FACULTY OF SCIENCE

SYLLABUS OF BSC PHYSICS

B.Sc. (PHYSICS)(3 yrs Programme)

First Year

Code No.	Subject	Internal Marks	External Marks	Total
BPHY101	Mechanics, Oscillation and Properties of Matter	30	70	100
BPHY102	Electricity, Magnetism & Electromagnetic Theory	30	70	100
BPHY103	Properties of Matter and Kinetic Theory of Gases	30	70	100
BPHY104	Physical Chemistry-I	30	70	100
BPHY105	Inorganic Chemistry -I	30	70	100
BPHY106	Organic Chemistry- I	30	70	100
BPHY107	Diversity of Cryptogams and Gymnosperms	30	70	100
BPHY108	Algebra and Trigonometry	30	70	100
BPHY109	Invertebrate and vertebrate	30	70	100
BPHY110	Fundamentals of IT	30	70	100
BPHY111	English -I	30	70	100
BPHY112	Hindi –I	30	70	100
BPHY101-P	Mechanics, Oscillation and Properties of Matter-Lab	20	30	50
BPHY102-P	Electricity, Magnetism & Electromagnetic Theory-Lab	20	30	50
BPHY103-P	Properties of Matter and Kinetic Theory of Gases-Lab	20	30	50
BPHY108-P	Fundamentals of IT-LAB	20	30	50
	Total	**440**	**960**	**1400**

Second Year				
Code No.	**Subject**	**Internal Marks**	**External Marks**	**Total**
BPHY201	Kinetic Theory , Thermodynamics and Statistical Physics	30	70	100
BPHY202	Waves, Acoustics and optics	30	70	100
BPHY203	Semiconductor Devices	30	70	100
BPHY204	Linear and Digital Integrated Circuits and Instruments	30	70	100
BPHY205	Physical Chemistry-II	30	70	100
BPHY206	Inorganic Chemistry-II	30	70	100
BPHY207	Organic Chemistry-II	30	70	100
BPHY208	General Microbiology and Biochemistry	30	70	100
BPHY209	Advanced-Calculus	30	70	100
BPHY210	Environmental science	30	70	100
BPHY211	English -II	30	70	100
BPHY212	Hindi -II	30	70	100
BPHY201-P	Kinetic Theory , Thermodynamics and Statistical Physics-Lab	20	30	50
BPHY202-P	Waves, Acoustics and optics -Lab	20	30	50
BPHY203-P	Semiconductor Devices -Lab	20	30	50
BPHY204-P	Linear and Digital Integrated Circuits and Instruments-Lab	20	30	50
	Total	**440**	**960**	**1400**

Third Year

Code No.	Subject	Internal Marks	External Marks	Total
BPHY301	Relativity, Quantum Mechanics, Atomic, Molecular and Nuclear physics	30	70	100
BPHY302	Solid State Physics, Solid State Devices and Electronics	30	70	100
BPHY303	Atomic and Molecular Spectroscopy	30	70	100
BPHY304	Mathematical Physics	30	70	100
BPHY305	Thermal Physics	30	70	100
BPHY306	Physics of Materials	30	70	100
BPHY307	English -III	30	70	100
BPHY308	Hindi -III	30	70	100
BPHY302-P	Solid State Physics, Solid State Devices and Electronics-Lab	20	30	50
BPHY303-P	Atomic and Molecular Spectroscopy-Lab	20	30	50
BPHY304-P	Mathematical Physics-Lab	20	30	50
BPHY305-P	Thermal Physics-Lab	20	30	50
BPHY306-P	Physics of Materials-Lab	20	30	50
	Total	**340**	**710**	**1050**

BPHY101

External Marks: 70
Internal Marks: 30

Mechanics, Oscillation and Properties of Matter

Unit: I

Mechanics

Laws of motion, motion in a uniform field, components of velocity and acceleration in different coordinate systems. Motion under a central force, Kepler's laws Gravitational law and field ,motion of a satellite, System of particles, center of mass, equation of motion conservation of linear and angularmomentum,conservationofenergy,elasticandinelasticcollisions.

Unit: II

Oscillations and Rigid Body Motion

Rigid body motion, rotational motion moment of inertia and their products, Theorem on moment of Inertia, principal moments and axes, Euler's equations. Potential well and periodic oscillations ,case o harmonic oscillations,differentialequationanditssolution,kineticandpotential energy, examples of simple harmonic oscillations, spring and mass system.

Unit: III

Super position of Harmonic Motions

Principle of superposition, Superposition of two simple harmonic motions of the same frequency along the same line, interference, superposition of two mutually perpendicular simple harmonic vibrations of the same frequency, Lissjous figures, case of different frequencies. Two coupled oscillators damped harmonic oscillator, power dissipation, quality factor, examples, power absorption, resonance in systems with many degrees of freedom.

Unit: IV

Motion of charged particles in Electric and magnetic fields

E as an accelerating field, electron gun, case of discharge tube, linear accelerator. E as deflecting field, CRO, sensitivity, Transverse B field 180^0 deflection, velocity selector, curvature of tracks for energy determination of nuclear particles, principle of a cyclotron. Mutually perpendicular E and B fields, its resolution. Parallel E and B fields, positive ray parabolas,

Unit: V

Properties of matter.

Elasticity, small deformations, Hook's law, elastic constants for an isotropic olid, beam supported at both the ends, cantilever, torsion of a cylinder, bending moment and shearing forces. Poisson's rays, Relation blow.

Equation of continuity, Euler's equation, Bernoulli's theorem, viscous fluids, stream line and Turbulent flow, poiseulle's law capillary tube flow, Reynolds' snumber, Stoke's law.

Surface tension and surface energy, molecular interpretation of surface tension pressure on a curved liquid surface, wetting.

BPHY102 External Marks: 70
Internal Marks: 30

Electricity, Magnetism & Electromagnetic Theory

Unit: I

Mathematical Background

Scalars and vectors, dot and cross products, triple vector product ,gradient of a scalar field and its geometrical interpretation , divergence and line , surface and volume integrals, flux of vector field Gauss divergence theorem , Green's Theorem and stake's Theorem .

Unit: II

Electrostatics

Law of conservation of charge, coulomb's law calculations of E for simple distributions of charges at rest, dipole and quadruple fields. Work done on a charge in an electro static field expressed as a line integral. Conservative nature of the electro static field . Electric potential torque on a dipole in a uniform electric field and its energy, flux of the electric field, Gauss's law and its application for finding E symmetric charge distributions, Gaussian pillbox , field at the surface of a conductor. Screening of E field by a conductor, capacitors, electro static field energy. Force perunitare a on the surface of a conductor in an electric field. Conducting sphere in a uniform electric field point charge infront of a grounded infinite conductor. Dielectrics, parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector, displacement vector D.

Unit: III

Electric Currents (Steady and Alternating)

Steady current, current density J, non – steady currents and continuity equation, Kirchoff's law and analysis of multi loop circuits, rise and decay of current in LR and CR circuits, decay constants, transients in LCR circuits, AC circuits, complex numbers and their applications in solving AC circuit problem complex impedance and reactance, series and parallel resonance, Q factor power consumed by an ACcircuit,powerfactor,Yandnetworksandtransmissionofelectricpower.

Unit: IV

Magneto statics

Force on a moving charge Lorentz force equation and definition of B force on a straight conductor carrying current in a uniform magnetic field, torque on a current loop, magnetic dipole moment, angular momentum and gyro magnetic ratio. Biot and savart's law calculation of Horder in simple geometrical situations, Ampere's law field due to a magnetic dipole, magnetization current, magnetization vector, Half order field magnetic permeability(linear cases), interpretation of a bar magnet as a surface distribution of solenoid current.

Unit-V

Time varying fields and Electromagnetic waves

Electromagnetic induction, Faraday's law, electromotive force, integral and differential form of faraday's law, mutual and self inductance, transformers, energy in a static magnetic field. Maxwell's displacement

BPHY103

External Marks: 70
Internal Marks: 30

Properties of Matter and Kinetic Theory of Gases

Unit I:

Moment of inertia Rotation of rigid body, Moment of inertial, Torque, angular momentum, Kinetic Energy of rotation. Theorem of perpendicular and parallel axes (with proof), Moment of inertia of solid sphere, hollow sphere, spherical shell, solid cylinder, hollow cylinder and solid bar of rectangular cross–section, Fly wheel, Moment of inertia of an irregular body, Acceleration of a body rolling down on an inclined plane.

Unit 2:

Elasticity Elasticity, Stress and Strain, Hook's law, Elastic constant and their relations, Poisson's ratio, Torsion of cylinder and twisting couple, Determination of coefficient of modulus of rigidity for the material of wire by Maxwell's needle, Bending of beam (Bending moment and its magnitude), Cantilever and Centrally loaded beam, Determination of Young's modulus for the material of the beam and Elastic constants for the material of the wire by Searle's method.

Unit 3:

Kinetic theory of gases-I Assumption of Kinetic theory of gases, pressure of an ideal gas (with derivation), Kinetic interpretation of Temperature, Ideal Gas equation, Degree of freedom, Law of equipartition of energy and its application for specific heat of gases, Real gases, Vander wall's equation, Brownian motion(Qualitative)

Unit 4:

Kinetic theory of gases-II Maxwell's distribution of speed and velocities (derivation required), Experimental verification of Maxwell's law of speed distribution: most probable speed, average and r.m.s. speed, Mean free path, Transport of energy and momentum, Diffusion of gases.

