalues of a three-dimensional harmonic oscillator, Energy eigenvalues of (a) plane rigid rotator (b) 3-D rigid rotator, Partial wave expansion of a free particle wave function. angular momentum operators, orbital angular momentum, Commutation relations, Eigenfunctions and Eigenvalues of L^2 and L_z

Unit - III Matrix Theory

Hilber Space, Linear Vector Space, dimensions and basis, operators, commutator algebra, derivation of uncertainty relation through operators, postulates of quantum mechanics.

Matrix formulation of quantum theory (representation in discrete basis) – matrix representation of vector and operators, Bra and Ket notations, projection operators, matrix theory of Linear harmonic oscillator, matrices for *a, x, p* and H

Angular momentum: Matrix formulation of angular momentum, matrices for $\mathbf{J^2}$ and $\mathbf{j_z}$, addition of two angular momentum.

Spin-Pauli spin matrices and their algebra.

Unit - IV Approximation Methods

Formulation of variational approximation method, application of variational method: (1) ground state of helium atom, (2) Zero point energy of Simple Harmonic Oscillator. The WKB approximation, Application of WKB approximation: (1) Connection formulas for penetration though a barrier, (2) bound energy levels in a potential well.

Unit - V Approximation Methods for Bound States - I

Stationay perturbation theory, Nondegenerate case, Formulation upto second order, Penurbation of a linear harmonic oscillator (i) estimation of correction to second order for perturbation terms depending on x and x^2 (ii) first order correction to energy by x^3 and x^4 type terms, Ground state of Helium atom, Stark effect of a plane rigid rotator.

Books Recommended:

1. Intro. to quantum mechanics David j Griffith
2. Quantum Mechanics: L.I. Schiff.
3. Quantum Mechanics: J.T. Powell and Crasemann
4. Quantum Mech. & Field Theory By " Agrawal.
5. Quantum Mechanics A. K. Ghatak & S.Loknathan
6. Intro. to quantum mechanics by *Pauling & Wilson*

PT – 203 CONDENSED MATTER PHYSICS - I

Max. Marks: 85 Pass Marks : 29

Note: This paper has been divided into FIVE units, The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit,

Unit – I Crystal Structure

A review of concepts of space and crystal lattice, Primitive vectors and cells; Symmetry elements, Miller indices for planes and axes, Space groups and point groups, Bragg's law, Construction of reciprocal lattice, reciprocal lattice vectors, Brillion zones, Reciprocal lattice of SC, BCC and FCC, Structure and atomic factors

Unit – II Lattice Dynamics and Thermal Properties

Vibrations of one dimensional monoatomic and diatomic lattices, Quantization of lattice vibrations, Phonon momentum, Qualitative description of phonons in three dimensional lattice, phonon density of states, Einstein and Debye models of lattice specific heat, Anharmonic effects in crystals: thermal expansion of solids, Equation of states of solids, Phonon-phonon interaction and thermal conductivity

Unit – III Electronic Energy Bands

A brief review of properties of free electron gas, Hall effect and quantised Hall effect, The periodic potentials, Bloch theorem and Born-von Kramer boundary conditions, General remarks about Bloch theorem, Fermi surface, Electron density of states, Kroning-Penny model, Equation for electron wave in a periodic potential: solution of central equation, approximate solution near zone boundary, Construction of Fermi surfaces, The tight binding approximation for bond structure, Effective mass in solids

Unit – IV Elements of Semiconductor Physics

Examples of semiconductors, Typical band structure of a semiconductor, Number of carriers in thermal equilibrium, Intrinsic (non-degenerate) semiconductors, Extrinsic semiconductors, Effect of doping, Impurity levels, Population of impurity levels, Fields and carrier densities in equilibrium, p-n junctions, Elementary picture of rectification by p-n junction.

Unit – V Optical Properties of Solids

Optical reflectance, Kramers-Kroning relations, Electronic intra and inter band transitions, Direct and indirect transitions, Absorption of light in metals and semiconductors, Idea of excitons, Elements of Raman effects in solids, Energy loss by fast moving particle in solids

BOOKS RECOMMENDED

1. Introduction to solid state physics: Kittel
2. Solid State Physics: Ashcroft and Mermin
3. An introduction to x-ray crystallography: woolfson
4. Solid state Physics: Azaroff
5. Intermediate quantum theory of crystalline solids: Aniamalu
6. Solid state Physics: Epifanov

PT – 204 DIGITAL ELECTRONICS, NUMERICAL ANALYSIS AND COMPUTER PROGRAMMING

Max. Marks: 85 Pass Marks : 29

Note: This paper has been divided into FIVE units, The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit,

Unit – I Binary Logic, Digital Switching Circuits, Counters

Binary number systems and other codes, Binary arithmetic, Boolean theorem, synthesis of Boolean functions, Karnaugh diagram, Logic Gates, combinational logic: half and full adders, demultiplexers, Multiplexers, D/A and A/D converters.

