SCHEME OF EXAMINATION

&

DETAILED SYLLABUS

For

B.Sc.(CHEMISTRY)

FACULTY OF SCIENCE

Kalinga University, Raipur
B.Sc. (CHEMISTRY)(3 yrs Programme)
w.e.f 2014-15 Session

First Year

Code No.	Subject	Internal Marks	External Marks	Total
BCHM01	Physical Chemistry-I	30	70	100
BCHM102	Inorganic Chemistry -I	30	70	100
BCHM103	Organic Chemistry- I	30	70	100
BCHM104	Mechanics, Oscillation and Properties of Matter	30	70	100
BCHM105	Diversity of Cryptogams and Gymnosperms	30	70	100
BCHM106	Algebra and Trigonometry	30	70	100
BCHM107	Invertebrate and vertebrate	30	70	100
BCHM108	Fundamentals of IT	30	70	100
BCHM109	English -I	30	70	100
BCHM110	Hindi –I	30	70	100
BCHM101-P	Physical Chemistry-I Lab	20	30	50
BCHM102-P	Inorganic Chemistry-I Lab	20	30	50
BCHM103-P	Organic Chemistry-I Lab	20	30	50
BCHM108-P	Fundamentals of IT-LAB	20	30	50
	Total	**380**	**820**	**1200**

Second Year					
Code No.	**Subject**	**Internal Marks**	**External Marks**	**Total**
BCHM201	Physical Chemistry-II	30	70	100
BCHM202	Inorganic Chemistry-II	30	70	100
BCHM203	Organic Chemistry-II	30	70	100
BCHM204	Kinetic Theory , Thermodynamics and Statistical Physics	30	70	100
BCHM205	General Microbiology and Biochemistry	30	70	100
BCHM206	Advanced-Calculus	30	70	100
BCHM207	Genetics	30	70	100
BCHM208	Environmental science	30	70	100
BCHM209	English -II	30	70	100
BCHM210	Hindi -II	30	70	100
BCHM201-P	Physical Chemistry-II Lab	20	30	50
BCHM202-P	Inorganic Chemistry -II Lab	20	30	50
BCHM203-P	Organic Chemistry -II Lab	20	30	50
	Total	**360**	**760**	**1150**

Third Year

Code No.	Subject	Internal Marks	External Marks	Total
BCHM301	Physical Chemistry-III	30	70	100
BCHM302	Inorganic Chemistry-III	30	70	100
BCHM303	Organic Chemistry-III	30	70	100
BCHM304	Physical Chemistry-IV	30	70	100
BCHM305	Inorganic Chemistry-IV	30	70	100
BCHM306	Organic Chemistry-IV	30	70	100
BCHM307	English -III	30	70	100
BCHM308	Hindi -III	30	70	100
BCHM301-P	Physical Chemistry-III Lab	20	30	50
BCHM302-P	Inorganic Chemistry-III Lab	20	30	50
BCHM303-P	Organic Chemistry-III Lab	20	30	50
BCHM304-P	Physical Chemistry-IV Lab	20	30	50
BCHM305-P	Inorganic Chemistry-IV Lab	20	30	50
BCHM306-P	Organic Chemistry-IV Lab	20	30	50
	Total	**360**	**740**	**1100**

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.

BCHM102   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 $\psi2$, 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. Weak 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.

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.

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 angular momentum, conservation of energy ,elastic and inelastic collisions.

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 of harmonic oscillations, differential equation and its solution, kinetic and potential 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.

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.

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 sectors 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.

BCHM107   External Term: 70
                                                                           Internal Marks: 30

Invertebrate and vertebrate

Unit-I
Classification of Non Chordates upto classes according to Parker sand eswell.(7th Edition)
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.

BCHM108   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.

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.

