For the Session 2020-23

B.Sc Semester V Chemistry Paper I

PAPER CODE 22-5004

Inorganic Chemistry

Scheme of examination: *MM: 23*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Hard and Soft Acids and Bases (HSAB) : Classification of acids and bases as hard and soft. Pearson's HSAB concept acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

Unit-II

Metal-Ligand Bonding in Transition Metal complexes: Limitations of valence bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

UNIT – III

Thermodynamic and Kinetic Aspects of Metal Complexes: A brief outline of thermo- dynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.

UNIT - IV

Organometallic Chemistry-I: Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyl and aryls of Li, Al, Hg, Sn and Ti.

UNIT – V

Bioinorganic Chemistry I: Essential and trace elements to Biological processes, Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+}.

Session 2020-21

PAPER CODE 22-5005

Organic Chemistry

Scheme of examination: *MM: 23*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Organometallic and Organosulphur Compounds: Organometallic Compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc Compounds: Formation and chemical reactions. Organolithium compounds: Formation and chemical reactions.

Organosulphur compounds: Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.

Unit-II

Heterocylic Compounds-I: Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions, with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.

Unit-III

Carbohydrates: Classification and nomenclature monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D(+) - structures of glucose. Mechanism of mutarotation. Structure of

ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving strcture determination.

Unit-IV

Amino Acids: Classification, structure and stereochemistry of amino acids. Acid-base behaviour, isoelectric point and electrophoresis. Preparation and reactions of α-amino acids.

Unit-V

Synthetic Polymers: Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers.

Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes.

Natural and synthetic rubbers.

PAPER CODE 22-5006

Physical Chemistry

Scheme of examination: *MM: 24*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Elementray quantum Mechanics-I: Black-body, radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects. Compton effect.
De Broglie hypothesis Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator.

UNIT - II

Elementary quantum Mechanics-II: Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box.
Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

Unit-III

(a)Spectroscopy: Introduction: Electromagnetic radiation, of the spectrum, basic features of different spectrometers, statement of the Born-Openheimer approximation, degrees of freedom.
(b)Electronic Spectrum: Concept of Potential Energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Frank Condon principle.
Qualitative description of σ, π and n M.O. their energy levels and the respective transitions.

UNIT – IV

Solutions, Dilute Solutions and Colligative Properties-I: Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient.

Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Experimental methods for determining osmotic pressure.

UNIT - V

Solutions, Dilute Solutions and Colligative Properties-II: Elevation of boiling point and depression in freezing point. Thermodynamic derivation of relation between molecular weight and elevation of boiling point and depression in freezing point. Experimental methods for determining elevation of boiling point and depression in freezing point. Abnormal molar mass, degree of dissociation and association of solutes.

For the Session 2020-23

B.Sc Semester VI Chemistry Paper I

PAPER CODE 22-6004

Inorganic Chemistry

Scheme of examination: *MM: 23*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Magnetic Properties of Transition Metal Complexes: Types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of μ_s values and μ_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

UNIT II

Electron Spectra of Transition Metal Complexes: Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series, Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6)]^{3+}$ complex ion.

UNIT III

Organometallic Chemistry-II: A brief account of metal ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

UNIT IV

Bioinorganic Chemistry-II: Metalloporphyrins with special reference to haemoglobin and myoglobin. Nitrogen fixation.

UNIT V

Silicones and Phosphazenes: Silicones and phosphazenes as example of inorganic polymers, nature of bonding in triphosphazenes.

Session 2020-21

PAPER CODE 22-6005

Organic Chemistry

Scheme of examination: *MM: 23*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

NMR Spectroscopy: Nuclear magnetic resonance (NMR) spectroscopy. Proton Magnetic Resonance (H-NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constant,

areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene

and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

UNIT II

Heterocylic Compounds-II: Introduction to condensed five and six-membered heterocyles. Preparation and reactions of indole, quainoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquionoline.

UNIT III

Organic Synthesis via Enolates: Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate : the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1,3-dithianes. Alkylation and acylation of examines.

UNIT IV

Peptides, Proteins and Nucleic Acids: Structures and nomenclature of peptides and proteins.Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid phase peptide synthesis. Structures of peptides and proteins. Levels of protein structure. Protein denaturation / renaturation.

Nucleic acids: Introduction. Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

UNIT V

Fats, Oils and Detergents: Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value, Soaps, synthetic detergents, alkyl and aryl sulphonates.

Synthetic Dyes: Colour and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange. Congo red. Malachite green. Crystal violet, Phenolphthalein. Fluorescein. Alizarin and Indigo.

PAPER CODE 22-6006

Physical Chemistry

Scheme of examination: *MM: 24*

1 *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

UNIT – I

Molecular orbital theory, basic ideas-criteria for forming M.O. from A.O. construction of M.O's by LCAO - H_2^+ ion, calculation of energy levels from wave functions, Hybrid orbitals - sp, sp^2, sp^3 calculation of coefficients of A. O.'s used in these hybrid orbitals. Introduction to valence bond model of H_2, comparison of M.O. and V.B. models.

