St. PETER'S UNIVERSITY

St. Peter's Institute of Higher Education and Research
(Declared Under Section 3 of the UGC Act, 1956)
AVADI, CHENNAI – 600 054
TAMIL NADU

B.Sc. (CHEMISTRY)
Code No. - 313
(Effective From **2009 – 2010**)
(Distance Education)

Regulations and Syllabi
(I & II & III Year)

St. PETER'S INSTITUTE OF DISTANCE EDUCATION
Recognized by Distance Education Council and
Joint Committee of UGC – AICTE - DEC, New Delhi
(Ref. F. No. DEC/SPU/CHN/TN/Recog/09/14 dated 02.04.2009 and
Ref.F.No.DEC/Recog/2009/3169 dated 09.09.2009)

St. PETER'S UNIVERSITY
St. PETER'S INSTITUTE OF DISTANCE EDUCATION
Chennai – 600 054.

Code No. – 313
B.Sc. (CHEMISTRY)
(Distance Education)

Regulations and Syllabi
(Effective from 2009 – 2010)

1. **Eligibility:** Candidates who have passed the Higher Secondary Examination conducted by the Government of Tamilnadu with Mathematics, Physics and Chemistry as one of the subjects, or any other examination recognized as equivalent thereto are eligible for admission to Three Year B.Sc Programme in Chemistry.

2. **Duration:** Three Years.

3. **Medium:** English is the medium of instruction and examination.

4. **Methodology:** The methodology of distance education includes the supply of self-instructional study materials in print format and in CD, face-to-face instruction for theory and practicals for a limited period during week ends and on holidays, provision of virtual class in phased manner, dissemination of information over e-mail, Student - Support Service at various Centres of the University, Continuous Assessment and End Assessment conducted by the University at various parts of India.

5. **Weightage for Continuous and End Assessment:** There is no weightage for Continuous Assessment unless the ratio is specifically mentioned in the scheme of Examinations. The End Assessment (EA) has 100% weightage.

6. **Credit System:** Credit system be followed with 36 credits for each Year and each credit is equivalent to 25-30 hours of effective study provided in the Time Table of the formal system.

7. **Scheme of Examinations**

First Year

Code No.	Course Title	Credit	Marks	
	Theory		EA	Total
109UTMT01 109UHIT01	Tamil - I Hindi - I	6	100	100
109UEHT02	English - I	6	100	100
109UCHT03	General Chemistry – I	6	100	100
109UCHT04	Allied-I: Physics compulsory	6	100	100
109UCHP01	Inorganic Analysis and Preparation(Practical) Record	6	90 10	100
109UCHP02	Allied-I: Practical Record	6	90 10	100
	Total	**36**	**600**	**600**

Second Year

Code No.	Course Title	Credit	Marks	
	Theory		EA	Total
209UTMT01 209UHIT01	Tamil - II Hindi - II	6	100	100
209UEHT02	English - II	6	100	100
209UCHT03	General Chemistry – II	8	100	100
209UCHT04	Allied-II: Mathematics	8	100	100
209UCHP01	Major Practical – I Record	8	90 10	100
	Total	**36**	**500**	**500**

Third Year

Code No.	Course Title	Credit	Marks	
	Theory		EA	Total
309UCHT01	Inorganic Chemistry	6	100	100
309UCHT02	Organic Chemistry	6	100	100
309UCHT03	Physical Chemistry	6	100	100
309UCHT04	Analytical Chemistry	6	100	100
309UCHT05	Application Oriented subject:Pharmaceutical, Industrial and Agricultural Chemistry	4	100	100
309UCHP01	Practical – II: Organic analysis and Gravimetric Estimation Record	4	90 10	100
309UCHP02	Practical – III: Organic preparation and Physical Chemistry Experiment Record	4	90 10	100
	Total	**36**	**700**	**700**

8. **Passing Requirements:** The minimum pass mark (raw score) be 40% in End Assessment.

9. **Grading System:** Grading System on a 10 Point Scale be followed with 1 mark = 0.1 and the conversion of the Grade point as given below.

$$\text{Overall Grade Point Average (OGPA)} = \frac{\text{Sum of Weighted Grade Points}}{\text{Total Credits}}$$

$$= \frac{\Sigma (EA)C}{\Sigma C}$$

The Overall Grade: The Overall Grade and Classification of all successful candidates be arrived at from the Overall Grade Point Average as stipulated in the following conversion Table.

Grade	Over all Grade Point Average(OGPA)	Over all weighted Average marks	Classification
0	9.00 to 10.00	90.00 to 100	First Class
A	8.00 to 8.99	80.00 to 89.99	First Class
B	7.00 to 7.99	70.00 to 79.99	First Class
C	6.00 to 6.99	60.00 to 69.99	First Class
D	5.00 to 5.99	50.00 to 59.99	Second Class
E	4.00 to 4.99	40.00 to 49.99	Third Class
F	0.00 to 3.99	0.00 to 39.99	**Fail**

The Grade Sheets of successful candidates provide particulars such as (1) Overall weighted Average Marks, (2) Overall Grade Point Average,   (3) Overall Grade and (4) Overall classification.

10. Pattern of the Question Paper: The question paper for the End Assessment will be set for three hours and for a maximum of 100 marks with following divisions and details.

Part A: 10 questions (with equal distribution to all units in the syllabus). Each question carries 2 marks.

Part B: 5 questions with either or type (with equal distribution to all the units in the syllabus). Each question carries 16 marks.

The total marks scored by the candidates will be calculated to the maximum prescribed in the Regulations.