Clock generator, sequential logic: RS flip flop, D flip flop, T flip flop, JK flip flop, Master-Slave flip flop, Shift register, Ripple counter, Decade counter, up-down counter, divide by n counters, Synchronous counters, Applications of counters, Dynamic MOS circuit, two phases of MOS, Idea of MOS shift register and MOSROM

Unit – II Numerical Solutions, Least Square Fits and Error Analysis

Numerical solutions of Transcedental equations: Iterative method, Bisection method, False Position and Newton Raphson method, Numerical solutions of simultaneous linear equations: Gauss Elimination and Gauss Seidel method, Least Square fits: Linear and polynomial regression, Error analysis: Basic concepts of errors and their types with special reference to numerical methods

Unit – III Interpolation, Numerical Integration and Solution of Differential Equations

Forward, Backward and Central differences and their symbolic relation with shift operator, Newton 's forward and backward interpolation, Gauss central difference interpolation formula, Trapezoidal formula and Simpson 1/3 rule, Solution of Differential equation: Picard's method, Eulers method, and Runga-Kutta methods (second and Fourth order)

Unit – IV Computer Programming

Introduction to modern digital computers, Organization to a digital computer, Computer instruction and programs, Motivation of high level languages, Basic elements of any programming language, Arithmetic expressions, operators, Standard arithmetic functions, Input and output statements, various types of control statements, loops, nesting of loops, concept of main program, subprograms, declarations statements

Unit – V Programming in 'C'

Introduction to programming in C; constants, variables, operators, header files; Statements: Input/output, control, looping, general examples based on units II and III.

BOOKS RECOMMENDED

1. Digital principals and applications: Malvino & Leach
2. Electronic Devices and Circuits: Millman and Halkius
3. Numerical Analysis: Rajaram
4. Computer programming by S.S. Sastri
5. Programming in C: Balaguruswami
6. Numerical Computational methods by Patil and Verma

COURSE DETAILS PHYSICS III SEMESTER (July - December 2018)

Note: Each course shall be of 100 Marks out of which 15 marks are allotted to internal assessment and 85 marks for University examination. Minimum pass marks are 05 for the internal assessment and 29 for the University examination.

THEORY COURSES.

PT – 301 QUANTUM MECHANICS - II
Unit - I Approximation methods for bound states - II
Unit- II Approximation methods for time dependent problems
Unit - III Identical Particles
Unit - IV scattering theory
Unit - V Elements of relativistic quantum mechanics

PT – 302 ATOMIC PHYSICS, MOLECULAR SPECTROSCOPY & NUCLEAR INSTRUMENTATION
Unit – I Atomic Physics
Unit – II Rotational Spectra
Unit – III Vibrational and Vibronic Spectra
Unit – IV Fluorescence Spectroscopy
Unit – V Nuclear Instrumentation

PT – 303 CONDENSED MATTER PHYSICS – II
UNIT – I Point Defects and Alloys
UNIT – II Dielectric and Ferroelectrics
UNIT – III Magnetic Properties of Solids
UNIT – IV Superconductivity – I
Unit – V Superconductivity – II

PT – 304A MICROWAVE AND OPTICAL COMMUNICATION
Unit – I Microwave Generators and Solid State Devices
Unit – II Microwave Propagation and Components
Unit – III Microwave Integrated Circuits
Unit – IV Optical Fibers
Unit – V Integrated Optics

PT – 304B MATERIALS SCIENCE – I
Unit - I Classification of Materials
Unit - II Phase Transitions
Unit - III Diffusion in Materials and Microscopy
Unit - IV Elastic and Anelastic Behavior
Unit - V Exotic Materials

PT – 304C COMPUTER APPLICATIONS IN PHYSICS – I
Unit – I Computer Peripherals
Unit – II Assembly Language Programming
Unit – III Operating System and Software
Unit – IV MS Office
Unit – V DBMS

LABORATORY COURSES
PL – 305 General Laboratory
PL – 306A Electronics Laboratory
PL – 306B Material Science Laboratory
PL – 306C Computer Science Laboratory

PT – 301 QUANTUM MECHANICS - II

Max. Marks: 85 Pass Marks : 29

Unit - I Approximation methods for bound states - II

Formulation of first order time independent perturbation theory for degenerate levels, Application to first order Stark effect of a hydrogen like atom, Fine structure splitting of atomic energy levels, Zeeman effect with and without electron spin.