Reference:

1. Properties of Matter by D.S. Mathur.

2. Heat and Thermodynamics (5th Edition) by Mark W. Zermansky.

BPHY104

External Term: 70
Internal Marks: 30

Physical Chemistry-I

UNIT-I :Mathematical Concepts

Logarithmic relations, curves stretching, linear graphs and calculation of slopes,Differentiation of functions like Kx, ex, xn, sinx, logx; maxima and minima, partialdifferentiation and reciprocity relations. Integration of some useful / relevant functions;permutations and combinations. Factorials, Probability, General introductions to computers,different components of a computers. Hardware and software, input-output devices, binarynumbers and arithmetic; introduction to computer languages, Programming and operatingsystems.

Unit-2 Gaseous States

Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of State, Critical phenomenon: PV isotherms of ideal gases, continuity of states,theisotherms of van der Waals equations, relationship between critical constants and vander Waalsconstants, the law of corresponding states, reduced equation of state, Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell'sdistribution of molecular velocities, collision numbers, mean free path and collision diameter, Liquefaction of gases (based on Joule Thompson effect).

Unit 3: Liquid State

Intermolecular forces, structure of liquids (a qualitative description) Structural differences between solids, liquids and gases.Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure ofnematic and cholestic phases. Thermography and seven segment cell.

Colloidal State

Definition of colloids, classification of colloids. Solids in liquids (sols): properties- Kinetic,optical and electrical ; stability of colloids, protective action, Hardy-Schulz law, gold number.Liquids in liquids (emulsions) types of emulsions, preparation. Emulsifier. Liquids in solids(gels): classification, preparation and properties, inhibition, genera applications of colloids.

Unit- 4 Solid State

Definition of space lattice, Unit cell Laws of crystallography - (i) Law of constancy ofinterfacial angles (ii) Law of rationality of indices (iii) Laws of symmetry. Symmetry elementsin crystals, X-ray diffraction by crystals. Derivation of Bragg.s equation. Determination ofcrystal structure *of* NaCI, KC1 and CsCI (Laue'c method and powder method.) Catalysis.characteristics of catalysed reactions, classification of catalysis miscellaneous. Examples

Unit- 5 Chemical Kinetics-

Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction concentration, temperature, pressure, solvent, light, catalyst concentration dependence ofrates, mathematical characteristics of simple chemical reactions- zero. order, pseudo order,half life and mean life Determination of the order of reaction differential method, method ofintegration, method of half life period and isolation method. Experimental methods ofchemical kinetics-conduct metric, potentiometic, optical methods, polarimetry andspectrophotometer. Theories of chemical kinetics: effect of temperature on rate of reactiArrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis.) Expression for the rateconstant based on equilibr ium constant and thermodynamic aspects.

BPHY105

External Term: 70
Internal Marks: 30

Inorganic Chemistry-I

Unit I: Atomic Structure

Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrödinger wave equation, significance of ψ and ψ2 , quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, and d orbitals. Aufbau and Pauli exclusion principles, Hund.s multiplicity rules, Electronic configurations of the elements, effective nuclear charge, Atomic and ionic radii, ionization energy, electron Affinity and electronegativity: definition, method of determination, trends in periodic table and applications.

Unit II : Chemical Bonding

Covalent bond- valence bond theory and its limitations, directional characteristic of covalent bond, Hybridization and shapes of simple molecules and ions. Valence Shell Electron Pair Repulsion (VSEPR) theory to NH3, SF4, ClF3, ICl4 -.and H2O Molecular Orbital theory for homonuclear and heteronuclear (CO and NO) diatomic molecules, multi-center bonding in electron deficient molecules, bond strength and the bond energy, % ionic character from dipole moment and electronegativity difference. W eak interactions , hydrogen bonding, van der Waals forces.

Unit III Ionic Solids

Ionic structures , radius ratio effect and coordination number, limitation of radius ratio rule, Lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions. Fajan.s rule, Metallic bond free electron, Valance bond and Band theories Comparative study, diagonal relationships, salient features of hydrides, salvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.

Unit IV p-Block Elements

Comparative study (including diagonal relationship) of groups 13-17 elements,compounds like hydrides, oxides, oxyacids and halides of groups 13-16 Hydrides of boron-diborane and higher boranes. Borazine, borohydrides

Unit V p-Block elements

Fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens. Chemical properti gases, chemistry of xenon, structure and bonding in xenon compounds.

BPHY106

External Term: 70
Internal Marks: 30

Organic Chemistry-I

Unit I Structure and Bonding

Hybridizations, Bond lengths and bond angles, bond energy : Localized and delocalized chemical bond, van-der W aals interactions, inclusion compounds, clatherates, charge transfer complex, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding, **Mechanism of Organic reactions** : Curved arrow notations, drawing electron movement with arrows, half headed and double headed arrow, homolytic and heterolytic bond breaking Electrophiles and nucleophiles. Types of organic reactions. Energy consideration. Reactive intermediates- carbocations, carbanions, free radicals and carbenes. Methods of determination of reaction mechanism.

Unit II Stereochemistry

Concept of isomerism, types of isomerism, optical isomerism, elements of symmetry, molecular chirallity, enantiomers, stereogenic centres, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, distereoisomers, mesocompounds, resolution of enantiomers, inversion, retention and racemization.
Relative and absolute configurations, sequence rules, D & L , R & S systems of nomenclature, Nomenclature E and Z system, geometrical isomerism in alicyclic compounds. Conformation, conformational analysis of ethane and n-butane. Conformations of cyclohexanes, axial and equatorial bonds, Newman projection and Saw horse formulae, Fischer and Flying wedge formulae.

Unit III Alkanes, Cycloalkanes and Aromaticity

IUPAC nomenclature, classification, isomerism in alkanes, sources, and methods of preparation (with special reference to Wurtz, Kolbe., Corey.House, reactions and decaroxylation of carboxylic acids), Physical properties and chemical reactions of alkanes. Mechanism of free radical halogination of alkanes, Cycloalkanes : nomenclature, methods of preparations, chemical reactions. Bayer.s strain theory and its limitations. ring strain in cyclopropane and cyclobutanes. Theory of stainless rings, Nomenclature of benzene derivatives. The aryl group Aromatic nucleus and side chain Structure of benzene molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure. MO picture. Aromaticity the Huckel rule, aromatic ions. Aromatic electrophilic substitution general pattern of the mechanism, role of (a and n complexes) Mechanism of nitration, halogenation. sulphonation. mercuration and Friedel-Crafts reaction Energy profile diagrams. Activating and deactivating substituents. orientation and ortho/pararatio. Side chain reactions of benzene derivatives. Birch reduction. Methods of formationand chemical reactions of alkylbenzenes, alkynylbenzenes and biphenyl

Unit-IV Alkenes Cycloalkanes, Dienes and alkynes

Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regio-selectivity in alcohol dehydration the Saytzeff rule, Hoffmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff.s rule, hydroboration-oxidation oxymercurationreduction, Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO4, polymerization of alkenes, Substitution at the allylic and vinylic positions of alkenes, ndustrial applications of ethylene and propene.

Methods of formation, conformation and chemical reactions of cycloalkenes nomemclature and classification of dienes: isolated conjugated and cumulated dienes, Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions-1,2 and 1,4 additions, Diels Alder reaction. Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes, Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidatiion and polymerization

Unit-V Alkyl and Aryl Halides

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions echanims of nucleophilic substitution reaction of alkyl halides, SN2 and SN1 reactions,

with energy profile diagrams. Polyhalogen compounds: chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides versus allyl, vinyl and aryl halides, Synthesis and uses of DDT and BHC, Freon.

BPHY107 External Marks: 70
Internal Marks: 30

Diversity of Cryptogams and Gymnosperms

Unit I

Algae: General Characteristics of Algae. Important Features of Chlorophyceae, Pheaophyceae and Rhodophyceae. - Life Cycle of Spirogyra, Ectocarpus, Polysiphonia. Economic Importance of Algae.

Unit II

Fungi:General Characteristics of Fungi. Out line of Structure, Mode of Nutrition and Life History of Zygomycetes (Mucor), Ascomycetes (Peziza), Basidiomycetes (Ustilago nuda, Puccinia graminis), and

Deuteromycetes (Alternaria solani) . Economic Importance of Fungi.

Unit III

Bryophyta: General Characteristics of Bryophytes. Comparative study of sporophytes of Bryophytes.

Life Cycle of Marchantia and Polytrichum.

Unit IV

Pteridophyta: General Characterstics of Pteridophytes. Stelar organization. Homospory and Heterospory.

Life cycle of Pteris. **Gymnosperms** General Characterstics of Gymnosperms.Resemblances and differences of Gymnosperms with Pteridophytes and Angiospperms, Life Cycle of Pinus.

Reference Books

Diversity of Cryptogams and Gymnosperms

1. Chapman V.J & Chapman D.J, The Algae, Macmillan India Ltd.

2. Fritsch F. B 1945, Structure and Reproduction of Algae Vol.I & II.Cambridge University Press.

3. Bilgrami, K.S. and Saha, L.C., 2001, A text Book Of Algae, CBS, Publishers, New Delhi.

4. Kamat, N.D. , 1982, Topics in algae, Sai Kripa Prakashan, Aurangabad.

5. Kumar, H.D. 1999, Introductory Phycology, East West Press, New Delhi.

6. Smith G.M 1955, Cryptogamic Botany Vol.I, McGraw Hill.

7. Vashishta B.R 1990, Botany for Degree Students, Algae, S.Chand & Co.

8. Singh V., Pandey P.C and Jain D.K 1998, A Text book of Botany for Undergraduate Students, Rastogi Publications.

9. Alexopoulos C.J & MIMS C.V 1988. Introductory Mycology, John Wiley & Sons.Smith G.M 1955, Ciyptoganiic Botany, Vol.I McGraw Hill.