11. Syllabus

B.Sc.CHEMISTRY -FIRST YEAR
109UCHT03: GENERAL CHEMISTRY- I

UNIT-I
Atomic Structure

1.1.Fundamental particles of matter – their composition –Comparison between Rutherford's model of atom and Bohr's model-Outline of the Bohr-Sommerfeld model-its limitations-Black body radiation-Photo electric effect- de Broglie theory-Heisenberg's uncertainty principle- Quantum numbers.

Wave mechanical concept of atom – Schrodinger's wave equation (derivation not needed)-significance of Ψ and Ψ^2 – Eigen functions and Eigen values-shapes of different orbitals – Differences between an orbit and orbital.

Electronic structure

1.2. Pauli's Exclusion principle and its application-Hund's rule-its basis and applications - stability of half-filled and fully - filled orbitals-Aufbau principle and its limitations.

1.3. Periodic properties: Atomic and ionic radii, Ionization Energy, Electron affinity and Electronegativity – Definition, Variation of the periodic properties along periods and groups-theoretical explanation for the variations.

1.4. s, p, d and f block elements-classification and characteristic properties.

UNIT-II
Principles of Qualitative analysis: Basic principles of Inorganic semimicro analysis-semimicro techniques-principles involved in Na_2CO_3 extract preparation-common ion effect and solubility product and their applications in qualitative analysis - separation of cations into groups.

Principles of Volumetric analysis- Definition of molarity, molality, normality and mole fraction-Definition and examples for Primary and Secondary standards. Theories of acid-base, redox, iodometric and iodimetric titrations-calculations of equivalent weight - Theories of acid-base, redox, adsorption and fluorescence indicators and choice of indicators

UNIT - III Structure and Bonding

3.1. Electron displacement effects :

3.1.1. Inductive, inductomeric and steric effects-their effect on properties of compounds

3.1.2.Mesomeric, resonance, hyperconjugation-localised and delocalised chemical bond

3.2.Intermolecular interactions-Dipole-Dipole interaction, van der Waals forces, hydrogen bond and its types-effect of intermolecular forces on physical properties-melting point, boiling point and solubility.

3.3.Reactive intermediates -carbocations, carbanions, free radicals and carbenes with examples.

3.4.Cycloalkanes-Wurtz reaction, Dieckmann ring closure & reduction of aromatic hydrocarbons -.Baeyer's strain theory and its limitations-Sache-Mohr theory– Ring strain in small rings (cyclopropane and cyclobutane)-theory of strainless rings.

3.6.Alkenes:

Electrophilic and free redical mechanism of addition in alkenes-Markownikoff's rule-peroxide effect-mechanism of Hydroboration, Ozonolysis and allylic substitution by NBS.

1,2 and 1,4 additions-thermodynamic and kinetic controlled products-Diels - Alder reaction.

UNIT-IV

Chemical Bond

4.1.1. Ionic bond-mode of formation – properties of ionic compounds-inert pair effect-Born-Haber cycle-polarisation of ions-factors affecting polarisation-importance of polarisation of ions-Fajan's rules and applications.

4.1.2. Covalent Bond-mode of formation-properties of covalent compounds-Valence Bond theory-Postulates of Pauling-Slater's theory-Different types of overlapping. Molecular orbital theory-Postulates-Bonding and antibonding molecular orbitals-Tabulation of various M.Os formed from atomic orbitals-Energy level diagrams for M.Os-Bond order-Electronic configuration of Hetero nuclear diatomic molecules - CO, NO and HF.

4.1.3. Coordinate Bond-mode of formation-importance of coordinate bond in the formation of metal complexes.

Hydrides,Carbides and Noble gases

4.2.1. Hydrides-Classification-Types of Hydrides-Ionic Hydrides-LiH and NaH-Preparation, properties and uses.

Covalent Hydrides – silanes - General study - Chemistry of monosilanes and disilanes-Differences between silanes and alkanes.

Metallic Hydrides-Preparation, properties, and uses (A brief study.) Complex Hydrides-$NaBH_4$ and $LiAlH_4$-preparation, properties, and uses.

4.2.2. Carbides-Preparation, properties and technical applications.

4.2.3. Noble Gases-position of Noble gases in the periodic Table – Preparation, properties and structure of compounds of Xenon.

UNIT-V

The Gaseous State

5.1.1. **Behaviour of ideal gases.**

Kinetic molecular theory of gases-the kinetic gas equation-Derivation of the gas laws-kinetic theory and temperature-Boltzmann constant-Maxwell's distribution of molecular velocities-types of molecular velocities- collision diameter-collision freqeuency-mean free path-Degrees of freedom of gaseous molecules-Principle of equipartition of energy.

5.1.2. **Behaviour of Real gases**

Deviations from ideal behaviour- -Explanation of deviations - Boyle point. The virial equation of state-derivation of the principle of corresponding states.

The Liquid State:

5.2.1. Structure of liquids-Vapour-pressure-Trouton's rule-surface tension-surface energy-some effects of surface tension-viscosity-effect of temperature on viscosity (Experimental determination of surface tension and viscosity not necessary)-Refractive index-specific refraction-molar refraction. Physical properties and chemical constitution-Molar volume and chemical constitution-Parachor and chemical constitution-Viscosity and chemical constitution-Molar refraction and chemical constitution.

109UCHT04 – ALLIED – I: PHYSICS

UNIT – I: WAVES AND OSCILLATIONS

Simple harmonic motion – composition of two simple harmonic motion at right angles(periods in the ratio 1:1) – Lissajou's figures – uses – laws of transverse vibrations of stings – Melde's string – transverse and longitudinal modes – determination of a.c frequency using sonometer (steel and brass wires) – ultrasonics – production – application and uses – reverberation – factors for good acoustics of hall and auditorium.