Unit- II Approximation methods for time dependent problems

Time dependent perturbation theory, first order transition probability, constant perturbation, harmonic perturbation, Fermi Golden Rules, Atom in a radiation field, Einstein's *A* and *B* coefficients, Plane electromagnetic waves, Electric dipole transitions, selection rules.

Unit - III Identical Particles

Indistinguishability, Exchange degeneracy, Symmetric and antisymmetric wlave functions for many particle systems, Spin and statistics, Computation of interaction energy for two-particle systems, Exchange interaction, Application to ground state of a helium-like atom, Structure of wave function lor excited states of a helium-like atom, Pauli exclusion principle (qualitative), Collisions of identical particles Allowed states of 2-particle systems.

Unit - IV Scattering theory

Scattering cross section, Laboratory and center-of-mass coordinate systems, Transformation of variables from one system to another, Asymptotic behaviour, Scattering by spherically symmetric potentials, Partial waves and phase shifts, Partial wave expansion of differential cross section, Total cross section, Ramsauer – Townsend effect Scattering by a perfectly rigid sphere, Scattering *by* a square potential well, Green's functions in scattering theory, Born approximation, Application to scattering by (i) a square potential well (ii) Yukawa potential, Hypergeometric functions, Scattering in a Coulomb field (separation in parabolic coordinates), Rutherford formula.

Unit - V Elements of relativistic quantum mechanics

Klein - Gordon equation, Free particle solutions, Dirac equation for a free particle, Free particle solution, Negative energy, Hole theory, Reduction of Dirac equation into covariant form, Gamma matrices and their algebra, Existence of spin, Electromagnetic potentials in Dirac equation, Existence of magnetic moment.

Books Recommended:

1. Introduction to Quantum Mechanics:David J. Griffiths
2. Quantum Mechanics: L.I. Schiff
3. Quanrum Mechanics: J.L. Powell and Crasmann
4. Introduction to Quantum Mechanics: Pauling and Wilson
5. Quantum Mechanics and Field Theon: B. K Agrawal
6. Quantum Mechanics: A.K Ghatak and S. Loknathan
7. Practical Quantum Mechanics: Flugge.

PT – 302 ATOMIC & MOLECULAR PHYSICS AND NUCLEAR INSTRUMENTATION

Max. Marks: 85 Pass Marks : 29

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Atomic Physics

Quantum states of one electron atom, atomic orbitals, Hydrogen spectrum, spectra of alkali elements, spin orbit interaction and fine structure of alkali spectra, normal and anomalous Zeeman effect, Pschenback effect, Startk effect, two electron system, equivalent and non equivalent electrons, Pauli's exclusion principle, interaction energy, L-S and J-J coupling, Hyperfine structure, line broadening mechanisms.

Unit – II Rotational Spectra

Type of molecules: Linear, non-linear, symmetric top, asymmetric top, spherical top; rotational spectra of diatomic molecules as a rigid rotator, energy level diagram and spectra, rotational spectra of non rigid rotator, energy level diagram and spectra, intensity of rotational lines, applications of rotational spectra and pure rotational Raman spectra.

Unit – III Vibrational and Vibrational-rotational Spectra

Vibrational energy of diatomic molecules, diatomic molecule as a simple oscillator, its energy level diagram and spectrum, Morse potential energy curve, molecules as vibrating rotator, vibration spectrum of diatomic molecules, PQR branches, infrared spectrometry, vibrational Raman spectroscopy, structure determination from Raman and IR spectroscopy.

Unit – IV Fluorescence Spectroscopy

Vibronic interaction, Herzberg Teller theory, fluorescence spectroscopy, Kasha's rule, Quantum yield, non radiative transition, Jablonski diagram, time resolved fluorescence and determination of excited state life time.

Unit – V Nuclear Instrumentation

Ionization of matter by charge particles, interaction of electromagnetic radiation with matter, stopping power and range, photo electric effect, Compton effect and pair production, radiation detection, gas filled counters, solid state counters, scintillation counter, photomultiplier tube, Cerenkov detector, nuclear emulsions, Betatron, electron synchrotron and proton synchrotron.