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
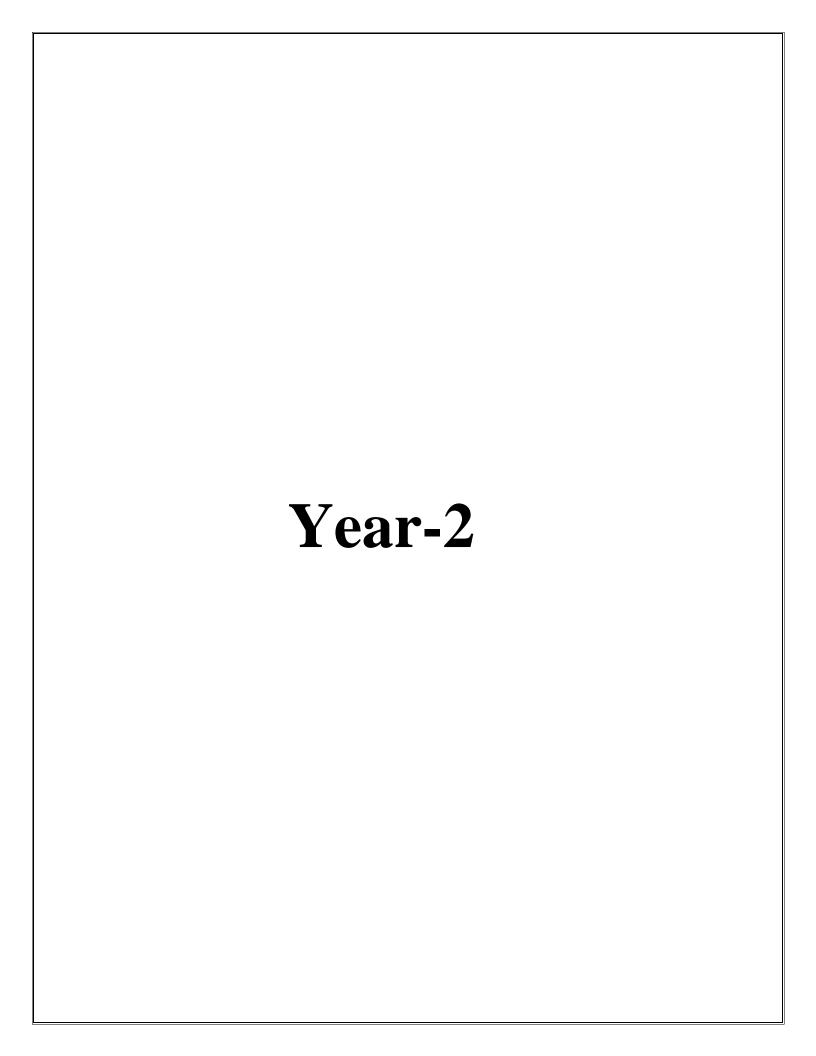10. Controlling the Appearance of a Chart

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

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.

UNIT IV

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.

UNIT V

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.

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

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.

UNIT II

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.

UNIT III

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.

UNIT IV

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).

UNIT V

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.

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 of 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 .

BCHM205

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.

BCHM206

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 geometricalinterpretations.Darboux'sintermediatevaluetheoremforderivatives.

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.

BCHM207 External Term: 70
Internal Marks: 30

Genetics

Unit -I: Heredity & Variation, Gene Expression
1. Chromosome: The physical basis of heredity and transmitters of heredity.
2. Types of Chromosomes: Lamp brush, Salivary gland and Beta Chromosome.
3. Nucleocytoplasmic interaction
4. Heredity and variation: Sources of variation Genotype, Phenotype and Environmental variation (Elementary idea)
5. Gene Expression: Regulation of protein synthesis, transcriptions in Prokaryotes and Eukaryotes.
6. Gene Expression: Translation, Operon model.

Unit -II: Linkage and Chromosomal Aberrations

1. Gene linkage: Kinds and Theories of linkage, significance of linkage.
2. Gene linkage: Mechanism of genetic recombination; linkage maps
3. Sex Chromosome System: Sex differntiation. Chromosome theory of sex determination.
4. Sex linked inheritance (Haemophilia, colour blindness)
5. Structural changes in chromosomes.
6. Numerical changes in chromosomes.