UNIT – II: PROPERTIES OF MATTER

Elasticity: Elastic constants – bending of beam – Young's modulus by non-uniform bending – energy stored in a stretched wire – torsion in a wire – determination of rigidity modulus by torsional pendulum – static torsion.

Viscosity: Coefficient of viscosity – Poissuelle's formula – comparison of viscosities – burette method – Stoke's law – terminal velocity – viscosity of highly viscous liquid – lubrication.

Surface tension: Molecular theory of surface tension – excess of pressure inside a drop and bubble – variation of surface tension with temperature – Jaeger's method.

UNIT – III: THERMAL PHYSICS AND ATOMIC PHYSICS

Joule–Kelvin effect – Joule-Thomson porous plug experiment – theory and application – liquefaction of gasses – Linde's process – Helium I and II – adiabatic demagnetization. Thermodynamic equilibrium – laws of thermodynamics – entropy change of entropy in reversible and irreversible processes.

Atom model – vector atom model – electron, spin, quantum numbers – Pauli's exclusion principle – electronic configuration of elements and periodic classification of elements – various quantum numbers – magnetic dipole moment of electron due to orbital and spin motion – Bohr magneton – spatial quantization – Stern and Gerlach experiment.

UNIT – IV: ELECTRICITY AND MAGNETISM

Capacitor – energy of a charged capacitor – loss of energy due to sharing of charges – magnetic field due to a current carrying conductor – Biot Savart's Law – Field along the axis of the coil carrying current – peak, average and RMS values of ac current and voltage – power factor and current values in an ac circuit – circuit

control and protective devices – switch and its types – fuses circuit breaker and relays.

Digital Electronics: NAND and NOR gates – Universal building blocks – Boolean algebra – Demorgan's theorem – verification – elementary ideas of ICs – SSI, MSI, LSI and VLSI – Half adder, Full adder, Half Subtractor and Full Subtractor.

UNIT – V: GEOMETRICAL OPTICS AND PHYSICAL OPTICS

Refraction – Refractive index by microscopy – air cell – refraction at grazing incidence and grazing emergence in prisms – combination of two small angled prisms to produce dispersion without deviation and deviation without dispersion – direct vision prism – constant deviation prism – defects of images – coma – distortion – spherical and chromatic aberration in lenses.

Velocity of light – Michelson's method – Interference: Colours of thin films – air wedge – determination of diameter of a thin wire by air wedge – test for optical flatness – Diffraction – Fresnel's explanation of rectilinear propagation of light – theory of transmission grating – Normal incidence – polarization – double refraction – optical activity – polarimeter.

Text Book:

1. Allied Physics by R. Murugesan, S. Chand & Co, New Delhi(2008).
2. Waves and Oscillations by Brijlal and N. Subramaniam, Vikas Publishing house, New Delhi(2001)
3. Properties of Matter by Brijlal and N. Subramaniam S. Chand & Co., New Delhi(1994)
4. Heat and Thermodynamics by J.B.Rajam and C.L. Arora, S.Chand & Co., 8th edition, New Delhi(1976)
5. Optics and Spectroscopy by R. Murugesan, S.Chand & Co, New Delhi(2005).

Reference Books:

1. Fundamentals of Physics by Resnick Halliday and Walker, John Willey and Sons, Asia Pvt Ltd, 6th edition, Singapore.
2. Text book of Sound by V.R. Khanna and R.S. Bedi, Kedharnaath Publish & Co, 1st edition, Meerut (1998).
3. Electricity and Magnetism by N.S. Khare and S.S. Srivastava, Atma Ram & sons, 10th Edition, New Delhi(1983).
4. Optics by D.R. Khanna and H.R. Gulati, S.Chand & Co., New Delhi(1979).

109UCHP01: PRACTICAL – I INORGANIC QUALITATIVE ANALYSIS AND PREPARATION

1. Inorganic qualitative analysis : Analysis of a mixture containing two cations and two anions of which one will be an interfering ion. Semimicro methods using the conventional scheme with hydrogen sulphide may be adopted.

   Anions to be studied : Carbonate, sulphide, sulphate, nitrate, fluoride, chloride, bromide, borate, oxalate, arsenite, arsenate, phosphate, chromate. Cations to be studied :Lead, Bismuth, copper, cadmium, arsenic, iron, aluminium,Cobalt,Nickel,Zinc,Barium,calcium, magnesium, ammonium.

2. Inorganic preparations :
   a) Sodium thiosulphate
   b) Ferrous ammonium sulphate
   c) TetrammineCopper (II) sulphate
      Microcosmic Salt

109UCHP02: ALLIED PRACTICAL (PHYSICS)

1. Young's Modulus by Non-uniform bending using Pin and Microscope
2. Young's Modulus by Non-uniform bending using Optic lever – Scale and telescope
3. Rigidity modulus by Static torsion method
4. Rigidity modulus by torsional oscillations without mass
5. Surface tension and interfacial tension – Drop Weight method
6. Comparison of Viscosities of two liquids – Burette method
7. Specific Heat Capacity of a liquid – Half time correction
8. Sonometer – Determination of a.c frequency
9. Newton's rings – Radius of curvature
10. Airwedge – Thickness of a wire
11. Spectrometer – Grating – Wavelength of Mercury lines – Normal Incidence
12. Potentiometer – Voltmeter Calbration
13. P.O. Box – Specific resistance
14. B.G. – Figure of merit
15. Construction of AND,OR, NOT gates – using diodes and Transistor
16. Zener Diode – Characteristics
17. NAND gate as a universal gate

Note: Use of Digital Balance Permitted

Books for Study and Refernce:

1. Practical Physics by M.N. Srinivasan S. chand & Co.,
2. Practical Physics by M. Arul Thalapathy Comptek Publishers.

209UCHT03: GENERAL CHEMISTRY – II

UNIT-I

1.1. Transition Elements and Group Study

1.1.1.Transition Elements – position in the Periodic Table-General characteristics of d-block elements – an objective study of the properties expected.