BOOKS RECOMMENDED

1. Introduction to Atomic Physics: H.E.White
2. Fundamentals of Molecular spectroscopy: C.N.Banwell and E.M.McCash
3. Spectra of diatomic molecules: Herzberg
4. Spectroscopy Vol.I&II: Walker and Straughen
5. Nuclear Physics: Kaplan

PT – 303 CONDENSED MATTER PHYSICS – II

Max. Marks: 85 Pass Marks : 29

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Point Defects and Alloys

Lattice vacancies, Interstials and their thermodynamical calculations, Features of point defects, Color centres, Formation of alloys, Order-disorder transformation, Elementary theory of order

Unit – II Dielectric and Ferroelectric

Static polarization: various types of polarization, Local fields, Clausius-Mossotti relation, Time dependent polarization and dielectric relation, Lyddane-Sachs-Teller relation, Ferroelectric crystals, Classification of ferroelectric crystals, polarization catastrophe, First and second order phase transitions, Idea of antiferroelectricity, Piezo-electricity and ferroelectricity

Unit – III Magnetic Properties of Solids

Quantum theory of paramagnetism and ferromagnetism, exchange integral and Heissenberg interaction, Magnon and magnon dispersion relation, Antiferromagnetic and ferrimagnetic orders, Anisotropy energy, Bloch Walls, Idea of ferrites

Unit – IV Superconductivity – I

ConcePT of superconducting state, Thermodynamical properties of superconductors, London's equation and penetration depths, Magnetic properties and critical magnetic fields, Meissner effect, Flux quantization, Microwave and infrared properties, Coherence length

Unit – V Superconductivity – II

Two fluid model for superconducting state, Ginzburg-Landau theory, Basic featurs of Pipard's non local theory, elements of BCS theory of superconductivity, Isotpe effect, Single particle tunneling, DC and AC Josephson effects, Josephson tunneling, a Qualitative description of high Tc superconductivity in ceramic oxides.

BOOKS RECOMMENDED

1. Introduction to solid state physics: Kittel
2. Solid state Physics: Ashcroff and Marmin
3. Solid State Physics: Epifanov
4. Superconductivity: Parks
5. Intermediate quantum theory of crystalline solids: Animalu
6. Solid state Physics: Zimam

PT – 304A MICROWAVE AND OPTICAL COMMUNICATION

Max. Marks: 85 Pass Marks : 29

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Microwave Generators and Solid State Devices

Transit time effect at high frequency, failure of triodes/diodes at high frequency, concept of velocity modulation and current modulation, Klystron, Operation and characteristic, Reflex Klystron, Magnetron, Principle of operation and microwave characteristics of Gunn diode and Impatt diode

Unit – II Microwave Propagation and Components

Wave propagation in circular wave-guide, solution of wave equation in cylindrical coordinates, TE and TM modes in circular wave guides, TEM modes in circular wave guides, power transmission and losses in circular wave guide, Cavity resonators, Wave-guide Tee's (Magic Tee), S-parameters

Unit – III Microwave Integrated Circuits

Characteristics impedance of microstrip lines, effective dielectric constant, Losses in microstrip lines, Dielectric losses, Ohmic losses, Radiation Losses, The quality factor Q of the transmission line, microstrip line discontinuities, idea of capacitance and inductors, Idea of material used for integrated circuit, Brief idea about microwave integrated circuit

Unit – IV Optical Fibres

Basic optical laws and definitions, Optical fibre modes and configuration, Mode theory for circular waveguides, Solution of wave equation for index fibres, Power flow in step index fibres, Graded index fibres, Modes in graded index fibres

Unit – V Integrated Optics

Idea of modes in asymmetric planer wave guide, Strip waveguide, Phase modulators,Mach-Zehnder interferometer modulator, Optical directional couplers, PIN diode photodetectors, Avalanche photodiode detectors, Idea of optical fibre communication system

BOOKS RECOMMENDED

1. Radio and electrical engineering: Terman.
2. Microwave devices and circuits: Lio.
3. Microwave: Atwarter.
4. Microwave Engineering: Rizzi.
5. Microstrip lines: K.C. Gupta.
6. Optical fibre system: C.K.Kao.
7. Optical fibre communication: Kaiser.
8. Optical communication system: Gower.
9. Optical electronics: Ghatak.
10. An introduction to optical fibres : Cherian.

PT – 304B MATERIALS SCIENCE – I

Max. Marks: 85 Pass Marks : 29

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit - I Classification of Materials

Types of materials: Crystalline, Polycrystalline, Amorphous (Introduction and their structure), Elementary idea of polymers (structure and properties) methods of polymerization, Glasses: Structure and properties, Type of Glasses, Fracture in glasses, Composite Materials: Introduction, their types and properties, Different types of bonding, Medalung energy for ionic crystal.

Unit - II Phase Transitions

Thermodynamics of phase transformation, Free-energy calculation, I and II order transformation, Hume-Rothery rule, solid solution and types of solid solutions, Phase rule, One-, Two- component systems, Eutectic and peritectic phase diagrams, Lever rule, Phase diagrams of Mg-Al, Fe-C Kinetics of transformation, Homogeneous and heterogeneous nucleation, Growth kinetics.