UNIT II

Rotational Spectrum: Diatomic molecules, Energy levels of a rigid rotator (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution), determination of bond length, qualitative description of non-rigid rotator, isotope effect.

UNIT III

Vibrational Spectrum: Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups. Raman Spectrum concept of polarizability, pure rotational and pure vibrational Raman Spectra of diatomic molecules, selection rules.

UNIT IV

Photochemistry: Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus-

Drapper law, Stark -Einstein law, Jablosnski diagram depicting various processes occurring in the exited sate, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions-energy transfer processes (simplex examples).

UNIT V

Physical Properties and Molecular Structure: Optical activity, polarization - (Calusius-Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties - paramagnetism, diamagnetism and ferromagnetism.

For the Session 2022-23

CHEMISTRY PRACTICAL B.Sc. PT-III

5 hrs. Duration | 4 hrs./ week

Max. Marks: 100 | Min. Marks: 36

PAPER CODE ..P-22-6004

Inorganic Chemistry

Synthesis and Analysis

(a) Preparation of sodium trioxalato ferrate (III) $Na_3[fe(c_2O_4)_3]$ and determination of its composition by permaganometry.

(b) Preparation of Ni-DMG complex, $[Ni(DMG)_2]$

(c) Preparation of copper tetraammine complex $[cu(NH_3)_4]SO_4$.

(d) Preparation of cis-and trans-bisoxalato diaqua chromates (III) ion.

Instrumentation

Calorimetry

(a) Job's (b) Mole-ratio method

Adulteration-Food stuffs

Effluent analysis water analysis

Solvent Extraction

Separation and estimation of Mg (II) and Fe(II)

Ion Exchange Method

Separation and estimation of Mg(II) and Zn(II)

ORGANIC CHEMISTRY

Laboratory Techniques

Steam Distillation

Naphthalene from its suspension in water

Clove oil from Clove

Separation of o-and p-nitrophenols.

Column Chromatography

Separation of fluoresein and methylene blue

Separation of leaf pigments from spinach leaves.

Resolution of recemic mixture of (=) mandelic acid.

Qualitative Analysis

Analysis of an organic mixture containing two solid components using water, $NaHCO_3$, for separation and preparation of suitable derivatives.

Synthesis of Organic Compounds

(a) Acetylation of salicylic acid, aniline, glucose and hydroquinone.
Benzoylation of aniline and phenol.

(b) Aliphatic electrophilic substitution
Preparation of iodoform from ethanol and acetone...

(c) Aaromatic electrophilic substitution
Nitration
Preparation of m-dinitrobenzene
Preparation of p-nitroacetanilide
Halogenation
Preparation of p-bromoacetanilide
Preparation of 2,4,6-triburomophenol

(d) Diazotization/coupling
Preparation of methyl orange and methyl red

(e) Oxidation
Preparation of benzoic acid from toluene

(f) Reduction
Preparation of aniline from nitrobenzene
Preparation of m-nitroaniline from m-dinitrobenzene.

Stereochemical Study of Organic Compounds via Models

R and S configuration of optical isomers.
E,Z configuration of geometrical isomers.
Conformational analysis of cyclohexanes and substituted cyclohexanes.

Physical Chemistry

Electrochemistry-I

(a) To determine the strength of the given acid conductometrically using standard alkali solution.

(b) To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.

(c) To study the saponification of ethyl acetate conductometrically.

Refractometry, Polarimetry

(a) To verify law of refraction of mixtures e.g. of glycerol and water) using Abbe's retractometer.

(b) To determine the specific rotation of a given optically active compound.

(c) To determine the ionisation constant of a weak acid conductometrically.

(d) To titrate potentiometrically the given ferrous ammounium sulphate solution using $KmnO_4/K_2Cr_2O_7$ as titrant and calculate the redox potential of Fe^{++}/Fe^{+++} system on the hydrogen scale.

Molecular Weight Determination

(a) Determination of molecular weight of a non-volatile solute by Rast method/Backmann freezing point method.

(b) Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebullioscopy.

Colorimetry

To verify Beer-Lambert law $KMnO_4/K_2cr_2O_7$ and determine the concentration of the given solution of the substance.

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B.Sc Semester V Maths Paper I PAPER CODE 22-5007

ABSTRACT ALGEBRA

Scheme of examination: MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Definition and simple properties of Groups and Subgroups. Cyclic group.

UNIT – II

Permutation Groups. Cosets, Lagrange's theorem on the order of subgroups of a finit order group.

UNIT – III

Morphism of groups, Cayley's theorem. Normal subgroups and Quotient groups. Fundamental theorems of Isomorphism.

UNIT – IV

Definition and simple properties of Rings. Integral domain and field, Characteristics of a Ring and Field.

B.Sc Semester V Maths Paper II

PAPER CODE 22-5008

COMPLEX ANALYSIS - I

Scheme of examination: MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Complex plane, connected and Compact sets. Curves and Regions in complex plane. Jordan curve Theorem (Statement only). Extended complex plane. Stereographic projection.