1.1.2.Occurrence, extraction, properties and uses of Titanium, Zirconium, Molybdenum, Tungsten and Platinum.

1.1.3.Chemistry of Titanium dioxide, Titanium tetrachloride, Vanadium pentoxide, Ammonium Vanadate, Zirconium dioxide, Zirconium halides, Ammonium molybdate, Molybdenum blue, Tungsten tri oxide, Tungsten Bronzes, Chloroplatinic acid and Barium Platinocyanide.

1.1.4.Group study of Ti, V and Cr groups.

1.2. Nuclear Chemistry

1.2.1. Nuclear stability-n/p ratio- nuclear forces-Exchange theory and nuclear fluid theory.

1.2.2 Natural radioactivity – modes of decay-Geiger – Nuttal rule. Units of radioactivity – Kinetics of radioactive disintegration-Half life and average life-Radioactive equilibrium – Numerical problems

1.2.3. Mass defect and binding energy - Artificial transmutation and artificial radioactivity.

1.2.4. Nuclear fission and nuclear fusion-mechanisms-applications-differences – Stellar Energy.

1.2.5. Application of radioactive isotopes-C-14 dating, rock dating – Numerical problems - isotopes as tracers-study of reaction mechanism (e.g. ester hydrolysis), radiodiagnosis and radiotherapy.

1.2.6. Nuclear reactors in India..

UNIT-II

2.1. **Alkynes** - Acidity of alkynes-formation of acetylides-oxidation - ozonolysis and hydroboration, addition of water with $HgSO_4$ catalyst.

2.1.1 Reaction mechanism II

Aliphatic nucleophilic substitution- S_N1, S_N2 and S_Ni reactions – Reactivity-effects of structure of substrate, attacking nucleophile, leaving group and reaction medium

Elimination reactions-mechanisms of E_1 and E_2 reactions-cis and trans eliminations-Hofmann and Saytzeff rule.

2.1.2. Unsaturated alcohols-preparation and reactions of allyl alcohol.

2.2. Aromatic hydrocarbons and aromaticity-reasonance in benzene-delocalised cloud in benzene-aromaticity-Huckel's (4n+2) rule and its simple applications.

2.2.1. Reaction mechanism III

Electrophilic substitution reactions in aromatic compounds-general mechanism –Nitration, Halogenation, Sulphonation, Friedel-Crafts acylation and alkylation-directive influence – Orientation-ortho/para ratio.

2.2.2. Polynuclear aromatic hydrocarbons- naphthalene and anthracene - isolation, synthesis ,properties, and uses.

2.3. **Reaction mechanism-IV**

2.3.1. Mechanism of -Kolbe's reaction-Reimer-Tiemann reaction-Gattermann, Lederer- Manasse and Houben-Hoesch reactions,perkins and haloform reactions.

2.3.2. Cresols, nitrophenols, aminophenols-alpha and beta naphthols-preparation and uses

2.3.3. Epoxides-synthesis, properties and uses, Crown ethers.

UNIT-III

3.1 **Reaction mechanism V**

3.1.1. Addition to Carbon –heteromultiple bond - Addition of HCN, NH_2OH, 2,4-dinitrophenyl hydrazine, semicarbazide & Grignard reagent .

3.1.2.Mechanisms of Mannich, Stobbe, Darzen, Wittig and Reformatsky reactions.

3.2. **Carboxylic acids**

3.2.1. Unsaturated acids-preparation and properties of acrylic, crotonic and cinnamic acids

3.2.2. Hydroxy acids-classification – preparation of Glycolic acid -Action of heat on α, β, γ and δ acids.

3.2.3. Dicarboxylic acids-preparation of oxalic, malonic, succinic, glutaric and adipic acids.Action of heat on these acids.

3.3. **Reaction mechanism VII**

3.3.1.Mechanism of esterification including trans esterification.

3.3.2.Hydrolysis of esters-mechanism

3.3.3. Tautomerism-definition-keto-enol, amido-imido and nitro-acinitro tautomerisms-acid-base inter conversion mechanism.

3.3.4. Malonic, and Acetoacetic esters - characteristic reactions of active methylene group -synthetic uses.

3.3.5. Diazonium compounds-diazotisation mechanism-diazonium ion as a weak electrophile-preparation and synthetic uses of diazoacetic ester & diazomethane.

UNIT IV

     4.1. **The Solid State** - Difference between crystalline and amorphous solids-isotropy and anisotropy- space lattice and unit cell-Bravis lattices- -Law of rational indices-Miller indices-X ray diffraction-Bragg's equation-Experimental methods.

4.2. **The colloidal State**

     Definition of colloids - Classification of colloids - solids in liquids (sols) - properties-Kinetic, optical and electrical-stability of colloids, protective action-Hardy-Schulze law, gold number.

     Liquids in liquids (emulsions): Types of emulsions-preparation, emulsifier

     Liquids in solids (gels): classification, preparation and properties, inhibition-general applications of colloids.