Unit - III Diffusion in Materials and Microscopy

Mechanism of diffusion, Energy of formation and motion, long distance motion, Rate theory of diffusion, Einstein relation (relation between diffusivity and mobility), Fick's laws of diffusion and solution of Fick's second law, Kirkendal effect, Diffusion of vacancies in ionic crystals, Experimental determination of Diffusion coefficient.

Unit - IV Elastic and Anelastic Behaviour

Atomic models for elastic behaviour, Elastic deformation in single crystals, Elastic anisotropy, Elastic constant and elastic moduli (Cubic system, isotropic body), Rubber like elasticity, anelastic behaviour, Thermo-elastic effect and relaxation process, Idea of viscoelastic behaviour (Spring-Dashpot model), Determination of elastic constant of cubic crystals by ultrasonic wave propagation

Unit - V Exotic Materials

Structure and symmetries of liquids, liquid crystals and amorphous solids, aperiodic solids and quasicrystals, definition and properties of nanostrucrured materials, methods of synthesis of nanomaterials, their characterization techniques, quantum size effect, idea of quanrum well, wire and dots.

BOOKS RECOMMENDED

1. Materials and Engineering. Raghavan
2. Introduction to Solids Wert and Thomson
3. Introduction to solids. L.V. Azaroff
4. Diffusion kinetics for atoms in crystals: Manning
5. Introduction to solid state Physics - Kittle
6. Elements Solid State Phsics - Ali Omar.
7. The Physics of Quasi Crystals - Steinhardt and Osrulond.
8. Hand Book of Nanostrucrured Materials and Nanotechnology (Vol I –IV) - Hari Singh Nalwa.

PT – 304C COMPUTER APPLICATIONS IN PHYSICS – I

Max. Marks: 85 Pass Marks : 29

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Computer Peripherals

Introduction to computer, Computer peripherals: input and output Units, concept about central processing unit; registers, register pairs, Timing and control Unit, fetch and execute cycle, memories: volatile and non-volatile memories, Differences between high and low-level languages, Concept about compiler and interpreter

Unit – II Assembly Language Programming

Concept of machine language, Assembly language and assembler, Instruction set of 8085, Op-codes, Mnemonics, Instruction and data format, Addressing modes, Instruction set: data transfer group, arithmetic group, logical group, branch group and stack, I/O and machine control group, Programs based on these statements

Unit – III Operating System and Soft wares

Historical perspective of operating systems: MS-DOS, Windows, Linux, Concepts of batch processing, multi-programming, timesharing, multiprocessing and real-time systems, Operating system services: User view and operators views; File management, File types, Operation on files, Device directory, Access methods, Allocation methods and free space management, Directory systems.

Unit – IV MS-Office

MS Word: Creating and editing Word document, saving and printing of document, autoformat, format paragraph, line spacing, space before and after paragraph, margins and gutters, page break, repagination, sections, creating headers and footers, setting and clearing tabs, table insertion, use of micro, mail merge creation, sorting and printing merge documents.

MS Excel: Creating and editing worksheet, entering and formatting numbers, dates, formulae, referencing cells, single range, mixed, copying entries, autofill - numbers, dates, time, protecting and un-protecting documents and cells. Moving cells, copying cell, sorting cells data, inserting rows and columns, deleting part of worksheet, changing column and row width,

Power Point: Power point basics, creating presentations, editing and moving text, formatting.

Unit – V DBMS

Data base file creation, editing, saving structure, entering, listing, removing, updating, sorting, searching and viewing records, closing database; seek, index, sort, time, date, mathematical functions, mathematical commands, control statements, do case, handling multiple database files.

BOOKS RECOMMENDED

1. Microsoft office: Ron Mansfield
2. FoxPro: R K Taxali
4. Windows 95 Made Easy by Tom Sheldon (Tata McGraw-Hill, New Delhi
5. Introduction to Microprocessor by Mathur

COURSE DETAILS
IV SEMESTER (January - June 2019)
PHYSICS

Note: Each course shall be of 100 Marks out of which 15 marks are allotted to internal assessment and 85 marks for University examination. Minimum pass marks are 05 for the internal assessment and 29 for the University examination.