UNIT – II

Complex valued function - Limits, Continuity and Differentiability. Analytic function, Cauchy- Riemann equations (cartesian and polar form). Harmonic functions, Construction of an analytic function.

UNIT – III

Complex integration, Complex line integrals, Cauchy integral theorem, Indefinite integral, Fundamental theorem of integral calculus for complex functions. Power series - Absolute convergence, Abel's theorem, Cauchy-Hadamard theorem, Circle and Radius of convergence, Analyticity of the sum function of a power series.

UNIT – IV

Cauchy integral formula, Analyticity of the derivative of an analytic function, Morera's theorem, Poisson integral formula Liouville' theorem. Taylor's theorem. Laurent's theorem. Maximum modulus theorem.

B.Sc Semester V Maths Paper III

PAPER CODE 22-5009

DYNAMICS AND COMPUTER PROGRAMMING IN 'C'

Scheme of examination: MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Velocity and Acceleration – along radial and transverse directions, along tangential and normal directions.

UNIT – II

S.H.M. Hooke's law motion along horizontal and vertical elastic strings.

UNIT – III

Motion in resisting medium-Resistance varies as velocity and square of velocity.

UNIT – IV

Programming languages and problems solving on computers, Algorithm, Flow chart, Programming in C-constants, Variables, Arithmetic and logical expressions, input-output conditional statements, Implementing loops in Programs, Defining and manipulation arrays and functions.

B.Sc Semester VI Maths Paper I

PAPER CODE 22-6007

LINEAR ALGEBRA

Scheme of examination: MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Subrings. Morphism of rings. Ideals and Quotient Ring. Maximal ideal and Prime ideal. Principal Ideal domain. Field of quotients of an integral domain. Prime fields.

UNIT II

Definition, Examples and Simple properties of Vector spaces and Subspaces.

UNIT III

Linear combination, Linear dependence and Linear independence of vectors. Linear span, Direct sum and Complement of subspaces. Generation of subspaces, sum of subspaces.

UNIT IV

Basis and Dimension. Quotient space and its dimension.

B.Sc Semester VI Maths Paper II

PAPER CODE 22-6008

COMPLEX ANALYSIS - II

Scheme of examination: MM: 35

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Singularities of an analytic function, Branch point, Meromorphic and Entire functions, Riemann's theorem, Casorati-Weierstrass theorem.

UNIT II

Residue at a singularity, Cauchy's residue theorem. Argument principle. Rouche's theorem. Fundamental theorem of Algebra.

UNIT III

Conformal mapping. Bilinear transformation and its properties. Elementary mappings: $w(z)=1/z,(z+1/z)$, z^2, e^z, sinz, cosz, and logz.

UNIT IV

Evaluation of a real definite integral by contour integration. Analytic continuation. Power series method of analytic continuation.

B.Sc Semester VI Maths Paper III PAPER CODE 22-6009

ADVANCED DYNAMICS

Scheme of examination: MM: 22

Note: In all five questions are to be answered. First question will be short answer type, compulsory and will cover the entire syllabus. There shall be two questions from each unit. A student has to answer at least one question from each unit.

UNIT – I

Work and energy; Cyclodial Motion

UNIT – II

Motion on a smooth curve in a vertical plane. Motion on the inside and outside of a smooth vertical circles

UNIT – III

Central orbits p-r equations. Apses. Time in an orbit. Kepler's laws of planetary motion.

UNIT – IV

Moments of inertia- M.I. of rods . circular rings, circular disks, solid and hollow sphares, Rectangular lamina, Ellipse and Triangle, Theorem of pareallel axis, Product of inertia.

B.Sc. Pt-III SEMESTER-V PAPER CODE 22-5010

Physics-I

Solid State Physics-I (MM 33)

Note: 34 marks assigned to theory papers are distributed in following manner

Continuous evaluation	**10 marks**
Term End Main Exam	**23 marks**

Duration : 3 hour

Note: *In all five questions are to be set in the paper. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will cover entire course and it will be compulsory.*

Unit- I

Bonding in Solids and Crystal structure: Force between atoms, Ionic bonds, Covalent and metallic bonds, Vander wall's and Hydrogen bonding. Periodicity in lattices, Basis, lattice point and space lattice, Translation vectors, Unit and primitive cell, Crystal systems, Packing fractions for Simple Cubic (SC), Body Centered Cubic (BCC), Face Centered Cubic (FCC) and Hexagonal lattice structures, Bravais space lattices.

Unit- II

Crystallography and Diffraction: Direction, planes and miller indices in a crystal lattice, Reciprocal lattice and its significance, Conversion of SC and FCC structures in reciprocal lattice frame, Concept of crystalline, polycrystalline and amorphous materials, X-ray diffraction by solids: Laue and Braggs equation, Study of crystals by X-rays: FWHM, Sherrer formula and lattice Constants (for simple cubic structure), Electron and Neutron diffraction (qualitative).