4.3**. Polymer Chemistry**

     4.3..1. Basic concepts: Monomers for addition polymers and condensation polymers, repeat units, polymer structures.Linear, branched and network polymers.

     4.3.2. Copolymers - block, alternating and graft copolymers

     4.3.3. Mechanism and kinetics of Free radical addition polymerization

     4.3.4. Average molecular weight concept-number and weight average
       molecular weight

     4.3.5. Polymer processing: Film casting, injection moulding and Fibre
       spinning.

     4.3.6. Application of polymers: Applications of polythene, Polyvinyl resins
       and biomedical polymers for contact lenses and dental uses.

UNIT V

5.1. The first law of thermodynamics and thermochemistry

5.1.1 -Expansion of an ideal gas-work done in reversible isothermal expansion-work done in reversible isothermal compression-work done in reversible adiabatic expansion – Joule-Thomson effect, Joule-Thomson coefficient-Inversion temperature-zeroth law of thermodynamics-Absolute temperature scale.

5.1.2. Kirchoff's equation-Flame and explosion temperatures.

5.2. Second law of thermodynamics-I

5.2.1. Limitations of the first law-need for second law-spontaneous processes-cyclic process-Carnot cycle –efficiency-Carnot theorem-Thermodynamic scale of temperature.

5.2.2. Concept of entropy-Entropy-a state function-Entropy change in isothermal expansion of an ideal gas-entropy change in reversible and irreversible processes-Clausius inequality-Entropy change accompanying change of phase-calculation of entropy changes of an ideal gas with changes in P, V and T –Entropy of mixture of ideal gases-entropy of mixing-physical significance of entropy.

5.3. Second law of thermodynamics-II

5.3.1. Work and free energy functions-Maxwell's relationships criteria for reversible and irreversible processes -Gibbs-Helmholtz equation-Partial molar free energy . Concept of chemical potential-Gibb's Duhem equation-Chemical potential in a system of ideal gases-Duhem-Margulus equation .Clapeyron equation-Clapeyron- Clausius equation-Applications of Clapeyron-Clausius equation-concept of fugacity-Determination of fugacity of a gas-Fugacity of a liquid component in a liquid solution-concept of activity-activity coefficient-standard states.

5.4. Third law of thermodynamics

Nernst heat theorem-statement of III law-Evaluation of absolute entropy from heat capacity measurements-Test for the validity of the law.

ALLIED -II
209UPHT04: MATHEMATICS

Unit – I Matrices

Characteristic equation – Eigen values and Eigen vectors – properties – problems – rank of a matrix – problems – solution of simultaneous equations using matrices – consistency condition.

Unit – II Theory Of Equations

Polynomial equations – relation between roots and coefficients – imaginary roots and irrational roots – solving equations under given conditions – transformation of equations – Descarte's rule of signs.

Unit – III Differential Calculus

Definition of a derivative, different types of differentiation – standard formula – successive differentiation – nth derivative – Leibnitz formula – problems.

Unit –IV

Partial differentiation – Euler's theorem – Curvature – Radius of Curvature in Cartesian and polar co – ordinates.

Unit – V Vector Analysis

Gradientϕ, divergence and curl of a vector point function – solenoid and irrotational vectors – unit normal vector – directional derivative – problems - Second order derivatives.

Text books

1. T.K. Manickavasagam pillai – Allied mathematics
2. P.R. Vittal – Allied Mathematics
3. S.P. Rajagopalan – Allied Mathematics.

209UCHP01: PRACTICAL (GENARAL CHEMISTRY – II)

ACIDIMETRY

1. Estimation of sodium hydroxide – standard sodium carbonate.
2. Estimation of borax – std. Sodium carbonate
3. Estimation of bicarbonate and carbonate in a mixture.

PERMANGANOMETRY

1. Estimation of oxalic acid – std. – Mohrs salt or ferrous sulphate.
2. Estimation of calcium
3. Estimation of sodium nitrite – std. Oxalic acid.
4. Estimation of ferric ion.
5. Estimation of percentage of manganese in pyrolusite.

IODIMETRY

1. Estimation of arsenious oxide.

ODOMETRY

1. Estimation of copper – std. Potassium dichromate.
2. Estimation of potassium dichromate – std. copper sulphate.

COMPLEXOMETRY

1. Estimation of zinc or magnesium using EDTA.
2. Estimation of zinc using potassium ferrocyanide.
3. Estimation of temporary and permanent hardness of water.

DICHROMETRY

1. Estimation of ferrous ion using diphenyl amine as indicator. / Precipitation titration.
2. Estimation of chloride in neutral medium.

309UCHT01 - INORGANIC CHEMISTRY (120 Hours)

UNIT-I

Concept of acids, bases and Non aqueous solvents

1.1. Acids and Bases: Arrhenius, Bronsted-Lowry, the Lux-Flood, Solvent system and Lewis concepts of acids and bases.Relative strength of acids and bases- Effect of solvent-Levelling effect.

1.2. Hard and Soft Acids and Bases-classification of acids and bases as hard and soft – examples-Pearson's HSAB concept - Applications of HSAB principle

1.3. Non-aqueous solvents-physical properties of a solvent, types of solvents and their general characteristics. Reactions in non-aqueous solvents with reference to liq. NH_3 and liq SO_2- Comparison.

Chemistry of f-block elements

1.4. Position in the Periodic Table-General characteristics of Lanthanides and Actinides-Lanthanide contraction and its consequences.