Unit -III: Human Genetics & Genetic Engineering

1. Human chromosomes and maps.
2. Common genetic diseases in man (Sickel cell anaemia, Albinism and Alkaptoneuria)
3. Multiple factors and blood groups.
4. Twins, physical traits, mental traits.
5. Techniques used in recombinant DNA technology.
6. Gene cloning and Polymerase chain Reaction (PCR).

Unit - IV: Cytoplasmic Inheritance, Nature and Functions of Genetic Material

1. Cytoplasmic inheritance: Material effect on Limnea (Shell Coiling), Carbondioxide sensitivity in Drosophilla and Kappa particles in Paramecium.
2. Chemistry of Gene: Nucleic Acids and their structure.
3. Concept of DNA replication.
4. Nucleosome (Solenoid model)
5. Split genes, overlapping gene and Pseudogenes.
6. Genetic Code.

Unit -V: Mutation and Applied Genetics

1. Types of mutation
2. Causes of mutation
3. Mutangens- Classification, Types and effects
4. Gene Therapy
5. DNA finger printing

Practical Excercise

1. Histological study of various endocrine glands, digestive organs, testis, ovary, kidney, lung, muscles, pancreas & liver.
2. Counting of RBC and WBC in blood sample.
3. Estimation of haematocrit value, bleeding time
4. Study of human salivary activity in relation to pH
6. pH determination by pH meter/pH paper
7. Use of Kymograph
8. Detection of protein, carbohydrate and lipids
9. Human blood groups
10. Detection of nitrogenous waste product in fish tank water, frog tank water, Bird excreta, mammalian kidney
11. Squash preparations of Onion root tip/ Chironomus salivary gland/Grasshopper testis
12. O2 Consumption in Fish
13. Problems on Genetics

BCHM208   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

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

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 संक्षिसियां, रचना एवं प्रयोगगत विवेचन ।

Year-3

Physical Chemistry-III

Unit -I

Spectroscopy -I

Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born Oppenheimer approximation, degree of freedom.

Rotational spectrum of 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.

Raman Spectrum, Concept of Polarizability, Pure Vibrational and pure rotational Raman Spectra of diatomic molecules, Application of Raman Spectrum.

Unit -II

Spectroscopy -II

UV Spectroscopy: Electronic Excitation, elementary idea of instrument used, Application to structure determination of organic molecules. Woodward- fieser rule for determining λ max of α, β- unsaturated Carbonyl Compounds.

Infrared Spectrum: Energy levels of simple harmonic oscillator, selection rule, pure Vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of enharmonic motion and Isotope on the spectrum, Idea of Vibrational frequencies of different functional groups.

Unit -III

Photochemistry I

Interaction of radiation with matter, difference between thermal and photochemical processes. Law of Photochemistry: Grothus-Draper law, Stark constant of Unimolecular reactions.

Photochemistry -II

Electronic transitions, Jablonski diagram depicting various process occurring in the excited state, Qualitative description of fluorescence, Phosphorescence, non-radiative Processes (Internal Conversion, Intersystem Crossing), Quantum Yield, Photosensitized reactions- energy transfer Processes.

Unit -IV

Physical Properties and Molecular structure optical activity, polarization- (Clausius-Mossotti equation), Orientation of dipole in electric field, dipole moment, induced dipole moment. **Measurement of dipole moment-** Temperature and refractivity method, dipole moment and structure of molecules.

Magnetic properties -Para magnetism, diamagnetism and ferromagnetism.

Solutions, Dilute and Colligative Properties- I

Ideal and non- ideal solutions, method of expressing concentrations of solutions, Activity and activity coefficient. Dilute solutions, colligative properties, Raoult's law, relative lowering of vapor pressure, molecular weight determination, osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure solutions, Dilute solutions and Colligative properties -II Elevation of boiling point and depression of freezing point. Thermodynamics derivation of relation between molecular weight and elevation of boiling point and depression in freezing point.

Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

Inorganic Chemistry-III

Unit -I
Bioinorganic Chemistry -I

Essential and trace element in biological processes, Metalloporphyrims with special reference to hemoglobin and myoglobin, Biological role of alkali and alkaline earth metal ions with special reference of $ca2+$, Nitrogen Fixation, Bioinorganic Chemistry -II, Role of metal ions in biological process, Na/K Pump, Metal Complex as therapeutic agents- anticancer agents, antiarthirits drug and Relation therapy.

Unit -II

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, elecronegativity and hardness and softness.

Gravimetric Analysis- Principles of gravimetric estimation, super saturation, co-precipitation, post- precipitation and Ash treatment with respect to the estimation of Ba, zn and cu, water analysis. Hardness, types of hardness- Temporary, Permanent and total hardness, acidity and alkalinity, BOD, COD and DO.

Unit -III
Inorganic Polymers

Introduction and Scope of inorganic polymers: Special characteristics, classification, homo and hetero atomic polymers and their applications.

Silicon's and Phosphazenes- Silicones and Phosphazenes as example of inorganic Polymers, nature of bonding in triphosphazenes.

Unit -IV
Organometallic Chemistry -I

Definition, nomenclature and classification of organometallic compound, Preparation, properties, bonding and applications of alkyls and aryls of Li, Al.

Unit -V
Organometallic Chemistry -II

A brief account of metal-ethylenic complexes and homogenous hydrogenation, mononuclear carbonyls and the nature of bonding in metal Carbonyls. Transition metal organometallic compounds with bonds to hydrogen and boron.

Organic Chemistry-III

Unit -I
Carbohydrates -I
Classification and Nomenclature, Monosaccharide, mechanism if osazon formation, interconversion of Glucose and Fructose, chain lengthening and chain shortening of Aldoses. Conversion of glucose into mannose. Configuration of monosaccharide, erytho and threo diasterioisomers. Conversion of glucose into mannose. Formation of glucosides, ethers and esters, determination of ring size of monosaccharide, cyclic structure of D(+) glucose, mechanism of Mutarotation. Structure of Ribose and deoxyribose.

Carbohydrates -II
An introduction to glycosidic linkage in di-and poly- saccharids. Reducing and non reducing sugars. Structure determination of maltose, sucrose, starch and cellulose.

Unit -II
Elementary Idea of fats, oils and Detergents-
Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Soapnificationvalue, iodine value, acid value.
Soap and Detergents- Classification of Dyes, Chemistry and Synthesis of Methyl orange, Congo red,Malachite green, Crystal violet, Phenolphthalein,fluorescein, Alizarinand Indigo.
Nucleic Acids- Nucleic Acid- Introduction, Constituents of Nucleic acids. Ribonucleosides and ribonodeotides. The double helical structure of DNA.

Unit -III
Organomettalic Compounds
Organomettalic Compounds- The Grignard's reagents- formation, structure, and synthetic applications. Organozinc compound: Formation and chemical reactions. Organ lithium compound: Formation and Chemical reactions.
Organic synthesis via Enolates-
Organic synthesis via Enolates. Acidity of α-hydrogen, 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 enamines.

Unit -IV
Organosulpher Compounds-
Nomenclature, structure features, method of formation and chemical reactions of thiols, thioethers, sulhonic acids, sulphonamides and sulphaguanidine.

Unit -V
Amino acids- Classification, structure and stereochemistry of amino acids, acid-base behavior, iso-electric point, general method of preparations and properties of α-amino acids.
Protein and Peptides- Introduction to peptides linkage, synthesis and end group analysis of Peptides. Solid Phase synthesis, classification, properties and structure of proteins (Primary, secondary and tertiary).