Unit- III

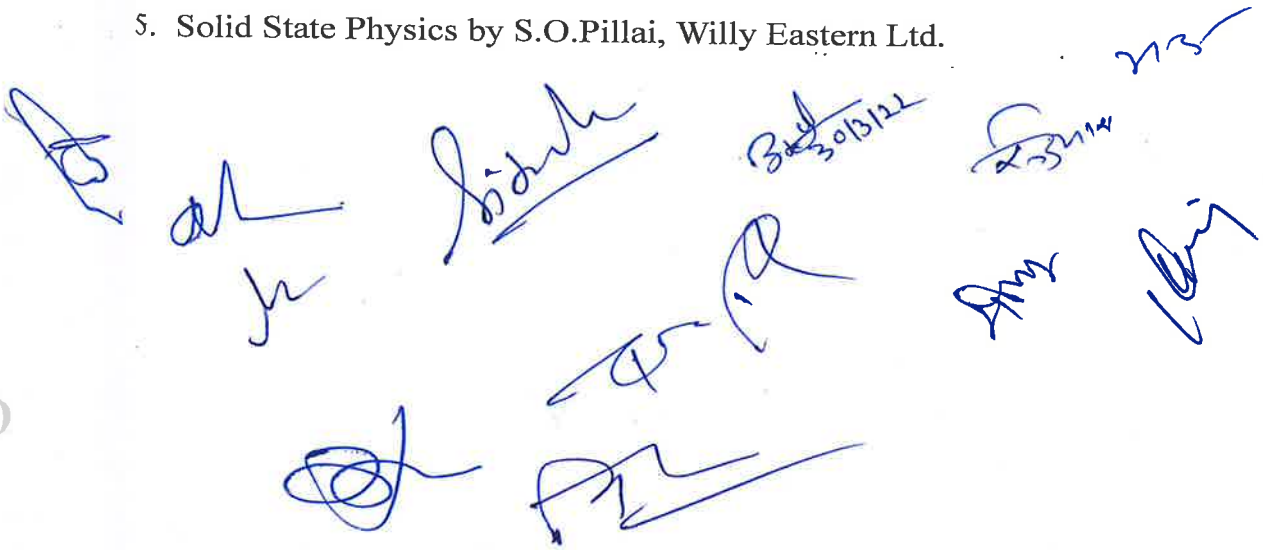
Band theory of solids: Formation of bands, Periodic potential and Bloch Theorem, Number of states in the bands, Kronig Penny model, Brilliuon zones, Crystal momentum and physical origin of effective mass, Negative Effective Mass and Holes, Energy dispersion relations: weak and tight binding.

Unit- IV

Semiconductors: Energy band Structures in Insulators, Conductors, Semiconductors, Concept of Direct and Indirect band gap in semiconductors, Generation and recombination of charge carriers, Mobility of current carriers, Hall Effect in semiconductors: Hall coefficient, Mobility, Charge carrier concentration, Conductivity and Hall angle.

Reference Books (Solid State Physics)

1. Introduction to Solid State Physics, Charles Kittel (Wiley Publication)
2. Elementary Solid State Physics, M. All Omar (Pearson Education)
3. Elements of X-ray diffraction, B. D. Cullity (Prentice Hall)
4. Solid State Physics by G.I Epifanov (Mir R publisher)
5. Solid State Physics by S.O.Pillai, Willy Eastern Ltd.



B.Sc. Pt-III SEMESTER-V

PAPER CODE 22-5011

Physics -II

Quantum Mechanics and Spectroscopy-I (MM 33)

Note: 33 marks assigned to theory papers are distributed in following manner

Continuous evaluation	**10 marks**
Term End Main Exam	**23 marks**

Duration : 3 hour

Note: *In all five questions are to be set in the paper. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will cover entire course and it will be compulsory.*

UNIT-I

Evolution of Quantum Mechanics : Difficulties of classical mechanics to explain: the black-body emission spectrum, specific heat of solids. Plank quanta concept and radiation law, Photo electric effect and Einstein's explanations. Compton effect, De- Broglie hypothesis, diffraction and interference experiments of particle (Davisson-Germer experiment). **Uncertainty principle:** position and momentum, angle and angular momentum, energy and time. Application of uncertainty principle: (i) Ground state energy of hydrogen atom, (ii) ground state energy of simple harmonic oscillator, (iii) Natural width of spectral lines, (iv) Non-existence of electron in nucleus.

UNIT-II

Operators in quantum mechanics: Operators: linear operators, product of two operators, commuting and non-commuting operators, simultaneous Eigen functions and Eigen values, orthogonal wave functions. Hermitian operators, their eigen values, Hermitian adjoint operators, eigenvalues and eigenfunctions; expectation values of operators: position, momentum, energy: Ehrenfest theorem and complementarity, Concept of group and phase velocity, wave packet, Gaussian wave packet, bra – ket notation.

UNIT-III

Schrodinger wave equation: general equation of wave propagation, propagation of matter waves, time dependent and time-independent. Schrodinger equation, wavefunction representation (Ψ), physical meaning of Ψ, properties and conditions on Ψ , postulates of wave mechanics, operators, observable and measurements; probability current density.