1.4.1 Isolation of Lanthanides from Monazite including the Ion exchange resin method.

1.4.2. Actinides-occurrence and preparation

1.4.3 Comparison of Lanthanides and Actinides.

1.4.4. Elements with atomic number 104 and 105-their position in the periodic table and synthesis.

UNIT II   Coordination Chemistry

2.1. Definition of the terms-Classification of ligands-Nomenclature of mononuclear and polynuclear complexes-chelating ligands and chelates-Examples-chelate effect-explanation.

3.2. Werner's theory-conductivity and precipitation studies 2Sidgwick's theory-Effective Atomic Number concept.

2.3. Isomerism in complexes-Structural Isomerism—types. Stereoisomerism-Geometrical isomerism in 4 and 6 coordinated complexes- Optical isomerism in 4-and 6-coordinated complexes- 2.4. Factors affecting the stability of complexes.

2.5. Theories of bonding in complexes-Valence Bond Theory-Postulates – Hybridisation and geometries of complexes-Outer orbital and inner orbital octahedral complexes. Square planar and tetrahedral complexes-V.B. Theory and magnetic properties of complexes-limitations of V.B. Theory.

2.6 Crystal Field Theory-postulates-d-orbital splitting in octahedral, tetrahedral and square planar complexes-strong and weak ligands-Spectrochemical series-High spin and low spin complexes-C.F. Theory and magnetic properties of complexes-Crystal Field Stabilisation Energy (CFSE) and its uses-Calculation of CFSE values of d^1 to d^{10} Octahedral and Tetrahedral complexes- C.F theory and colour of complexes-limitations of C.F. theory-comparison between VBT and CFT.

UNIT-III Application of Complexes and Environmental Chemistry

3.1. Complexometric Titrations-Principles and Types of titrations using EDTA.

3.2. EDTA and its applications –estimation of metals,hardness of water and sequesterisation.

3.3. **Environmental Chemistry**

3.3.1. Bhopal gas tragedy, Chernobyl disaster and Minimata diseases-A brief study

3.3.2. Air pollution-sources. Green House effect-Green House gases-Impact of Green House effect-Effects on ecosystem-measures to reduce the Green House effect.

3.3.3. Depletion of Ozone layer-Effects of Oxides of Nitrogen on Ozone layer-fluorocarbons and their effect on Ozone layer-methods to control ozone depletion.

3.3.4. Smog-photochemical smog-mechanism of formation.

3.3.5. Water pollution-sources-BOD and COD and its importance.   .

3.3.6. Soil pollution-sources-indiscriminate use of fertilizers and pesticides-dumping of urban solid waste, industries waste and radioactive waste-methods of disposal of wastes.

3.3.8. Noise pollution and Radioactive pollution- health

UNIT-IV

4.1. Bioinorganic Chemistry-Essential and trace elements in Biological processes- Biological role of Haemoglobin and Chlorophyll (elementary idea of structure and mechanism of their action)

4.2. Metal carbonyls-Bonding in carbonyls-Mono and binuclear Carbonyls of Ni, Fe, Cr, Co and Mn-Hybridisation and structure. Preparation, properties and uses.

4.3. Silicates-classification and structure–examples.

4.4 Organometallic compounds

4.4.1. Definition-classification-ionic, σ-bonded and non

classically bonded organometallic compounds-examples- nature of carbon-metal bond.

4.4.2. General methods of preparation – formation by addition and substitution reactions. General properties of organometallic compounds -physical and chemical characteristics.

4.4.3. Organometallic compounds of Li & B - preparation, properties, structure and uses.

4.4.4 Olefin complexes -Zeise salt –synthesis and structure

4.4.5. Cyclopentadienyl complexes- Ferrocene- Preparation,properties, structure and uses.

4.4.6. Uses of organometallic compounds.

UNIT-V

5.1. Solids: Band theory of conductors , semiconductors and insulators

5.2. Bragg's law and application of X-ray diffraction to crystal studies-structure of NaCl, LiCl and ZnS.

5.3. Imperfections in a crystal-Outline of Schottky defects, Frenkel defects, metal excess and metal deficiency defects and line defects.

5.4. Symmetry Elements and Symmetry operations – point groups-point groups of simple molecules like H_2, HCl, CO_2, H_2O, BF_3, NH_3,CH_2Cl_2, $[PtCl_4]^{2-}$, PCl_5, Cis and trans isomers of [$Pt(NH_3)_2 Cl_2$]

5.5. Magnetic properties of molecules: Magnetic susceptibility. Types of magnetic behaviour- diamagnetism and paramagnetism, Temperature and magnetic behaviour, Ferromagnetism and antiferromagnetism-Temperature independent paramagnetism- determination of magnetic moment using Guoy Balance-Applications of magnetic measurements.

309UCHT02 - ORGANIC CHEMISTRY

UNIT I Stereoisomerism

1.1.Definition-Classification into Optical and Geometrical isomerism.

1.2. Optical isomerism – Optical activity-Optical and Specific rotations-conditions for optical activity-asymmetric centre-Chirality-achiral molecules-meaning of (+) and (-) and D and L notations-Elements of symmetry.

1.3 Projection formulae-Fischer, Flying Wedge, Sawhorse and Newmann projection formulae-Notation of optical isomers- Cahn-Ingold –Prelog rules-R-S. notations for optical isomers with one and two asymmetric Carbon atoms-erythro and threo representations.

1.4. Racemisation-methods of racemisation (by substitution and tautomerism)-Resolution-methods of resolution (mechanical, seeding, biochemical and conversion to diastereoisomers)-Asymmetric synthesis (partial and absolute synthesis) Walden inversion.