10. Vashishta B.R. 1990, Botany for Degree Students, Fungi, S.Chand & Co. Webster J 1970, Introduction to Fungi, Cambridge University Press.

11. Sharma P.D.;The Fungi:Rastogi and company.,Meerut.

12. Parihar N.S 1967, An Introduction to Embryophyta Vol I & II, General Book Depot.

13. Prempuri 1973, Bryophytes - A Broad perspective. Atmaram & Sons.

14. Smith G.M 1955, Cryptogamic Botany Vol.II. McGraw Hill.

15. Sporne K.R 1976, Morphology of Pteridophytes, B1 Publications.

16. Vashista B.R 1978, Bryophytes, S.Chand & Co.

17. Vashista P.C 1976, Botany for Degree Students Vol IV. S.Chand & Co.

18. Vashista P.C, Pteridophyta: S Chand publications.

19. Vashista P.C, Gymnosperms: S Chand publications.

20. Vashista P.C, Bryophyta: S Chand publications.

21. Biodiversity and Quality of Life. Sengupta. Mc Millan India Pvt. Ltd.

22. Lee.R.E.,1999,Phycology,Cambridge University Press, Cambridge.

23. A.J.,Lack and D.E.Evans:Plant Biology:Viva books Pvt.Ltd.

24. Sharma O.P: Text book of Pteridophyta II edition:McMillan India Ltd.

BPHY108

External Term: 70
Internal Marks: 30

Algebra and Trigonometry

Unit-1

Linear independence of row and column matrices, Row rank, column rank and rank of a matrix. Equivalence of column and row ranks. Eigen values, Eigen Vector and the characteristic equation of a matrix cayley Hamilton theorem and its use in finding inverse of a matrix.

Unit-2

Applications of matrices to system of linear (both homogenous and non-homogeneous) equations. Theorems on consistency of a system of linear equations. Relations between the roots and coefficients of general polynomial equation in one variable . Transformation of equation. Descartes' rule of signs. Solution of cubic equations (Cardoon method)

Unit-3

Definition of a group with example and simple properties. Sub groups. Cyclic groups. Cosset decomposition. Lagrange's theorem and its consequences. Fermat's and Euler's theorems. Homomorphism and and isomorphism . Normal subgroup. Quotient groups.

Unit-4

The fundamental theorem of homomorphism. Permutation groups. Even and odd permutations. The alternating groups An Cayely's theorem. Introduction to flings. Sub rings .integral domains and fields. Characteristics of a ring.

Unit-5

Demovire's theorem and its applications. Direct and inverse circular and hyperbolic functions .Logarithm of a complex quantity. Expansion of trigonometrically functions.

BPHY109

External Term: 70
Internal Marks: 30

Invertebrate and vertebrate

Unit-I

Classification of Non Chordates upto classes according to Parker sand eswell.(7thEdition)

1. Classification of lower Invertebrates.
2. Classification of higher invertebrates.
3. Protozoa – Type study of Plasmodium.
4. Porifera – Type study of Sycon.

Unit-II

1. Coelenterata – Type study of Obelia.
2. Helminthes – Type study of Liver Fluke.
3. Annelida – Type study of Earthworm, Metamerism, Trochophore Larva.

Unit-III

1. Arthropoda – Type study of Prawn.

2 Mollusca – Type study of Pila.

3. Echinodermeta – External Features of Star Fish and Echinoderm Larvae.

Unit-IV

1. Origin of Chordates. Classification of phylum Chordata upto orders according to Parker and Haswell (Latest edition).
2. Hemichordata – External features and affinities of Balanoglossus.

Unit-V

1. Urochordata – Type study of Herdmania (excluding Development). Cephalochordata – Type study of Amphioxus. Affinities of Amphioxus.

Practical:

The Practical's work will be based on theory syllabus and the candidates will be required to show knowledge of the following –

1. Study of Museum Specimens, slides relevant to the type study in theory
2. Mounting (Temporary)
    a. Mouth parts of insects
    b. Statocyst of Prawn
    c. Ctenidium and Osphradium of Pila
    d. Scales of Teleost fish
    e. Mounting Material
3. Major Dissection
    a. Earthworm: Digestive system, nervous system and reproductive system.
    b. Cockroach: Digestive system,Nervous systm,
    c. Prawn: Nervous System, Appendages.
4 Minor Dissection
    a. Hastate plate and appendages of Prawn.
    b. Salivary glands of Cockroach.
    c. Radula of Pila.
5. Cell Biology
    a. Study of Prokaryotic and eukaryotic cell.
    b. Study of DNA and RNA models.
    c. Squash preparation of chromosomes from onion root tip.
    d. study of meiosis in grasshopper testis.

BPHY110 External Marks: 70
Internal Marks: 30

Fundamentals of IT

Objectives: **This is a basic paper for Commerce students to familiarize with computer and it's applications in the relevant fields and exposes them to other related papers of IT.**

UNIT – I

Introduction to Computers:

The evolution of computers - Computer Generation from First Generation to Fifth Generation, Classifications of Computers - Micro, Mini, Mainframe and Super Computers, Distributed Computer System, Parallel Computers.

Computer Hardware – Major Components of a Digital Computer, Block Diagram of Computer, Input-Output devices, Description of Computer Input Units, Output Units, CPU

Computer Memory - Memory Cell, Memory Organization, Read Only Memory, Serial Access Memory, Physical Devices Used to construct Memories, Magnetic Hard disk, floppy Disk Drives, Compact Disk Read Only Memory, Magnetic Tape Drives.

UNIT – II

Number System:

Decimal, Binary, Octal, Hexa-decimal. Conversion - Decimal to all other number systems, Binary to octal and Hexa Decimal, Addition of binary numbers, Binary subtraction, Use of complements to represent negative numbers, Conversion of a binary fraction to a decimal fraction and decimal to binary fraction, Binary Coded Decimal(BCD), ASCII Codes, EBCDIC codes, Gray codes, Unicodes.

Algorithm and Flowcharts:

Algorithm: Definition, Characteristics, Advantages and disadvantages, Examples
Flowchart: Definition, Define symbols of flowchart, Advantages and disadvantages, Examples

UNIT – III

Computer Software:

System software, assemblers, compilers, interpreters, linkers Elementary , Operating System concepts, different types of operating systems, Application Software.
Introduction to MS Office (MS-Word, MS PowerPoint, MS-Excel)
Computer Programming and Languages: Algorithms, flow chart, decision tables, pseudo code, Low level languages and introduction to high level languages.

UNIT – IV

Data Communication and Computer Networks:

Data Transmission mode, Data transmission media, Digital and Analog Transmission
What is computer Network? Network types, Network Topologies, Communication Protocol, OSI Model

UNIT - V

The Internet:

Definition, Brief History, Network Types (LAN, WAN and MAN), Client and Servers, Intranet, Extranet. Basic Services, Email, File Transfer Protocol, Telnet, Usenet News, Terminologies related to Internet: Protocol, Domain name, IP address, URL, World Wide Web.
Overview of various services on Internet: E-mail, FTP, Telnet, Chat, Instant Messaging
Internet Search Tools: Gopher, Archie, World Wide Web.
WWW Browsers: Line Browsers, Graphical Browsers, Java Enabled Browsers.

Uses of the Internet: Internet Service Providers and Types of Internet Connection: Direct/Leased line Connection, Remote Dial up Connection, SLIP/PPP Connection

Text Books:

1. Alex Leon & Mathews Leon, "Fundamentals of Information Technology", LeonTechworld, 1999.
2. Vikas Gupta, "Comdex Computer Kit", Wiley Dreamtech, Delhi, 2004
3. P. K. Sinha & Priti Sinha , "Computer Fundamentals", BPB Publications, 1992.

Reference Books:

1. V. Raja Raman, "Introduction to Computers", PHI, 1998.
2. Alex Leon & Mathews Leon, "Introduction to Computers", Vikas Publishing House, 1999.

Norton Peter, "Introduction to computers", 4th Ed., TMH, 2001.

BPHY111

External Term: 70
Internal Marks: 30

English-I

Objective: The objective of this course is to familiarize students about the dynamics of business language and discourse.

Unit -I

Texts: (Any Five)

1. Nirendranath Chakrabarti, "Amalkanti". (From oxford Anthology of Modern Indian Poetry, eds. Dharwadkar and Ramanujan).
2. Toru Dutt, "Sita"
3. Jawaharlal Nehru, "Tryst with Destiny".
4. Mirza Ghalib, "Delhi in 1857".
5. C. Rajagopalachari, Preface to the Mahabharata.
6. Nibir K. Ghosh, "Spiritual Nationalism of Sri Aurobindo".
7. Madhumalati Adhikari, "The Heritage of Indian Culture".
8. Rabindranath Tagore, "Where the Mind is Without Fear".
9. Kabir, one song translated by Tagore.
10. M.K. Gandhi, extract from "Satyagraha".
11. R.K. Narayan, "Toasted English".
12. Ruskin Bond," The Old Lama".
13. Khushwant Singh, " The Portrait of a Lady".
14. Ashok Mahadevan and Sushan Shetty,"Discovering Babasaheb", Section on "Clash of Titans" (Reader's Digest, December 2006).