UNIT-IV

Solutions of Schrödinger wave equations in simple cases: Time independent Schrodinger equation, stationary state solution, one dimensional problem: particle in one dimensional box, eigenfunctions and eigenvalues, discrete energy levels, generalization into three dimension and degeneracy of energy levels, concept of potential well and barrier, step potential, penetration through rectangular barrier, reflection and transmission coefficients, barriers with special shapes (graphical representation), quantum mechanical tunneling (alpha decay).

Reference books (Quantam Mechanics and Spectroscopy)

1. David J. Griffiths, Introduction to Quantum Mechanics, 2nd edition.
2. R. Shankar, Principles of Quantum Mechanics, 2nd edition.
3. Arthur Beiser, Perspective of modem Physics, 6th edition.
4. AK Ghatak and S Lokanathan, Quantum Mechanics: Theory and application.
5. HS Mani, GK Mehta, Introduction to modern Physics.
6. C.N. Banwell and E.M McCash,Fundamental of Molecular Spectroscopy, 4th edition.

B.Sc. Pt-III SEMESTER-V

PAPER CODE 22-5012

Physics -III

Nuclear and particle Physics-I (MM 34)

Note: 33 marks assigned to theory papers are distributed in following manner

Continuous evaluation	**10 marks**
Term End Main Exam	**24 marks**

Duration : 3 hour

Note: *In all five questions are to be set in the paper. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will cover entire course and it will be compulsory.*

Unit – I

Properties of Nucleus : Discovery of Nucleus, Rutherford Scattering, Constituents of the Nucleus: Mass, Charge, Size, Nuclear Density, Charge Distribution, Hofstadter's experiment, Nuclear Angular momentum, Nuclear Magnetic Dipole Moment, Electric Quadrupole Moment, Spin, Isospin, Wave Mechanical Properties: Parity and Statistics, Classification of Nuclei, Mass Defect and Binding Energy, Packing Fraction, Mass Spectrograph.

Unit- II

Nuclear Forces: Properties of Nuclear Forces, Yukawa Meson Theory, Nuclear Potential. **Nuclear Models:** Segre Chart, Liquid Drop Model, Semi Empirical Mass Formula, Condition of Stability, Fermi Gas Model, Evidence for Nuclear Shell Structure, Nuclear Magic Numbers and Basic Assumptions of the Shell Model.

Unit- III

Radioactive Decays: Alpha Decay-Basics of α - Decay Processes, Theory of β - Emmission Spectrum, Gammow Factor, Geiger Nuttal Law, Range of Alpha Particles, Beta Decay-Energy Kinematics for β –Decay, β-Decay Spectrum, Position Emission, Electron Capture, Pauli's Neutrino Hypothesis. Gamma Decay- Gamma Ray Emission and Kinematics, Internal Conversion. Applications of Radioactivity.

Unit- IV

Nuclear Fission and Fusion: Nuclear Fission, Spontaneous Fission and Potential Barrier, its Explanation by Liquid Drop Model, Chain Reaction, Controlled chain reaction, Four Factor Formula, Nuclear Reactors, Classification of Nuclear Reactor, Uncontrolled Chain Reaction, Nuclear Fusion, Energy released in Nuclear Fusion, Fusion in stars. **Nuclear Reactions:** Types of Reactions, Conservation Laws, Kinematics of Reactions, Q-Value, Threshold Energy, Reaction Rate, Reaction Cross-Section.

Reference Books (Nuclear and Particle Physics)

1. Nuclear and Particle Physics, W. E. Burcham and M Jobes,Addison Wesley Longman Inc.

2. Nuclear and Particle Physics, Brian R Martin, John Wiley & Sons.

3. Introduction to Nuclear and Particle Physics, Das and Ferbal, World Scientific.

4. Elements of Nuclear Physics, Walter E. Meyerhof, McGraw-Hill Book Company.

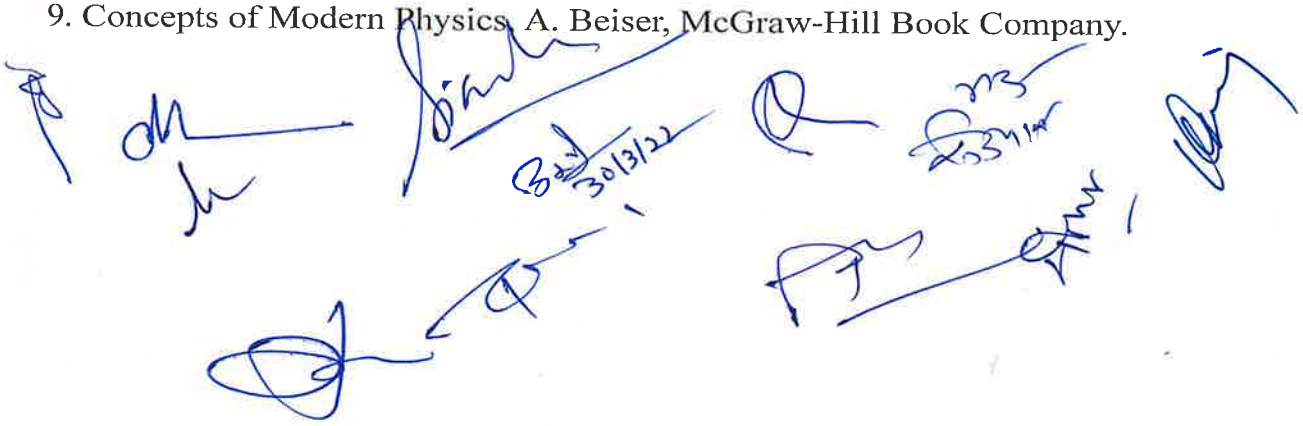
5. Introductory Nuclear Physics, Kenneth S. Krane, John Wiley & Sons.