1.4. Optical activity of allenes , spiranes and biphenyls.   1.5.   Geometrical isomerism- cis-trans, syn-anti and E-Z notations-geometrical isomerism in maleic and fumaric acids and unsymmetrical ketoximes-methods of distinguishing geometrical isomers using melting point, dipole moment, dehydration, cyclisation and heat of hydrogenation.

1.6. Conformational Analysis-introduction of terms-conformers-dihedral angle, torsional strain, conformational analysis of ethane, ethylene glycol, chlorohydrin and n-butane including energy diagrams-conformers of cyclohexane (chair, boat and skew boat forms)-axial and equatorial bonds-ring flipping showing axial equatorial interconversions-conformers of mono and disubstituted cyclohexanes-1:2 and 1:3 interactions-Conformation and stereochemistry of Cis and Trans decalins

UNIT II-CARBOHYDRATES

2.1.Classification

2.2.Monosaccharides-Reactions of Glucose and Fructose-osazone formation.

2.3.Constitution of glucose and fructose-open chain structure-Configuration and ring structure-mutarotation-determination of ring size

2.4.Haworth's projection formulae and conformation of monosaccharides.

2.5.Interconversions of monosaccharides-epimerisation-conversion of pentose to hexose and vice versa-aldose to ketose and vice versa.

2.6.Disaccharides-structural elucidation of sucrose and maltose.

2.7.Polysaccharides-structure of starch and cellulose-

properties-derivatives of cellulose.

UNIT- III

Heterocyclic Compounds   .

2.3. Preparation, properties and uses of furan, pyrrole & thiophene and aromatic character.

2.4. Synthesis and reactions of pyridine and piperidine-comparative study of basicity of pyrrole, pyridine and piperidine with amines.

2.5. Condensed five and six membered heterocyclics-preparation of indole, quinoline and isoquinoline-Fischer indole synthesis, Skraup synthesis and Bischer-Napieralski synthesis-Electrophilic substitution reactions.

Amino acids and proteins

3.1. Amino acids-classification-essential and non essential amino acids-preparation of alpha amino acids-glycine, alanine and tryptophan-General properties of amino acids-Zwitter ions, isoelectric point

3.2. Peptides-synthesis - Bergmann method-structure determination of polypeptides-end group analysis.

3.3. Proteins-classification based on physical and chemical properties and on physiological functions-primary and secondary structure of proteins-helical and sheet structures (elementary treatment only) – Denaturation of proteins.

3.4.**Vitamins**

Vitamins-occurrence and biological importance of Vitamin A, Thiamine, Riboflavin, Pyridoxin and Ascorbic acid. – Synthesis and structural elucidation of ascorbic acid.

UNIT- IV

4.1. Dyes

4.1.1.Theory of colour and constitution

4.1.2. Classification - according to structure and method of application.

4.1.3. Preparation and uses of

(i)   Azo dyes-methyl orange and bismark brown

(ii)   Triphenyl methane dyes-malachite green

(iii)   Phthalein dyes-phenolphthalein

(iv)   Vat dyes-indigo.Anthraquinone dyes - Alizarin

4.2. Nucleic acids

4.2.1. Nucleic acids-structures of ribose and 2-deoxyribose- DNA and RNA – their components – Biological functions of nucleic acids-Elementary ideas on replication and protein synthesis.

4.3. Chemistry of Natural products

4.3.1. Alkaloids -classification- isolation– general   methods   of determination of structure of alkaloids-synthesis and structural elucidation of piperine, conine and nicotine.

4.3.2. Terpenes-classification-isolation- isoprene rule-synthesis and structural elucidation of citral, geraniol, alpha terpeneol and alpha pinene

UNIT -V

5. Molecular rearrangements-.Classification as anionotropic, cationotropic and intermolecular and intramolecular.

5.2.Mechanisms of pinacol-pinacolone, Beckmann, benzidine, Hofmann, Curtius, Lossen, Schmidt, benzilic acid, Fries and Cope rearrangements.

5.3.Important reagents and their applications in organic chemistry – $AlCl_3$, BF_3, $LiAlH_4$, $NaBH_4$, PCl_5, P_2O_5, Na/ethanol, alcoholic KOH, H_2/Ni, H_2/Pd-BaSO$_4$, Zn/Hg-HCl, H_2N-NH_2/C_2H_5ONa, Ag_2O, HIO_4, Lead tetra acetate and Osmium tetroxide.

309UCHT03 - PHYSICAL CHEMISTRY

UNIT-I   Solutions

1.1. Solutions of gases in liquids – Henry's law- solutions of liquids in liquids-Raoult's law-Binary liquid mixture-ideal solution-deviation from ideal behaviour-Thermodynamics of ideal solutions-V.P-Composition curves, V-P-temperature curves-Azeotropic distillation.

1.2. Nernst's Distribution law-Thermodynamic derivations-applications. Solvent extraction.

1.3. Thermodynamic derivation of elevation of boiling point and depression of freezing point-van't Hoff factor-Abnormal molecular mass-Degree of dissociation and association.

Chemical Equilibrium

1.4. Thermodynamic derivation of equilibrium constants-Kp, Kc and Kx-Relations between Kp, Kc and Kx-Standard free energy change-Derivation of van't Hoff reaction isotherm

De Donder's treatment of chemical equilibria-concept of chemical affinity (no derivation)-Temperature dependance of equilibrium constant-van't Hoff isochore-Pressure dependance of equilibrium constant.

1.5 Adsorption- Physical and chemical adsorption-Types of adsorption isotherms-Freundlich adsorption isotherm-Derivation of   Langmuir adsorption isotherm-BET isotherm (postulates only) BET equation (statement). Determination of surface area-Applications of adsorption.