Unit -II

Comprehension of an unseen passage:

Questions should be objective/multiple choice, and should test (a) an understanding of the passage in question, and (b) a grasp of general language skills and issues with reference words and usage within the passage.

Unit -III Paragraph

Writing:

Based on expansion of an idea. Word Limit :100-150 words. Candidates to attempt any one of three alternative topics provided

Unit -IV

Basic language skills-Vocabulary:

Synonyms, antonyms, one- word substitution for phrases, prefixes, suffixes and word -derivation. Making sentences with idioms and phrases, corrections of sentences with words likely to be confused. Questions should not repeat examples or exercises given in the textbook.

Unit -V

Basic language skills - Grammar and Usage:

Modals, linking device, tenses and prepositions. Verb forms and structures, gerunds, participles and infinitives, verbs followed by a preposition and phrasal verbs, articles and determiners, countable and uncountable nouns, adjectives and articles. Questions should not repeat the examples or exercises given in the textbooks.

BPHY112

External Marks: 70
Internal Marks: 30

Hindi- I

आधार पाठ्यक्रम

प्रश्न पत्र – प्रथम

पाठ्य विषय

इकाई–1 पल्लवन, पत्राचार तथा अनुवाद एवं पारिभाषिक शब्दावली ।

इकाई–2 मुहावरे–लोकोक्तियाँ, शब्दशुद्धि, वाक्य शुद्धि, शब्द ज्ञान–पर्यायवाची, विलोम, अनेकार्थी, समश्रुत (समानोचरित) अनेक शब्दों के लिए एक शब्द ।

इकाई–3 देवनागरी लिपि की विशेषता, देवनागरी लिपि एवं वर्तनी का मानक रूप ।

इकाई–4 कम्प्यूटर में हिन्दी का अनुप्रयोग, हिन्दी में पदनाम ।

इकाई–5 हिन्दी अपठित, संक्षेपण, हिन्दी में संक्षिप्तीकरण ।

पाठ्य क्रम के लिए पुस्तकें –

1. भारतीयता के स्वर साधन धनंजय वर्मा – म. प्र. ग्रंथ अकादमी ।
2. नागरी लिपि और हिन्दी – अनंत चौधरी – ग्रंथ अकादमी पटना ।
3. कम्प्यूटर और हिन्दी – हरिमोहन – तक्षशिला प्रकाशन, दिल्ली ।

BPHY108-P

External Marks: 30
Internal Marks: 20

Fundamentals of IT LAB

1. Text Manipulations
2. Usage of Numbering, Bullets, Tools and Headers
3. Usage of Spell Check and Find and Replace
4. Text Formatting
5. Picture Insertion and Alignment
6. Creation of Documents Using Templates`
7. Creation of Templates
8. Mail Merge Concept
9. Copying Text and Picture From Excel
10. Creation of Tables, Formatting Tables
11. Splitting the Screen
12. Opening Multiple Document, Inserting Symbols in Documents

MS-EXCEL

1. Creation of Worksheet and Entering Information
2. Aligning, Editing Data in Cell
3. Excel Function (Date, Time, Statistical, Mathematical, Financial Functions)
4. Changing of Column Width and Row Height (Column and Range of Column)
5. Moving, copying, Inserting and Deleting Rows and Columns
6. Formatting Numbers and Other Numeric Formats
7. Drawing Borders Around Cells
8. Creation of Charts Raising Moving
9. Changing Chart Type
10. Controlling the Appearance of a Chart

MS -POWER POINT

Working With Slides

1. Creating, saving, closing presentation
2. Adding Headers and footers
3. Changing slide layout
4. Working fonts and bullets
5. Inserting Clip art: working with clipart,
6. Applying Transition and animation effects
7. Run and Slide Show

DOS

1. Basics of DOS
2. DOS (Internal & External Commands)
3. Use of Wild Card Character

.

Year-2

BPHY201 External Marks: 70
Internal Marks: 30

Kinetic Theory , Thermodynamics and Statistical Physics

Unit: I

Kinetic Theory of Matter

Ideal Gas : Kinetic model, deduction of Boyle's law ' interpretation of temperature, estimation of r.m.s speeds of molecules , Brownian motion , estimate of the Avogadro number . Equipartition of energy , specific heat of monatomic gas , extension to di-and triatomic gases. Behaviour at law temperatures. Adiabatic expansion of an ideal gas, application to atmospheric physics .

Real Gas : vander Waals gas, equation of state, nature of vander Waals forces, comparison with experimental P-V curves. The critical constants, gas and vapour. Joulr expansion of ideal gas, and of a vender Waals gas, Joule coefficient, estimation of J-T cooling.

Liquefaction of gases: Boyle temperature and inversion temperature. Principal of regenerative cooling and of cascade cooling liquefaction of hydrogen and helium. Refrigeration cycles, meaning of efficiency.

Unit: II

Thermodynamics

The laws of thermodynamics : The zeroeth law, various indicator diagrams, work done by and on the system, first law of thermodynamics, internal energy as a state function and other application. Reversible and irreversible changes, Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics. Different version of the second law, practical cycles used in internal combustion engines. Entropy, principal of increase of entropy. The thermodynamic scale of temperature; its identity with the perfect gas scale. Impossibility of attaining the absolute zero; third law of thermodynamics.

Thermodynamic relationships: Thermodynamic variables; extensive and intensive, Maxwell's general relationships application to Joule-Thomson cooling and adiabatic cooling in a general system, vender Waals gas, Clausius-Clapeyron heat equation. Thermo dynamic potentials and equilibrium of thermo dynamical systems, relation with thermo dynamical variables. Cooling due to adiabatic demagnetization, production and measurement of very low temperatures.

Unit : III

Statistical Physics

The statistical basis of thermo dynamics : Probability and thermodynamic probability, principal of equal a priori probabilities, probability distribution and its narrowing with increase in number of particles. The expressions for average properties. Constraints, accessible and inaccessible states, distribution of particles with a given total energy into a discrete set of energy states.

Some universal laws : The mu space representation, division of mu space into energy sheets and into phase cells of arbitrary . size. applications to one - dimensional harmonic oscillator and free particles. Equilibrium between two systems in thermal contact , bridge with macroscopic physics. Probability and thermodynamics, Boltzmann canonical distribution law and its applications ; ideal gas; Distribution speeds and of velocities experimental verification, distinction between mean , r.m.s. and most probable

speed values. Doppler broadening of spectral lines.

Unit: lV

Transport Phenomena and Black Body Radiation

Transport phenomena in gases : Molecular collisions, mean free path and collision cross sections. Estimates of molecular diameter and mean free path . Transport of mass , momentum and energy and inter - relationship , dependence on temperature and pressure .

Black body radiation : Pure temperature dependence, Stefan- Boltzmann law , pressure of radiation . Spectral distribution of black body radiation , wien's displacement law, Rayleigh - Jean's law, the ultraviolet catastrophy , Planck's quantum postulates , Planck's law, Complete fit experiment , Interpretation of behavior of specific heats of gases at low temperature.

Unit: V

Quantum Statistics and laser

Transition to quantum statistics : 'h' as a natural constant constant and its implications , cases of particle in one dimensional box and one dimensional harmonic oscillator . In distinguish ability of particles and its consequences , Bose - Einstein , and Fermi - Dirac conditions , applications to liquid helium , free electrons in a metal and photons in body chamber. Fermi level and Fermi energy.

Laser system: Purity of a spectral line , coherence length and coherence time , spatial coherence of a source , Einstein's A and B coefficients, Spontaneous and induced emissions , conditions for laser action , population inversion .

Application of lasers : Pulsed lasers and tunable lasers, spatial coherence and directionality estimates of beam intensity , temporal coherence and spectral energy density.

lasers and nonlinear optics : Polarization P including higher order terms in E and generation of harmonies, momentum mismatch and choice of the right crystal and direction for compensation .

BPHY202 External Marks: 70
Internal Marks: 30

Waves, Acoustics and optics

Unit: l

Waves

Waves in Media : Speed of transverse waves on a uniform string , speed of longitudinal waves in a fluid, energy density and energy transmission in waves, typical measurements . **Waves over liquid surface** : gravity waves and ripples . Group velocity and phase velocity, their measurements.

Superposition of waves : Linear homogeneous equations and the superposition principle , nonlinear superposition and consequences.

Standing waves : Standing waves as normal modes of bounded systems, examples, Harmonics and the quality of sound : Chladni's figures and vibrations of a drum. Production and detection of ultrasonic and waves and application .

Unit : ll

Acoustics

Noise and Music : The human ear and its responses; limits of human audibility intensity and loudness, bel and decibel the musical scale , temperament and musical instrument .

Reflection , refraction and diffraction of sound : Acoustic impedance of a medium , percentage reflection and redraction at a boundary , impedance matching for transducers, diffraction of sound, principle of a sonar system ranging .

Applied Acoustics : Transducers and their characteristics , recording and reproduction of sounds, velocity. The acoustics of halls , reverberation period , Sabine's formula .

Unit: lll

Geometrical Optics

Fermat's Principle : Principle of extremum path ,the aplanatic points of a sphere and other application . General theory of image formation : cardinal points of an optical system , general relationships, thick lens and lens combinations, Lagrange, equation of magnification , telescopic combinations, telephoto lenses and eyepieces.