Physical Chemistry - IV

Unit -I

Statistical Thermodynamics

Statistical thermodynamics of Maxwell Boltzmann distribution law. Maxwell-Boltzmann law and the concept of negative temperature, Maxwell-Boltzmann law of distribution of energy and velocity (evaluation of energy. Derivation of equation of states for a monatomic ideal gas

Unit -II

Nuclear Chemistry and Radioactivity

Nature of radiation from radioactive substances nuclear structure and nuclear properties. Nuclear reaction, radioactive disintegration series, kinetics of radioactive disintegration. Artificial transmutation of elements. Nuclear fission and nuclear fusion. Radio-carbon dating, synthetic elements. Composition of nuclei:forces operating within the nucleus, nuclear stability and mass energy. Types of nuclear reaction. The compound nuclear theory , scintillation counters. Activation analysis. Isotopic dilution and radioactive titration. Application

Unit -III

Polymers Chemistry

Polymerisation, classification of polymers, natural and synthetic polymers. General methods of preparation. addition and condesation polymer's. Number average molecular weight, Weight average molecular weight. Determination of molecular weight by osmotic, pressure method, viscosity method, light scattering method, kinetics of condensation polymerisation, kinetics of chain polymerisation, kinetics of cationic, anonic and condensation polymerisation. Copolymerisation

Unit –IV

Physical properties and Molecular structure

Optical activity, polarization, clausius- mossotti equation , orientation of dipoles in electric field. Dipole moment, induced dipolemoment, measurement of dipolemoment by temperature methods and refrectivity method. Dipolmoment and chemical constitution,

BCHM305   External Term: 70
                                                 Internal Marks: 30

Inorganic Chemistry -IV

UNIT-I

Organic Reagents in Inorganic Analysis:

Criteria for choice of organic reagents, use of following reagents in inorganic analysis: DMG, cupferron, 8-hydroxyquinoline, Nitroso E- naphthol, EDTA, Acetylacetone, dithiozone, dithiocarbamate. Advantages and disadvantages of organic reagents in inorganic analysis

UNIT-II

Analytical Chemistry:

Sources of errors in chemical analysis, classification of errors, precision, accuracy, statistical evaluation and interpretation of results in analytical chemistry (with numericals). Inorganic Polymers: Definition, classification, polymers based on hetroatomic structure ,PON polymer, polythiazyl, synthetic inorganic fibres Co-ordination polymers.

UNIT-III

Solvent Extraction:

 Basic principles of solvent extraction, classification and mechanism of extraction, extraction equilibria, techniques of extraction and applications in analytical chemistry. Ion - Exchange: Characteristics of ion-exchangers, mechanism of ion-exchange, ion-exchange equilibra, plate theory for ion-exchange, techniques of ion-exchange and applications of ion exchange for separations.

UNIT-IV

Chromatography:

 Classification of chromatographic methods, chromatographic terminology - Rf value, partition co-efficient, dyanmics of chromatography, basic principles of adsorption and partition chromatography, applications.

Organic Chemistry-IV

Spectroscopy

UNIT-I

Principle of nuclear magnetic resonance,the PMR spectrum,number of signals, peak areas, equivalent and nonequivalent protons positions of signals and chemical shift,shielding and deshielding of protons, proton counting,splitting of signals and coupling constants, magnetic equivalence of protons.Discussion of PMR spectra of the molecules: ethyl bromide, n-propyl bromide, isopropyl bromide, 1,1-dibromoethane, 1,1,2-tribromoethane, ethanol, acetaldehyde, ethyl acetate, toluene, benzaldehyde, acetophenone,p-anisidine and p-nitrotoluene.Simple problems on PMR spectroscopy for structure determination of organic compounds.

UNIT-2

1. Mass Spectroscopy: Introduction, instrumentation, mass spectrum, determination of molecular formula, parent peak and base peak, recognition of molecular ion peak, fragmentation pattern of alkanes, alkenes and benzene.

2.Organosulphur Compounds Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine. Synthetic detergents alkyl and aryl sulphonates.

UNIT-3

 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 glucose and fructose. Open chain and cyclic structure of D(+)-glucose & D(-) fructose. Mechanism of mutarotation. Structures of ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

UNIT-4

 Organometallic Compounds Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions. Organo lead compounds: formation and chemical reactions. Organo cadmium compounds: formation and chemical reactions. Organo copper compounds: formation and chemical reactions.

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.)