6. Introduction to Elementary Particles, David J. Griffiths, John Wiley & Sons.

7. Radiation Detection and Measurement, G.F. Knoll (John Wiley & Sons)

8. Introduction to Nuclear and Particle Physics, V. K. Mittal, R. C. Verma, S. C.Gupta,PHI

9. Concepts of Modern Physics, A. Beiser, McGraw-Hill Book Company.



B.Sc. Pt-III SEMESTER-VI

PAPER CODE 22-6010

Physics-I

Solid State Physics-II

(MM 33)

Note: 34 marks assigned to theory papers are distributed in following manner

Continuous evaluation	**10 marks**
Term End Main Exam	**23marks**

Duration : 3 hour

Note: *In all five questions are to be set in the paper. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will cover entire course and it will be compulsory.*

Unit- I

Thermal properties of Materials: Elastic waves, Phonon-Phonon dispersion relations in monatomic and diatomic linear lattice. Lattice heat capacity, Classical theory of specific heat, Dulong-Petit's law, Einstein and Debye's theory of specific heat of solids and limitations of these models, concept of Thermoelectric Power.

Unit-II

Electrical Properties of Materials: Drude-Lorentz theory, Sommerfeld's Model, Thermal conductivity, Electrical conductivity, Widemann-Franz relation, Thermionic Emission, Escape of electrons from metals, Hall Effect in Metals, Density of states.

Unit-III

Magnetic Properties of Materials: Classification of Magnetic Materials. Origin of Atomic Magnetism, Classical Langevin Theory of dia-and Paramagnetic Domains. Quantum theory of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism. Concept of Domain Wall, Magnetostriction, Heisenberg's Exchange Interaction, Relation between Exchange Integral and Weiss Constant.

Unit-IV

Superconductivity: Experimental features of superconductivity: Critical Temperature, Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory (No derivation); Cooper Pair and Coherence length. Josephson Effect (No derivation).

Reference Books (Solid State Physics)

1. Introduction to Solid State Physics, Charles Kittel (Wiley Publication)
2. Elementary Solid State Physics, M. All Omar (Pearson Education)
3. Elements of X-ray diffraction, B. D. Cullity (Prentice Hall)
4. Solid State Physics by G.I Epifanov (Mir R publisher)
5. Solid State Physics by S.O.Pillai, Willy Eastern Ltd.

B.Sc. Pt-III SEMESTER-VI

PAPER CODE 22-6011

Physics -II

Quantum Mechanics and Spectroscopy-II (MM 33)

Note: 33 marks assigned to theory papers are distributed in following manner

Continuous evaluation	**10 marks**
Term End Main Exam	**23 marks**

Duration : 3 hour

Note: *In all five questions are to be set in the paper. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will cover entire course and it will be compulsory.*

Unit – I

Solutions of Schrödinger wave equations in special cases: Symmetric square well potential, reflection and transmission coefficients, resonant scattering; Bound state problems: particle in one dimensional infinite potential well and finite depth potential well, energy eigenvalues and eigenfunctions, transcendental equation and its solution; Simple harmonic oscillator, Schrodinger equation for simple harmonic oscillator and its solution, eigenfunction, eigenvalues, zero point energy, quantum and classical probability density, parity, symmetric and antisymmetric wave functions with graphical representation.

Unit – II

Schrödinger equation in spherical coordinates: Schrodinger equation in spherical coordinates, Schrodinger equation for one electron atom in spherical coordinates, separation into radial and angular variables, solution of radial equation and angular equation, qualitative discussion of spherical harmonics, series solution and energy eigenvalues, stationary state wave function. Wave-functions of H-atom for ground and first excited state, average radius of H-atom, Bohr correspondence principle, orbital angular momentum and its quantization, commutation relation, eigenvalues and eigenfunctions.