THEORY COURSES

PT – 401 NUCLEAR PHYSICS
Unit – I Nucleus and its Properties
Unit –II Two body Problems
Unit -III Nuclear Models
Unit - IV Nuclear Decay
Unit - V Nuclear Reactions

PT – 402 INSTRUMENTATION and COSMIC RAYS
Unit – I Measurement of Temperature
Unit – II X-Ray Spectroscopy and Crystal Growth Techniques
Unit – III Biomedical Instrumentation
Unit – IV Elements of high-resolution spectroscopy
Unit – V Cosmic Rays

PT – 403 STATISTICAL MECHANICS
Unit – I Microcanonical Ensemble
Unit – II Canonical Ensemble
Unit – III Grand Canonical Ensemble – I
Unit – IV Grand Canonical Ensemble – II
Unit – V Fluctuations

PT – 404A INTEGRATED ELECTRONICS
Unit – I Materials for Integrated Circuits
Unit – II Integrated circuit fabrication technology
Unit – III Growth of Thin Films
Unit – IV Diffusion and Ion Implantation
Unit – V Monolithic circuit fabrication

PT – 404B MATERIALS SCIENCE – II
Unit – I Dislocation and Plastic Deformation of Materials
Unit – II Transport Properties of Solids
Unit – III Degradation of materials, electronic properties in magnetic field
Unit – IV Many Electron Problem in Solids
Unit – V Electron Phonon Interaction and Superconductivity

PT – 404C COMPUTER APPLICATIONS IN PHYSICS – II
Unit – I Networking and Multimedia
Unit – II Computer Graphics – I (2-D)
Unit – III Computer Graphics – II (3-D)
Unit – IV Simulation Programmes
Unit – V Development of Scientific Soft wares

LABORATORY COURSES

PL – 405 General Laboratory
PL – 406A Electronics Laboratory
PL – 406B Material Science Laboratory
PL – 406C Computer Science Laboratory

PT – 401 NUCLEAR PHYSICS

Max. Marks: 85 Pass Marks : 29

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Nucleus and its Properties

The constitution of the nucleus and its general properties: Proton-electron hypothesis, Nucleus as a quantum system, Proton-neutron hypothesis, Nuclear mass, Basic components of mass spectroscopy, Mirror nuclei and isotopic spin (introductory), Packing fraction and binding energies, Nuclear radius- its determination and interpretation of results (experimental details not required), Natural radioactivity, successive radioactive transformation, radioactive equilibrium, Gamow theory of alpha decay, nuclear spin, parity, magnetic moments, electric dipole and quadrupole moments (experimental details not required).

Unit –II Two body Problems

Binding energies and the Saturation of nuclear forces, Charge independence of nuclear force, The ground state of the deuteron (central forces), Comparison with experimental data on deuteron, Spin dependence of nuclear force, Tensor force, Neutron-proton scattering at low energies (below 10MeV), Cross-section, Laboratory and center of mass coordinate systems, Scattering length, Spin dependence of nuclear force, Singlet and triplet potentials, Effect of chemical binding, Coherent scattering of neutrons by protons (scattering by ortho- and para-hydrogen), Proton-Proton scattering at low energies (elementary theory), Exchange forces (elementary Yukawa theory).

Unit –III Nuclear Models

Liquid drop model, Semi empirical mass formula, Isobaric mass parabolae, Nuclear fission, The mass and energy distributions of the fission products, The energy release in fission, Application of liquid drop model to fission, Magic numbers, Single particle model of the nucleus, Spin-orbit coupling, Application to prediction of spin and magnetic moments (Schmidt values).

Unit - IV Nuclear Decay

Beta particle spectra, The continuous spectrum, Neutrino hypothesis, Fermi theory of beta-decay (non-relativistic), Kurie plots, Comparative half lives, Allowed and forbidden transitions, Selection rules, Symmetry laws and the non-conservation of parity in beta-decay, Gamma transitions, Multipole moments (mathematical results of theory to be assumed), Selection rules, Internal conversion (qualitative only), Nuclear isomerism

Unit - V Nuclear Reactions

Conservation laws for nuclear reactions, Q-value, The compound nucleus, Independence hypothesis, Resonances, Single level Breit-Wigner formula, Direct reaction (introductory ideas about stripping and pick-up reactions),

Books Recommended:

1. Nuclear physics: Kaplan
2. Nuclear physics: Enge
3. Nuclear physics: Evans
4. Nuclear physics: Blatt and Wisskopf

PT – 402 INSTRUMENTATION AND COSMIC RAYS

Max. Marks: 85 Pass Marks : 29

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Measurement of Temperature

Temperature scales, mechanical temperature sensors, liquid filled sensors, platinum resistance thermometer, principle and construction of resistance thermometer circuits, thermistors and its measuring circuits, thermocouple and its circuits, solid state sensors, temperature measurement by radiation methods, optical pyrometers.

Unit – II X-Ray Spectroscopy and Crystal Growth Techniques

X-ray spectrum, X-ray generating equipment, monochromators, powder and single crystal diffractometer, X-ray absorption meter, basic properties and uses of ESCA, electron probe microanalyser.