Aberration in images : Chromatic aberrations , achromatic , combination of lenses in contact and separated lenses., Monochromatic aberrations and their reductions ; aspherical mirrors and Schmidt corrector plates , aplanatic points, oil immersion objectives, meniscus lens.

Optical instruments: Entrance and exit pupils, need for a multiple lens eyepiece common types of eyepieces.

Unit: lV

Physical Optics (Interference and Diffraction)

Interference of a light: The principle of superposition , two - slit interference , coherence requirement for the sources , Optical path retardations , lateral shift of fringes , Rayleigh refract meter and other applications Localized fringes; thin films, applications for precision measurements for displacements.

Haidinger fringes: Fringes of equal inclination. Michael’s interferometer, its application for precision determination of wave length, wave length difference and the width of spectral lines. Twymann- Green interferometer and its uses. Intensity distribution in multiple beam interference, Kolinsky fringes, Fabric-Perot interferometer and etalon.**Fresnel diffraction:** Fresnel half - period zones, plates, straight edge, rectilinear propagation rectilinear propagation.

Unit: V

Fraunhofer Diffraction

Fraunhofer Diffraction : Diffraction at a slit , half - period zones , pharos diagram and integral calculus methods, the intensity distribution , diffraction at a circular aperture and a circular disc, resolution of images, Rayleigh criterion, resolving power of telescope and microscopic systems , outline of phase contrast microscopy.

Diffraction gratings: Diffraction at N parallel slits , intensity distribution , plane diffraction grating , reflection grating and blazed gratings. Concave grating and different mountings, Resolving power of a grating and comparison with resolving powers of prism and of a Fabric- Perot etalon .

Double refraction and optical rotation : Refraction in uniaxial crystals , its electromagnetic theory Phase retardation plates , double image prism, Rotation of plane of polarization , origin of optical rotation in liquids and in crystals.

BPHY203 External Marks: 70
Internal Marks: 30

Semiconductor Devices

Unit I: Semiconductors

Energy bands in solids, Intrinsic and extrinsic semiconductors, carrier mobility and electrical resistivity of semiconductors, Hall effect, p-n junction diode and their characteristics, Zener and Avalanche breakdown, Zener diode, Zener diode as a voltage regulator. Light emitting diodes (LED), Photoconduction in semiconductors, Photodiode, Solar Cell, p-n junction as a rectifier, half wave and full wave rectifiers (with derivation), filters (series inductor, shunt capacitance, L-section or choke, π and R.C. filter circuits).

Unit 2: Transistors

Junction transistors, Working of NPN and PNP transistors, Three configurations of transistor (C-B, C-E, C-C modes),Common base, common emitter and common collector characteristics of transistor, Constants of a transistor and their relation, Advantages and disadvantages of C-E configuration. D.C. load line .Transistor biasing; various methods of transistor biasing and stabilization.

Unit 3: Transistor Amplifiers

Amplifiers, Classification of amplifiers, common base and common emitter amplifiers, coupling of amplifiers, various methods of coupling, Resistance- Capacitance (RC) coupled amplifier (two stage, concept of band width, no derivation), Feedback in amplifiers, advantages of negative feedback, emitter follower, distortion in amplifiers.

Unit 4: Oscillators

Oscillators, Principle of oscillation, classification of oscillators, Condition for self sustained oscillation: Barkhausen criterion for oscillation, Tuned collector common emitter oscillator, Hartley oscillator, C.R.O. (Principle and Working).

Reference:

1. Basic Electronics and Linear Circuits by N.N.Bhargava. D.C. Kulshreshtha and S.C.Gupta (TITI CHD).
2. Solid State Electronics by J.P. Agarwal, Amit Agarwal (Pragati Prakashan Meerut).
3. Electronics Fundamentals and Applications by J.D. Ryder (Prentice Hall India)
4. Solid State Electronics by B.L.Theraja

BPHY204

External Marks: 70
Internal Marks: 30

Linear and Digital Integrated Circuits and Instruments

Unit I:

Basic Concepts of Integrated Circuits - active and passive components, discrete component circuits, wafer, chip, advantages of integrated circuits - MSI, LSI, VLSI (basic ideas and definitions only) Op-Amps - basic characteristics without detailed internal circuit of 1C: requirement of ideal voltage amplifier, characteristics of ideal op-amp, feedback in amplifier (black box approach), open loop and close loop gain, inverting and non-inverting amplifier, zero crossing detector - applications: mathematical operations such as addition, multiplication, integration and differentiation, electronic circuits such as Wien bridge oscillator, rectangular and triangular wave generators (all circuit analysis based on Kirchoff's laws

Unit II:

Digital Circuits - difference between analog and digital circuits, binary numbers, binary to decimal conversion, AND, OR and NOT gates (realization using diodes and transistor), Boolean algebra, Boolean equations of logic circuits, de Morgan theorem, NOR and NAND gates - combinational logic: Boolean laws and theorems, sum of products, method of realizing a circuit for a given truth table, truth table to Karnaugh map and simplification (elementary idea) - data processing circuits: multiplexers, demultiplexers, decoders, encoders, exclusive OR gate, parity checker, read-only memories (ROM, PROM, EPROM). - Arithmetic circuits: binary addition and subtraction (only 2's complement method), half adders and full adders and subtractors

Unit III :

- sequential circuits: flip-flops – RS, JK, D, clocked, preset and clear operation, race-around conditions in JK flip-flop, master slave JK flip-flop as building block of sequential circuits - shift registers: serial in serial out, serial in parallel out, parallel in parallel out (only upto 4 bits) - counters: asynchronous counters, synchronous counter, decade counter - D/A and A/D conversion, D/A converter – resistive network, accuracy and resolution, A/D converter – counter method, accuracy and resolution

Unit IV:

Electronic Instruments - timer: simple applications of 555 timer circuits - power supply: requirement of ideal voltage and current source, voltage source, half-wave and full-wave rectifier, bridge rectifier, L and C filters, ripple - oscilloscope: input attenuators, DC, AC, and ground, horizontal and vertical deflecting system, time base generation and synchronization, measurement of positive, positive-negative wave shape, rise time and fall time; frequency, amplitude and phase of sinusoidal waves.

BPHY205

External Marks: 70
Internal Marks: 30

Physical Chemistry –II

UNITI

Thermodynamics – I — 12 Hrs

Definition of thermodynamic terms: system, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.

First Law of Thermodynamics: statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law - Joule-Thomson coefficient and inversion temperature. Calculation of w, q, dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermochemistry: standard state, standard enthalpy of formation- Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation.

UNITII

Thermodynamics -II — 13 Hrs

Second law of thermodynamics: need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.

Concept of entropy: entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

Third law of thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.

UNITIII

Chemical Equilibrium — 5 Hrs

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chatelier's principle.

Reaction isotherm and reaction isochore – Clapeyron equation and Clausius -Clapeyron equation, applications.

Phase Equilibrium — 10 Hrs

Statement and meaning of the terms – phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system – water, CO_2 and S systems.

Phase equilibria of two component system – solid-liquid equilibria, simple eutectic – Bi-Cd, Pb-Ag systems, desilverisation of lead.

Solid solutions – compound formation with congruent melting point (Mg-Zn) and incongruent melting point, ($NaCl$-H_2O), ($FeCl_3$-H_2O) and $CuSO_4$-H_2O) system. Freezing mixtures, acetone -dry ice.

Liquid – liquid mixtures - Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system-azeotropes – HCl-H_2O and ethanol – water systems.

Partially miscible liquids – Phenol-water, trimethylamine-water, nicotine-water systems. Lower and upper consolute temperature. Effect of impurity on consolute temperature.

Immiscible liquids, steam distillation.

Nernst distribution law – thermodynamic derivation, applications.

UNITIV

Electrochemistry – I — 10 Hrs

Electrical transport -conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution.

Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method.

Applications of conductivity measurements: determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

UNITV

Electrochemistry - II — 10 Hrs

Types of reversible electrodes – gas-metal ion, metal-metal ion, metal-insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes- standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic and Galvanic cells – reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements. Computation of cell EMF. Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K), polarization, over potential and hydrogen overvoltage.

Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

Definition of pH and pK_a determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods.

Buffers – mechanism of buffer action, Henderson-Hazel equation. Hydrolysis of salts.

Corrosion – types, theories and methods of combating it.

BPHY206

External Term: 70
Internal Marks: 30

Inorganic Chemistry -II

UNITI

Chemistry of Elements of First Transition Series — 10 Hrs

Characteristic properties of d-block elements.
Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

UNITII

Chemistry of Elements of Second and Third Transition Series — 10 Hrs

General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry

UNITIII

Coordination Compounds — 10 Hrs

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes

Oxidation and Reduction — 8 Hrs

Use of redox potential data – analysis of redox cycle, redox stability in water – Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements.

UNITIV

Chemistry of Lanthanide Elements — 6 Hrs

Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

Chemistry of Actinides — 4 Hrs

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides

UNITV

Acids and Bases — 6 Hrs

Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases.

Non-aqueous Solvents — 6 Hrs

Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

BPHY207

External Marks: 70
Internal Marks: 30

Organic Chemistry -II

UNIT I

Electromagnetic Spectrum: Absorption Spectra — 10 Hrs

Ultraviolet (UV) absorption spectroscopy — absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones.
Infrared (IR) absorption spectroscopy — molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.

UNITII

Alcohols — 6 Hrs

Classification and nomenclature.
Monohydric alcohols — nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols.
Dihydric alcohols — nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement.
Trihydric alcohols — nomenclature and methods of formation, chemical reactions of glycerol.