Unit – III

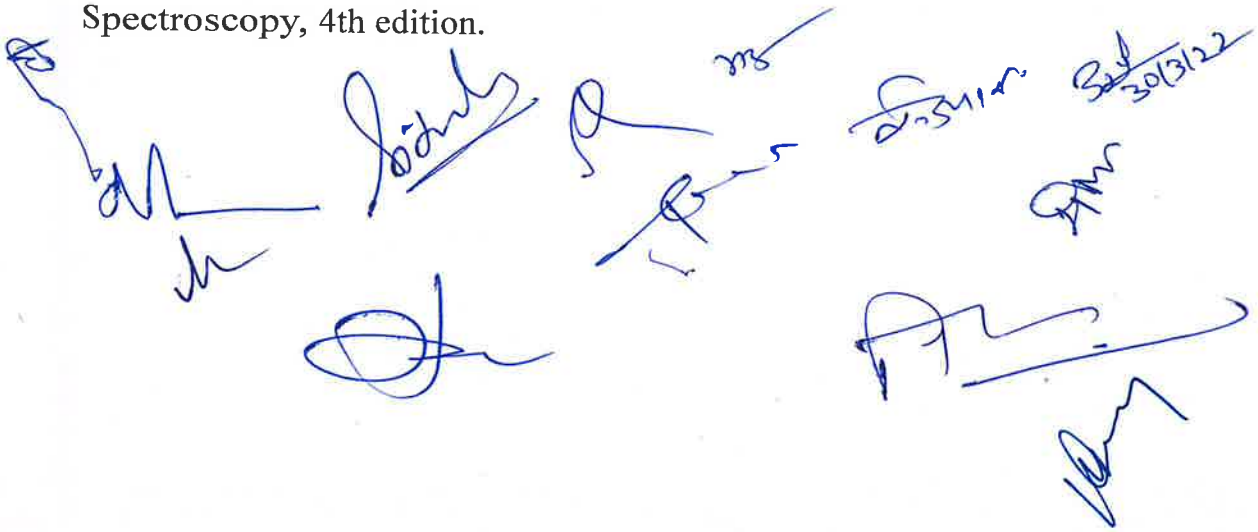
Hydrogen atom spectra: Energy level derivation for H-atom, quantum features of hydrogen spectra and hydrogen like spectra, Stern_Gerlach experiment, electron spin, spin magnetic moment, spin- orbit coupling, qualitative explanation of fine structure, Franck-Hertz experiment, Zeeman Effect, normal Zeeman splitting, Qualitative understanding about Stark effect.

Unit- IV

Molecular spectroscopy: rigid rotator: Absorption and emission spectroscopy, its block diagram, explanation about function of each elements and its limitations; single beam spectrophotometer. Molecular spectroscopy: concept of rigid rotator, rotational energy levels, rotational spectra, selection rules, intensity of spectral lines, isotopic effect; Vibrational energy levels, vibrational spectra, selection rules, isotopic effect, effect of anharmonicity in vibrational spectra, vibrational-rotational spectra of CO and HCI molecules.shapes (graphical representation), quantum mechanical tunneling (alpha decay).

Reference books (Quantam Mechanics and Spectroscopy)

1. David J. Griffiths, Introduction to Quantum Mechanics, 2nd edition.
2. R. Shankar, Principles of Quantum Mechanics, 2nd edition.
3. Arthur Beiser, Perspective of modem Physics, 6th edition.
4. AK Ghatak and S Lokanathan, Quantum Mechanics: Theory and application.
5. HS Mani, GK Mehta, Introduction to modern Physics.
6. C.N. Banwell and E.M McCash,Fundamental of Molecular Spectroscopy, 4th edition.



B.Sc. Pt-III SEMESTER-VI PAPER CODE 22-6012

Physics-III

Nuclear and particle Physics-II (MM 34)

Note: 33 marks assigned to theory papers are distributed in following manner

Continuous evaluation	**10 marks**
Term End Main Exam	**24 marks**

Duration : 3 hour

Note: *In all five questions are to be set in the paper. Four questions will be out of the four units taking one question from every unit with 100% internal choice. Fifth question will cover entire course and it will be compulsory.*

Unit- I

Interaction of Nuclear Radiation with Matter: Energy Loss by Heavy Charged Particles in Matter, Interaction of Electrons with Matter, Range of Charged Particle, Bremsstrahlung, Cherenkov Radiation, Gamma Ray Interaction With Matter.

Unit-II

Radiation Detectors: Gas filled detector, Avalanche, Geiger Discharge, Ionization Chamber, Proportional Counter, Geiger Muller Counter. **Particle Accelerators:** Ion Source, Van-de-Graff Accelerator (Tandem Aceelerator), Linear Accelerator, Cyclotron, Synchrocyclotron, Betatron, Proton Synchrotron

Unit-III

Elementary Particles: Necessity of high energy to discover elementary constituents, historical introduction to discovery of elementary particles (electron, positron, neutrinos, strange mesons, charm quark, intermediate vector bosons, bottom quark, top quark and Higgs boson) Elementary particles and their quantum(charge, spin parity, isospin, strangeness, etc.), elementary particles included in the standard model.

Unit- IV

Fundamental Interactions: Four types of fundamental forces. Symmetries and Conservation Laws, Discrete symmetries C, P, and T invariance. Application of Symmetry arguments to particle reactions. Parity non-conservation in weak interaction, CP violation. **Quark Model:** Flavor symmetries, Gellmann-Nishijima formula, the eight fold way, Quark model, Octet Diagram for Mesons and Baryons, Concept of Quark model, Color Quantum Number and Gluons.