Theories of crystal growth, Growth of Single crystals from melt, Czocharlski method, Concept of annealing and quenching, Thin film deposition, Vacuum evaporation and chemical vapour deposition

Unit – III Biomedical Instrumentation

Electrocardiography, ECG amplifiers, electrodes and leads, ECG recorder principles, types of ECG recorders, measurement of blood flow, magnetic blood flow recorder, ultrasonic blood flow meter, principles of ultrasonic measurement, basic modes of transmission, ultrasonic imaging.

Unit – IV Elements of high-resolution spectroscopy

Principles of Mossbauer spectroscopy, applications of Mossbauer spectroscopy: chemical shift, quadrupole effects, effect of magnetic field; spin resonance spectroscopy: nature of spinning particles, interaction between spin and magnetic field, Larmor precession; introduction to magnetic resonance spectroscopy and its applications.

Qualitative description of AFM, SEM and TEM.

Unit – V Cosmic Rays

Nature, composition, charge and energy spectrum of primary cosmic rays, production and propagation of secondary cosmic rays, Rossi curve, cascade showers, physical properties of elementary particles, fundamental interactions and conservation laws, associated production and strangeness, leptons and hadrons, Quark model-SU (2) and SU (3) multiplets, Gellmann-Okubo mass formula.

BOOKS RECOMMENDED:

1. Instrumentation devices and systems: G.S.Rangan et al
2. Handbook of X-ray: Kelbel
3. Biomedical Instrumentation: L.Cromwell et al
4. Plasma Physics: F.F.Chen

PT – 403 STATISTICAL MECHANICS

Max. Marks: 85 Pass Marks : 29

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Microcanonical Ensemble

Concept of phase spaces, Liouville's theorem, Concept of Gibb's ensembles: microcanonical ensemble, canonical and grand canonical ensembles, Thermodynamical potential functions and their relations, Partition function of micro-canonical ensembles and its application to (a) classical ideal gas (b) Gibb's paradox, Sackur Tetrode equation.

Unit – II Canonical Ensemble

Canonical ensemble, Maxwell Boltzmann distribution, Maxwell's distribution of velocities and speeds, Boltzmann energy equipartition theorem, Rotational and vibrational partition function, Their application to diatomic molecules.

Unit – III Grand Canonical Ensemble – I

Grand canonical partition function, Derivation of Bose Einstein statistics, Weak and strong degeneracy, Applications of Bose Einstein statistics to Bose Einstein condensation and phase transition, Thermodynamical properties of an ideal Bose Einstein gas, Liquid helium and its properties, Two fluid model for liquid helium .

Unit – IV Grand Canonical Ensemble – II

Grand canonical partition function and derivatives of FD statistics, Application of FD statistics to (a) FD degeneracy of electron gas in metals, Boltzmann transport equation and its application to Sommerfeld theory of electrical conductivity and thermal conductivity: Weidemann-Franz law.

Unit – V Fluctuations

Elementary discussion of fluctuations, Fluctuations in ensembles: (Microcanonical, canonical, grand canonical), One-dimensional random walk problem, Brownian motion, Electrical noise: (Nyquist theorem).

BOOKS RECOMMENDED

1. Statistical Mechanics: ESR Gopal
2. Statistical Mechanics: Huang
3. Statistical Mechanics: Mendle

PT – 404A INTEGRATED ELECTRONICS

Max. Marks: 85 Pass Marks : 29

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Materials for Integrated Circuits

Electronic grade Silicon, Purification of metallurgical grade Silicon, Float zone crystal growing method, Czochralski method, Silicon lapping and polishing and Wafer preparation, Vapor phase epitaxy, Liquid phase epitaxy, Oxidation: thermal, dry and wet, Plasma oxidation.

Unit - II Integrated circuit fabrication technology

Optical lithography, photo mask, photo resist and process of lithography, idea of electron beam and X-ray lithography, wet chemical etching, reactive plasma etching

Unit - III Growth of Thin Films

Evaporation theory, physical vapour deposition method, design construction of high vacuum coating unit, flash electron beam evaporation system, idea of DC sputtering system, idea of thick film circuits.

Unit - IV Diffusion and Ion Implantation

Doping by diffusion, Idea of diffusion profile, Error function and Gaussian profile methods, Ion implantation, advantages and disadvantages of ion implantation, Neutron doping, Basic monolithic integrated circuit, Fabrication of integrated and thin film resistor and capacitors: their equivalent circuits, Integrated inductor.

Unit – V Monolithic circuit fabrication

Fabrication of monolithic diodes in various configuration, fabrication of integrated transistors, Idea of buried layer, fabrication, Monolithic circuit layout design rules, isolation method, Monolithic FET, MOS FET processing, advantages and limitations of MOS devices, CCD devices, Idea of large and medium scale Integration.