Phenols — 6 Hrs

Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols — electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.

UNITIII

Aldehydes and Ketones — 14 Hrs

Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties.

Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction.

Use of acetals as protecting group. Oxidation of aldehydes, Baeyer–Villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions. Halogenation of enolizable ketones.

An introduction to α,β unsaturated aldehydes and ketones.

UNITIV

Carboxylic Acids — 6 Hrs

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation.

Methods of formation and chemical reactions of halo acids. Hydroxy acids: malic, tartaric and citric acids.

Methods of formation and chemical reactions of unsaturated monocarboxylic acids.

Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents.

Carboxylic Acid Derivatives — 3 Hrs

Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.

Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis (acidic and basic).

UNITV

Ethers and Epoxides — 3 Hrs

Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions — cleavage and autoxidation, Ziesel's method.

Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

Organic Compounds of Nitrogen — 12 Hrs

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid.

Halonitroarenes: reactivity. Structure and nomenclature of amines, physical properties. Stereochemistry of amines. Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hofmann bromamide reaction.

Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, azo coupling.

Practical syllabus

Inorganic Chemistry

Calibration of fractional weights, pipettes and burettes. Preparation of standard solutions. Dilution- 0.1 M to 0.001 M solutions.

Quantitative Analysis

Volumetric Analysis

(a) Determination of acetic acid in commercial vinegar using NaOH
(b) Determination of alkali content – antacid tablet using HCl.
(c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
(d) Estimation of hardness of water by EDTA.
(e) Estimation of ferrous and ferric by dichromate method.
(f) Estimation of copper using thiosulphate.

Gravimetric Analysis

Analysis of Cu as CuSCN and Ni as Ni (dimethylgloxime).

Organic Chemistry

Laboratory Techniques

A. Thin Layer Chromatography

Determination of R_f values and identification of organic compounds.

(a) Separation of green leaf pigments (spinach leaves may be used).
(b) Preparation and separation of 2,4-dinitrophenylhydrazones of acetone, 2-butanone, hexan-2- and 3-one using toluene and light petroleum (40:60).
(c) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5).

B. Paper Chromatography: Ascending and Circular

Determination of R_f values and identification of organic compounds.

(a) Separation of a mixture of phenylalanine and glycine. Alanine and aspartic acid. Leucine and glutamic acid. Spray reagent – ninhydrin.
(b) Separation of a mixture of D, L – alanine, glycine, and L-Leucine using n-butanol:acetic acid:water (4:1:5). Spray reagent – ninhydrin.

(c) Separation of monosaccharides – a mixture of D-galactose and D – fructose using n-butanol:acetone:water (4:5:1). Spray reagent – aniline hydrogen phthalate.

Qualitative Analysis

Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.

Physical Chemistry

Transition Temperature

1. Determination of the transition temperature of the given substance by thermometric/dialometric method (e.g. $MnCl_2.4H_2O/SrBr_2.2H_2O$).

Phase Equilibrium

1. To study the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system.
2. To construct the phase diagram of two component (e.g. diphenylamine -benzophenone) system by cooling curve method.

Thermochemistry

1. To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
2. To determine the enthalpy of neutralisation of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
3. To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

BPHY208

External Marks: 70
Internal Marks: 30

General Microbiology & Biochemistry

Unit- I

History of Microbiology and Microscopy

Meaning, definition and history of Microbiology.
Contributions of Antony von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Iwanowsky, Beijerinck, Winogradsky and Alexander Fleming.
Importance and applications of Microbiology.
Principles of microscopy – bright field, dark field, phase-contrast, fluorescent and electron microscopy (SEM and TEM). Ocular and stage micrometers. Size determination of microorganisms.
Principles and types of stains - Simple stain, differential stain, negative stain, structural stains - spore, capsule, flagella. Hanging-drop method.

Unit-II

Microbiological Techniques

Sterilization and disinfection techniques

Principles and methods of sterilization.

Physical methods - autoclave, hot-air oven, pressure cooker, laminar air flow, filter sterilization.

Radiation methods - UV rays, gamma rays, ultrasonic methods.

Chemical methods - Use of alcohols, aldehydes, fumigants, phenols, halogens and hypochlorites. Phenol coefficient.

Isolation of pure culture techniques - Enrichment culturing, dilution-plating, streak-plate, spread-plate and micromanipulator.

Preservation of microbial cultures - subculturing, overlaying cultures with mineral oils, lyophilization, sand cultures, storage at low temperature.

Unit-III

Introductory Biochemistry

Water- as universal solvent, Weak interaction in aqueous system, Ionization of water.
Buffer- Introduction to buffer concept, Relation of pH, pK and buffer concentration.
Carbohydrates - Classification, Structure and Function. Protein- Classification, Structure and Function.

Unit-IV

Lipid- Structure and Function.Nucleic Acid- Structure and Function.Vitamins- Structure and Function.Enzymes- Major Groups and Nomenclature of Enzymes. Coenzymes and Prosthetic Group.Factors affecting Enzyme activity.Michaelis Menton Equation

Reference Books

1. Ram Reddy, S. and Reddy, S.M. (2007). **Essentials of Virology**. Scientific Publishers India, Jodhpur.
2. Reddy, S.M. (2003). **University Microbiology –I** . Galgotia Publications Pvt Ltd., New Delhi.
3. Dube, R.C. and Maheswari, D.K. (2000) **General Microbiology**. S Chand ,New Delhi.
4. Prescott, M.J., Harley, J.P. and Klein, D.A. (2002). **Microbiology.** 5th Edition, WCB Mc GrawHill, New York.
5. Madigan, M.T., Martinkl, J.M. and Parker, J. (2000). **Brock Biology of Microorganisms**, 9th Edition, MacMillan Press, England.
6. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). **General Microbiology**, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.
7. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). **Microbiology**. 5th Edition, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi.
8. Principles of Biochemistry. Albert L. Lehninger. CBS Publishers and Distributors.
9. Biochemistry- Lubert Stryer Freeman International Edition.
10. Biochemistry- Keshav Trehan. Wiley Eastern Publications.
11. Fundamentals of Biochemistry- J. L. Jain, S .Chand & Company.
12. Biochemistry- Prasarnaga, Bangalore University.
13. Fundamentals of Biochemistry- Dr. A.C. Deb.
14. Essentials of Biophysics. Narayana, P. (2000) .New Age International Publisher
15. New Delhi.
16. A text book of Biophysics. Roy, R.N. (1999). New Central Book Agency.

BPHY209

External Marks: 70
Internal Marks: 30

Advanced-Calculus

Unit-I

Definition of a sequence. Theorems on limits of sequences. Bounded and monotonic sequence. Cauchy's convergence criterion. Series of non-negative terms. Comparison tests. Cauchy's integral tests. Ratio tests, Raabe's, logarithmic, de Morgan and Bertrand's tests.(without proofs) Alternating series, Leibnitz's theorem . Absolute and conditional convergence.

Unit-II

Continuity of single variables Sequential continuity. Properties of continuous functions. Uniform continuity. Chain rule of differentiability. Mean value theorems and their geometrical interpretations. Darboux intermediate value theorem for derivatives.

Unit-III

Limit and continuity of functions of two variables. Partial differentiation. Change of variables. Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables Jacobeans.

Unit-IV

Envelopes, Evolutes, Maxima, Minima and saddle point of functions of two variables. Lagrange multiplier method. Indeterminate forms.

Unit-V

Beta and Gamma functions. Double and triple integrals. Dirichlet's integrals, change of order of integration in double integrals.

BPHY210

External Marks: 70
Internal Marks: 30

Environmental Science

Unit-1

Diversities of lifeforms- Concept of taxonomy, systematic and classification with respect to plant kingdom, animal kingdom and microbial world.

Unit-2

Fundamental of chemical equilibrium and reaction kinetics -Stochiometry, chemical equilibrium, thermodynamics application in reaction process (both chemical and biological process), acid base reaction, solubility products, bioinorganic complexes and their importance.

Unit-3

Radiation Physics-Electromagnetic radiation characteristics and its biological effects, radioactivity-source, characteristics, and impacts, radiation in diagnosis and therapy of diseases, radioisotopes and radionuclide in biological systems

Unit-4

Tropical monsoon-causes, and impacts, impacts of climate change on tropical monsoon

Unit-5

Noise Pollution- source of noise, distinction between sound and noise, noise impacts, noise monitoring and control strategies

BPHY211

External Marks: 70
Internal Marks: 30

English -II

Unit-I (Any Five)

1. Walt Whitman – O Captain! My Caption!
2. George Orwell – What is Science
3. J. Bronowski - The Dilemma of The Scientist
4. Will Durant – The Origin of Science
5. Somerset Maugham – The Luncheon
    - Henry The Last Leaf
6. Major Ancient Indian Scientist Adopted
7. C.P Snow- Ramanujan
8. Aldous Huxley – J.C.Bose
9. Human Rights
10. R.K Narayan – The Axe
11. Dr. C.V Raman - Water
12. Robert Frost – stopping by Woods on a Snow evening
13. Dr. Yashodhara Mishra – Understanding Gender issues.

Unit-II

Comprehension of an unseen passage question should be objective/Multiple - choice and should test (a) an understanding of the passage in question, and (b) a group of general language skills and issues with Reference Word and usage Within the passage.

Unit-III

Paragraph Writing: - Based on expansion word limit 100-150 words. Candidates to attempt any one of three alternative topics provided.