Reference Books (Nuclear and Particle Physics)

1. Nuclear and Particle Physics, W. E. Burcham and M Jobes,Addison Wesley Longman Inc.

2. Nuclear and Particle Physics, Brian R Martin, John Wiley & Sons.

3. Introduction to Nuclear and Particle Physics, Das and Ferbal, World Scientific.

4. Elements of Nuclear Physics, Walter E. Meyerhof, McGraw-Hill Book Company.

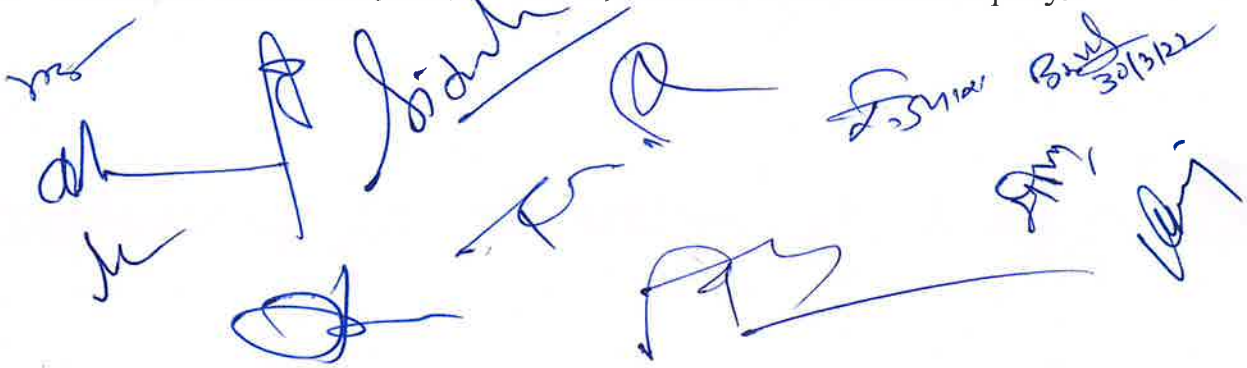
5. Introductory Nuclear Physics, Kenneth S. Krane, John Wiley & Sons.

6. Introduction to Elementary Particles, David J. Griffiths, John Wiley & Sons.

7. Radiation Detection and Measurement, G.F. Knoll (John Wiley & Sons)

8. Introduction to Nuclear and Particle Physics, V. K. Mittal, R. C. Verma, S. C.Gupta,PHI

9. Concepts of Modern Physics, A. Beiser, McGraw-Hill Book Company.



B. Sc Part III

PAPER CODE P-22-6010

PHYSICS PRACTICALS SYLLABUS

Note:- Total number of experiments to be performed by the students during the session should be 16 selecting and 8 from each section.

Section – A

1. Determination of Planck's constant by photo cell using optical filters.
2. Determination of Planck's constant using solar cell.
3. Determination of Stefan's constant (Black body method).
4. Study of the temperature dependence of resistance of a semi –conductor (four probe method).
5. Study of Iodine spectrum with the help of grating and spectrometer and ordinary bulb light.
6. Study of characteristics of GM counter and verification of inverse square law for the same strength of a radioactive source.
7. Study of β-absorption in AL foil using GM Counter.
8. To find the magnetic susceptibility of paramagnetic solution using Quinck's method. Also find the ionic molecular susceptibility of the ion and magnetic moment of the ion in terms of Bohr magneton.
9. Determination of coefficient of rigidity as a function of temperature using torsional oscillator (resonance method).
10. Study of polarization by reflection from a glass plate with the help of Nichol's Prism and photo cell and verification of Brewster law and law of Malus.
11. e/m measurement by helical Method.
12. Measurement of magnetic field using ballistic galvanometers and search coil. Study of variation of magnetic field of an electromagnet with current.
13. Measurement of electric charge by Millikan's oil drop method.

Section – B

1. Study of R-C transmission line at 50 Hz
2. Study of L-C transmission line
   (i) At fixed frequency.
   (ii) At variable frequency.
3. Study of resonance in an LCR circuit (using air core inductance and damping by metal plate).
   (i) At fixed frequency by varying C, and
   (ii) By varying frequency.
4. Study of the characteristics of junction diode & Zener diode.
5. Study of
   (i) Recovery time of junction diode and point contact diode.
   (ii) Recovery time as a function of frequency of operation and switching current.
6. To design Zener regulated power supply and study the regulation with various loads.
7. To study the characteristics of a field effect transistor (FET) and design/study amplifier of finite gain.
8. To study the frequency response of a transistor amplifier and obtain the input and output impedence (frequency response with change of component of R and C).
9. To design and study of an R-C phase shift oscillator and measure output impedence (frequency response with change of component of R and C).
10. To study a voltage multiplier circuit of generate high voltage D.C. from A.C.
11. Using discrete components, study OR, AND, NOT logic gates, compare with TTL integrated circuits (I.C's).
12. Application of operational amplifier (OP-AMP) AS : Minimum two of the following exercises- (a) Buffer (for accurate voltage measurement) (b) Inverting amplifier (c) Non inverting amplifier.