Books Recommended:

1. Fundamentals of Electronics: Millman and Halkias
2. Fundamentals of Electronics. Botkar

PT – 404B MATERIALS SCIENCE – II

Max. Marks: 85 Pass Marks : 29

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Dislocation and Plastic Deformation of Materials

Concept of dislocation, Dislocation of Movement, Stress field and strain energy of a dislocation, Forces on dislocation and between dislocations, Homogeneous nucleation of dislocations, Typical tensile stress-strain curve, Strength of a material, Work hardening by impurity atoms, yield drops, Shear strength of perfect and real solids, Creeps and their mechanism, Toughness, Fatigue, Methods of observing dislocations (their introduction, merits and demerits).

Unit – II Transport Properties of Solids

Electrical conductivity of metals and alloys, Extrinsic, intrinsic semiconductors and amorphous semiconductors, Scattering of electrons by phonons, impurity, etc, Relaxation time, Carrier mobility and its temperature dependence, Mathiesson's rule for resistivity, temperature dependence of metallic resistivity.

Unit- III Degradation of materials, electronic properties in magnetic field

Mechanism of oxidation, Oxidation-resistant materials, Corrosion and protection against it, Classical theory of magneto-conductivity, Cyclotron resonance, k-space analysis of motion in uniform magnetic field, de Hass von Alphon effect, Ultrasonic attenuation and skin effect.

Unit-IV Many Electron Problem In Solids

Interacting electron gas; concept of many electron system, Thomas-Fremi Theory, Hartree and Hartree-Fock approximation, Correlation energy, Lindhardt theory, and Thomas-Fermi theory of screening, Plasma oscillations in free electron gas, Dielectric function of an electron gas in random phase approximation, strongly interacting Fermi system, Idea of Landau's quasi-particle theory of Fermi liquid

Unit-V Electron Phonon Interaction And Superconductivity

Interaction of electron with acoustic and optical phonon, Polarons, Superconductivity, Manifestation of energy gap, Isotope effect, Cooper Pairing due to Phonons, BCS theory, Ginzsburg-Landau theory and applications to Josephson effect (D.C. and A.C. both), Macroscopic quantum interference, Vortices and Type II - Superconductors, Idea of high Tc superconductivity.

BOOKS RECOMMENDED

1. Introduction to Dislocations: Hull
2. Material Science and Engineering: Raghwan
3. Solid Slate Physics: Ashcroft and Mormin
4. Introduction to Solid Slate Physics - Kittle
5. Introduction to Superconductivity - Roseinnes and Rhodrick
6. Quantum theory of Solids -Kittel
7. Theoretical Solid State Physic - Huang.

PT – 404C COMPUTER APPLICATIONS IN PHYSICS – II

Max. Marks: 85 Pass Marks : 29

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Networking and Multimedia

Network types of architecture: LAN, WAN, MAN topology, interfaces and devices, multimedia, technique of data compression, voice, video, interactive video-on-demand over the net, mobile computing, Fundamental of network and management (NM), elements of NM its need and functional areas, configuration, performance and security managements.

Unit – II Computer Graphics – I (2-D)

Types of graphic devices, CRT display, Random and raster scan graphics, DDA, Line drawing, Algorithms, Bresenham's algorithms, Cell encoding, Frame buffers, Raster addressing, Line and character display, Transformation of points, Lines and objects, Homogeneous coordinate systems and transformation matrices for various operations, Sequential transformations, Viewport planning, Window clipping, Window to Viewport mapping, Physical device coordinates, Zooming

Unit – III Computer Graphics – II (3-D)

3-D transformations: Translational, Rotational and Scaling; Clipping in three-dimension, 3-D viewing transformation, 3-D drawing: direct projection, quadratic surfaces, removing hidden surfaces, drawing a cube and a sphere

Unit – IV Simulation Programmes

Knowledge about input, processing and output related to following problems for writing computer programs and showing results in the form of list or plots: Charging of capacitor, Discharging of capacitor, Resonance in LC circuit, Drawing potential energy curve, Programming for trapezoidal rule and Simpson’s 1/3 rule. Expressing various shape wave functions as a Fourier series. Obtaining approximate numerical solutions to the simultaneous equations using Gauss Seidel method.

Unit – V Development of Scientific Soft wares

Obtaining numerical solution to ordinary differential equations using different initial conditions; Solution of Schrodinger equation for different potential: Potential well problem in one- and three-dimension, Interaction between two charged particles, penetration of charge particles through a potential barrier,

BOOKS RECOMMENDED

1. Computer graphics by S.Harrington
2. Computer graphics by D.Hearn and P.M.Baker
3. Procedural elements for computer graphics by D.F.Rogers
4. Numerical Computational methods by Patil and Verma