Unit-IV

Basic language Skill-Vocabulary Synonyms Antonyms one word Substitution of Phrases, Prefixes, Suffixes and word Derivation making Sentence With Idioms and Phrases Corrections of Sentence With Words Likely to be Confused Question Should not repeat the Examples Or exercises given in the text book

Unit-V

Basic language Skill- Grammar and Usage modals linking devices, tenses, and preposition verb forms Structures Gerunds Participles and infinitive, verbs followed by a preposition and phrasal verbs, articles and determines Countable and uncountable nouns adjectives, and adverbs. Questions Should not repeat the example exercise given in the text book

BPHY212

External Marks: 70
Internal Marks: 30

Hindi -II

भाग - दो, आधार पाठ्यक्रम
(हिन्दी भाषा)

खण्ड-क निम्नलिखित 5 लेखकों के एक-एक निबंध पाठ्यक्रम में सम्मिलित होंगे -

1. महात्मा गांधी - सत्य और अहिंसा
2. विनोबा भावे - ग्राम सेवा
3. आचार्य नरेन्द्र देव - युवकों का समाज में स्थान
4. वासुदेव शरण अग्रवाल - मातृ-भूमि
5. भगवतशरण उपाध्याय - हिमालय की व्युत्पत्ति
6. हरि ठाकुर - डॉ. खूबचंद बघेल

खण्ड-ख हिन्दी भाषा और उसके विविध रूप

- कार्यालयीन भाषा
- मीडिया की भाषा
- वित्त एवं वाणिज्य की भाषा
- मशीनी भाषा

खण्ड-ग अनुवाद व्यवहार : अंग्रेजी से हिन्दी में अनुवाद

हिन्दी की व्यवहारिक कोटियाँ-

रचनागत प्रयोगगत उदाहरण, संज्ञा, सर्वनाम, विशेषण, क्रिया विशेषण, समास, संधि एवं संक्षिप्तियां, रचना एवं प्रयोगगत विवेचन ।

Year-3

BPHY301

External Marks: 70
Internal Marks: 30

Relativity, Quantum Mechanics, Atomic, Molecular and Nuclear Physics

Unit: I

Relativity and Quantum Theory

Reference system, integral frames, Galilean invariance and conservation laws, propagation of light, Michelson-Morley experiment; search for ether. Postulates for the special theory of relatively, Lorentz transformation, length contraction, time dilation, velocity addition theorem, variation of mass with velocity, mass-Energy equivalence, particle with zero rest mass.

Origin of the quantum theory : Failure of classical physics to explain the Phenomena such as black-body spectrum, photoelectric effect, Ritz combination principal in spectra, stability of an atom. Planck's radiation law, Einstein's explanation of photoelectric effect, Bohr's quantization of angular momentum and its application to hydrogen atom, limitation of Bohr's theory.

Unit: II

Quantum Mechanics

Wave-particle duality and uncertainly principal: de Broglie hypothesis for matter waves; the concept of wave and group velocity, evidence for diffraction and interference of particles, experimental demonstration of matter waves. Consequence of de Broglie's concepts; quantization in hydrogen atom; energies of a particle in box, wave packets, Heisenberg's uncertainty relation for p and x, *its* extension energy and time.

Consequence of the uncertainty relation: gamma ray microscope, diffraction at a slit, particle in a box, position of electron in a Bohr orbit.

Quantum Mechanics: Schrodinger's equation. postulatory basis of quantum mechanics; operators, expectation values, transition probabilities, applications to particle in a one and three dimensional boxes, harmonic oscillator, reflection at a step potential, transmission across a potential barrier.

Unit :III

Atomic physics

Hydrogen atom; natural occurrence of n, l and m quantum numbers, the related physical quantities. Comparison with Bohr's theory.

Specteria of hydrogen, deuteron and alkali atoms spectral terms, doublet fine structure, screening constants for alkali spectra for s, p, d and f states, selection rules. Singlet and triplet fine structure in alkaline earth spectra. L-S and j-j couplings. **Week spectra**: continuous X-Ray spectrum and its dependence on voltage, Duane and Hunt's law. Characteristics X-Rays, Moseley's law, doublet structure of X-ray spectra, X-ray absorption spectra.

Unit :IV

Molecular Physics

Discrete set of electronic energies of molecules, quantization of Vibrational and rotational energies, determination of inter nuclear distance, pure rotational and rotation-vibration spectra. Dissociation limit for the ground and other electronic states, transition rules for pure vibration and electronic vibration spectra. Raman effect, Stokes and anti-stokes lines, complimentary character of Raman and infrared spectra, experimental arrangements for Raman spectroscopy. **Spectroscopic techniques** : Source of excitation, prism and grating spectro-graphs for visible, UV and IR, absorption spectroscopy, double

beam instruments, different recording systems.

Unit: V

Nuclear Physics

Interaction of charged particles and neutrons with matter, working of nuclear detectors, G-M counter, proportional counter and scintillation counter, cloud chambers, spark chamber, emulsions.

Structure of nuclei, basic properties (I,μ,Q and binding energy), deuteron binding energy, *p-p* and *n-p* scattering and general concepts of nuclear forces. Beta decay, range of alpha particle, Geiger-Natal law. Gamow's explanation of beta decay, alpha decay and continuous and discrete spectra. Nuclear reactions, channels, compound nucleus, direct reaction (Concepts).

Shell model: liquid drop model, fission and fusion (concepts), energy production in stars by *p-p* and carbon-nitrogen cycles (concepts).

BPHY302 External Marks: 70
Internal Marks: 30

Solid State Physics, Solid State Devices and Electronics

Unit: I

Crystal Structure and X-rays

Overview: Crystalline and gladly forms, liquid crystal, glass transition. **Structure**: Crystal structure; lattices and bases, fundamental translation vectors, unit cell, Winger-Seitz cell, allowed rotations, lattice types, lattice planes. Common crystal structures.

Laue's theory of X-ray diffraction, Bragg's law, Laue patterns.

Bonding: Potential between a pair of atoms; Lenard-Jones potential, concept of cohesive energy, covalent, Vander walls, ionic and metallic crystals.

Magnetism: Atomic magnetic moment, magnetic susceptibility, Dia, para and Ferromagnetism, Ferromagnetic domains, Hysteresis.

Unit: II

Lattice Vibration

Thermal properties: Lattice vibrations, simple harmonic oscillator, second order expansion of Lenard-Jones potential about the minimum, vibration of one dimensional monatomic chain under harmonic and nearest neighbor interaction approximation, concept of phonons, density of modes (1-0). Debye model; lattice specific heat, low temperature limit, extension (conceptual) to 3-D.

Band Structure: Electrons in periodic potential; nearly free electron mode (qualitative), energy band, energy gap. Metals, insulators, semiconductors.

Motion of electrons : Free electrons, conduction electrons, electron collisions, mean free path, conductivity and Ohm's law. Density of states, Fermi energy, Fermi velocity, Fermi- Dirac distribution.

Unit: III

Solid State Device

Semi conductors: Intrinsic semiconductors, electrons and holes, Fermi level. Temperature dependence of electron and hole concentrations. Doping; impurity states, n and p type semiconductors, conductivity, mobility, Hall Effect, Hall coefficient.

Semiconductor devices: Metal-semiconductors junction, *p-n* junction, majority and minority carriers, diode, Zener and tunnel diodes, light emitting diode, transistor, solar cell.

Power supply : Diode as a circuit element, load line concept, rectification, ripple factor, zener diode, voltage stabilization, IC voltage regulation.

Unit: IV

Transistor and FET's

Characteristic of a transistor in CB, CE and CC mode, graphical analysis of the CE configuration, low frequency equivalent circuits, h- parameters, bias stability, thermal runways.

Field effect transistors: JEFT volt-ampere curves, biasing JEFT, a.c. operation of JEFT, source follower, Depletion and enhancement mode, MOSFET, biasing MOSFET, FET as variable voltage resistor, digital MOSFET circuits.

Unit: V

Amplifiers

Small signal amplifier: General Principals of operation, classification, distortion RC coupled amplifier, gain frequency response, input and output impedance, multistage amplifiers, transformer coupled amplifier, Equivalent circuits at low, medium and high frequencies; emitter follower, low frequency common source and common drain amplifier, Noise in electronic circuits.

Oscillator: Feed back in amplifiers, principle its effect on amplifiers, Characteristics. Principle of feedback amplifier. Barkhansen criteria. Hartley Colpit and Vein-Bridge oscillator.

Practical Included

BPHY303 External Marks: 70
Internal Marks: 30

Atomic and Molecular Spectroscopy

Unit – I: Historical background of atomic spectroscopy

Introduction of early observations, emission and absorption spectra, atomic spectra, wave number, spectrum of Hydrogen atom in Balmer series, Bohr atomic model(Bohr's postulates) , spectra of Hydrogen atom , explanation of spectral series in Hydrogen atom, un-quantized states and continuous spectra, spectral series in absorption spectra, effect of nuclear motion on line spectra (correction of finite nuclear mass), variation in Rydberg constant due to finite mass, short comings of Bohr's theory, Wilson sommerfeld quantization rule, de-Broglie interpretation of Bohr quantization law, Bohr's corresponding principle, Sommerfeld's extension of Bohr's model, Sommerfeld relativistic correction, Short comings of Bohr-Sommerfeld theory, Vector atom model; space quantization, electron spin, coupling of orbital and spin angular momentum, spectroscopic terms and their notation, quantum numbers associated with vector atom model, transition probability and selection rules.

Unit –II: Vector Atom Model (single valance electron)

Orbital magnetic dipole moment (Bohr megnaton), behavior of magnetic dipole in external magnetic filed; Larmors' precession and theorem. Penetrating and Non-penetrating orbits, Penetrating orbits on the classical model; Quantum defect, spin orbit interaction energy of the single valance electron, spin orbit interaction for penetrating and non-penetrating orbits. quantum mechanical relativity correction, Hydrogen fine spectra, Main features of Alkali Spectra and their theoretical interpretation, term series and limits, Rydeburg-Ritze combination principle, Absorption spectra of Alkali atoms. observed doublet fine structure in the spectra of alkali metals and its Interpretation, Intensity rules for doublets, comparison of Alkali spectra and Hydrogen spectrum .

UNIT-III: Vector Atom model (two valance electrons)

Essential features of spectra of Alkaline-earth elements, Vector model for two valance electron atom: application of spectra. Coupling Schemes;LS or Russell – Saunders Coupling Scheme and JJ coupling scheme, Interaction energy in L-S coupling (sp, pd configuration), Lande interval rule, Pauli principal and periodic classification of the elements. Interaction energy in JJ Coupling (sp, pd configuration), equivalent and non-equivalent electrons, Two valance electron system-spectral terms of non-equivalent and equivalent electrons, comparison of spectral terms in L-S And J-J coupling. Hyperfine structure of spectral lines and its origin; isotope effect, nuclear spin.

Unit –IV: Atom in External Field

Zeeman Effect (normal and Anomalous),Experimental set-up for studying Zeeman effect, Explanation of normal Zeeman effect(classical and quantum mechanical), Explanation of anomalous Zeeman effect(Lande g-factor), Zeeman pattern of D1 and D2 lines of Naatom, Paschen-Back effect of a single valence electron system. Weak field Stark effect of Hydrogen atom.

Molecular Physics

General Considerations, Electronic States of Diatomic Molecules, Rotational Spectra (Far IR and Microwave Region), Vibrational Spectra (IR Region), Rotator Model of Diatomic Molecule, Raman Effect, Electronic Spectra.

References

1 Beiser A, Concept of Modern Physics (1987), Mc Graw Hill Co Ltd, New Delhi 2 Rajab J B, Atomic Physics (2007), S Chand & Co, New Delhi 3 Fewkes J H and Yarwood J Atomic Physics Vol II (1991) Oxford University Press 4 Bransden B H and Joachain C J, Physics of Atoms and Molecules 2nd Ed (2009), Pearson Education, New Delhi. 5 Banwell, Molecular Spectroscopy 6 Ghoshal S N, Atomic and Nuclear Physics Vol I (1996) S Chand & Co, New Delhi 7 Gopalkrishnan K, Atomic and Nuclear Physics (1982), Mc Millan India New Delhi 8 Raj Kumar, Atomic and Moleculer Spectra:Laser , Kedarnath Ram nathpub. 9 S.L.Gupta, V.Kumar,R.C.Sharma, Elements of Spectroscopy,Pragati Prakashan.

BPHY304 External Marks: 70
Internal Marks: 30

Mathematical Physics

Unit I: Vector Algebra and Analysis

- review of vector algebra: addition, subtraction and product of two vectors - polar and axial vectors and their examples from physics - triple and quadruple product (without geometrical applications) - scalar and vector fields - differentiation of a vector w.r.t. a scalar - unit tangent vector and unit normal vector (without Frenet-Serret formulae) - directional derivatives - gradient, divergence, curl and Laplacian operations and their meaning - idea of line, surface and volume integrals - Gauss', Stokes' and Green's Theorems

Unit II: Orthogonal Curvilinear Coordinates and Multiple integrals

- derivation of gradient, divergence, curl and Laplacian in Cartesian, spherical and cylindrical coordinate systems - change of variables and Jacobian evaluation of line, surface and volume integrals

Unit III: Differential Equations

- classification of differential equations: linear and nonlinear, homogeneous and non-homogeneous - first order: separable and exact equations and integrating factor - second order: homogeneous equations with constant coefficients, Wronskian and general solution, statement of Existence and Uniqueness theorem for initial value problems, solution of non-homogeneous equations by D-operator method, particular integrals, method of undetermined coefficients and variation of parameters, equations reducible to those with constant coefficients, Bernoulli and Euler equations

Unit IV: Fourier Series

- Fourier series, Dirichlet conditions (statement only) - Orthogonality of sine and cosine functions - sine and cosine series distinctive features of Fourier expansions - half range expansions - applications: square wave, triangular wave, output of full wave rectifier and other simple functions, summing of infinite series

Calculus of Variations - constrained maxima and minima - method of Lagrange's undetermined multipliers and its application to simple problems in Physics - Euler – Lagrange Equation and its application to simple problems

Theory of Errors - systematic and random errors - propagation of errors, normal law of errors - standard and probable error - least square fitting of data (linear case)

BPHY305

External Marks: 70
Internal Marks: 30

Thermal Physics

Unit I:

Kinetic Theory of Gases - derivation of Maxwell's law of distribution of velocities and its experimental verification, mean free path, transport phenomena - viscosity, conduction and diffusion, Brownian motion, the theories of Langevin and Einstein and experimental determination of Avogadro's number - examples of Brownian motion in physics (galvanometer mirror, sedimentation, Johnson's noise)

Unit II:

-ideal gases: equation of state, internal energy, specific heats, entropy, isothermal and adiabatic processes, compressibility and expansion coefficient, adiabatic lapse rate - real gases: deviations from the ideal behaviour, the virial equation, Andrew's experiments on carbon dioxide gas, continuity of liquid and gaseous state, van der Waal's equation, critical constants and law of corresponding states, free expansion, Joule-Thomson effect

Unit III:

Thermodynamics - zeroth and first law of thermodynamics, reversible and irreversible processes, conversion of heat into work, Carnot theorem, second law of thermodynamics, thermodynamic temperature, Clausius inequality - entropy, entropy changes in reversible and irreversible processes, temperatureentropy diagrams, the principle of increase of entropy applications

Unit IV:

-thermodynamic potentials: enthalpy, Gibbs and Helmholtz functions, Maxwell relations and their applications - magnetic work, magnetic cooling by adiabatic demagnetization, approach to absolute zero - change of phase, equilibrium between a liquid and its vapour, Clausius-Clapeyron equation, the triple point with examples from physics, second order phase transitions.

BPHY306 External Marks: 70
Internal Marks: 30

Physics of Materials

Unit I:

Crystal Structure - amorphous and crystalline materials - lattice translation vectors, lattice with a basis-central and non-central elements, unit cell, reciprocal lattice, types of lattices, crystal diffraction: Bragg's law, diffraction of X-rays, atoms and geometrical structure factor - X-ray diffraction methods, measurement of lattice parameter for cubic lattices

Unit II:

Elementary Lattice Dynamics - lattice vibrations, linear monoatomic and diatomic chains, acoustical and optical phonons, qualitative description of the phonon spectrum in a solid, Brillouin zones, Einstein and Debye theories of specific heat of solids. T3 law Magnetic Properties of Matter - response of substances of magnetic field, dia-, para-, and ferri- and ferromagnetic materials, classical Langevin theory of dia and paramagnetic domains, quantum mechanical treatment of paramagnetism, Curie's law, Weiss' theory of ferromagnetism and ferromagnetic domains and discussion of BH hysteresis, qualitative discussion of ferrimagnets and ferrites

Unit III:

Dielectric Properties of Materials - polarization, local electric field at an atom, depolarization field, Lorentz fields of dipoles inside a cavity - dielectric constant and polarizability: electric susceptibility, polarizability, Clausius-Mosotti equation, classical theory of electronic polarizability, normal and anomalous dispersion, Cauchy and Sellmeier relations, orientational polarizability and Langevin-Debye equation, complex dielectric constant, dielectric constant and loss, qualitative discussion of ferroelectric properties of materials and PE hysteresis loop

Unit IV:

Electrical Properties of Materials - qualitative description of free electron theory and its inadequacies with reference to Hall effect and specific heat of electrons in a metal - elementary band theory, Bloch theorem, Kronig-Penney model, effective mass of electron, concept of hole, band gaps, difference between conductors, semiconductors and insulators, intrinsic and extrinsic semiconductors, p- and n type semiconductors, law of mass action, conductivity in semiconductors, mobility of carriers (lattice and impurity scattering), Hall effect in semiconductors Superconductivity - experimental properties, Meissner effect, type I and type II superconductors, London's equation and penetration depth.

BPHY307

External Marks: 70
Internal Marks: 30

English -III

Unit-1 Essay type answers in about 200 words. Four essay types question to be asked and two be attempted.

Unit-2 Writing skills for composition- Essay writing.

Unit-3 Précis writing.

Unit-4 (a) reading comprehension of an unseen passages.

(b) Vocabularye based on text.

Unit-5 Grammar: Advanced Exercises.

Note- Question on unit I and IV (b) shall be asked from the prescribed text. Which will comprise of popular creative writings and the following items.

Minimum needs: Housing and transport, Geo-economic profile of C.G. of education and culture, Women empowerment , Management of change (Physical quality of life) . War and human survival. The question of human social value, new Economic philosophy recent liberalization methods democratic decentralization (with reference to 73, 74 constitutional amendment.)

BPHY308

External Marks: 70
Internal Marks: 30

Hindi -III