UNIT-II   Chemical Kinetics

2.1. Derivation of rate constant of a second order reaction-when the reactants are taken at different initial concentrations-when the reactants are taken at the same initial concentrations-Determination of the rate constant of a II order reaction-Derivation of rate constant of a third order reaction-when the reactants are taken at the same initial concentrations.

2.2. Methods of determining the order of a reaction-Experimental methods in the study of kinetics-volumetry, manometry, polarimetry and colorimetry.

2.3 Kinetics of fast reactions by temperature jump method(no derivation) Effect of temperature on reaction rates-Derivation of Arrhenius equation-concept of activation energy-determination of Arrhenius frequency factor and energy of activation.

2.4. Collision theory of reaction rates-Derivation of rate constant of a bimolecular reaction from collision theory-Failures of CT.

2.5.Lindemann theory of unimolecular reactions.

2.6.Theory of Absolute Reaction Rates-Thermodynamic derivation of rate constant for a bimolecular reaction based on ARRT-comparison between ARRT and CT. Significance of free energy of activation and entropy of activation.

2.7.Kinetics of complex reactions of first order opposing, consecutive and parallel reactions-examples with mechanism (no derivation)

UNIT-III - Photochemistry

3.1.Grotthus-Draper law-The Stark Einstein law of photochemical equivalence-Quantum efficiency (quantum yield).

3.2.Energy transfer in photochemical reactions-photosensitisaiton-Photosynthesis in plants-Chemiluminescence - fluorescence and phosphorescence-lasers-uses of lasers.

3.3.Photochemical reactions-Kinetics of hydrogen-bromine reactions-decomposition of HI – Photolysis of aldehydes and ketones (Mechanism only)

Phase Rule

3.4.Definition of terms-Derivation of phase rule -One component systems-H_2O system, Sulphur system – explanation using Clausius -Clapeyron equation-supercooling and sublimation.

3.5.Two component systems-solid liquid equilibria-reduced phase rule – simple eutectic systems-Ag-Pb only-Compound formation with congruent melting point-Mg-Zn system only

3.6.Peritectic change-$FeCl_3$-H_2O system, KI-H_2O system-efflorescence-deliquescence.

3.7.C.S.T-phenol water system only- Effect of impurities

UNIT – IV - **Electro chemistry**

4.1.Metallic and electrolytic conductance –Definitions of specific, equivalent and molar conductances – Relations between them – measurement of conductance and cell constant.

4.2.Variation of conductance with dilution – Qualitative explanation – Strong and weak electrolytes.

4.3.Migrations of ions – transport number – determination by Hittorf and moving boundary methods – Kohlrausch's law – applications – calculation of equivalent conductance for weak electrolytes and determination of transport number.

4.4.Ionic mobilities and Ionic conductances.Diffusion and ionic mobility- molar ionic conductance and viscosity- Walden rule.

4.5.Applications of conductance measurements – Degree of dissociation of weak electrolytes – Determination of Ionic product of water – Determination of solubility of sparingly soluble salts – conductometric titrations.

4.6.Theory of strong electrolytes – Debye – Huckel – Onsager theory – verification of Onsager equation – Wien and Debye – Falkenhagen effect.

4.7.Activity and activity co-efficients of strong electrolytes – ionic strength.

4.8.Ostwalds dilution law – determination of dissociation constants – Ionic product of water – pH value.

4.9.Buffer solution – Henderson's equations – uses of Buffers including living systems .

4.10.Hydrolysis of salts – expression for hydrolysis constant – Degree of hydrolysis and pH of salt solutions for different types of salts – Determination of Degree of hydrolysis – conductance and distribution methods.

UNIT – V

5.1.Galvanic cells – Reversible and Irreversible cells – EMF and its measurement – Weston Standard cell – types of reversible single electrodes – standard Hydrogen electrode – calomel electrode – Derivation of Nernst equation both for emf of cells and single electrode potentials – Nernst theory for single electrode potential – standard reduction potentials – electro chemical series – significance.

5.2.Application of emf measurements – Application of Gibbs – Helmholtz equation to galvanic cells – calculation of thermodyamic quantities – pH using hydrogen, quinhydrone and glass electrodes – potentiometric titrations.

5.4. Concentration cells with and without transference – LJP expression – applications of concentrations cells – valency of ions – transport number – solubility product – activity coefficient.

5.5. Storage cells – Lead storage battery – mechanism of charging and discharging fuel cells – hydrogen – oxygen cell – polarization -

overvoltage- decomposition voltage.

309UCHT04 - ANALYTICAL CHEMISTRY

UNIT – I
1. The Role of Analytical Chemistry

1.1   Importance of analytical methods in Qualitative and Quantitative analysis- Chemical and instrumental methods- advantages and limitations of chemical and instrumental methods- methods of analysis- steps in analysis.

1.2   Safety Measures: Handling reagents and solutions-acids, alkali, bromine water, phenol, inflammable substances etc.,-Disposal of wastes, waste chemicals and fumes

1.3   Data analysis- idea of significant figures- its importance- accuracy- methods of expressing accuracy- error analysis- types of errors- minimizing errors-precision- methods of expressing precision-mean, median, mean deviation, standard deviation and confidence limits.

1.4   Chemical and single pan balance- precautions in using balance-sources of error in weighing-correction for buoyancy, temperature effects - calibration of weights.

1.5.Gravimetric Analysis

   1.5.1.. Principle- theories of precipitation- solubility product and precipitation - factors affecting solubility. Conditions of precipitation- co-precipitation & post precipitation, reduction of errors. Precipitation from homogeneous solution-washing and drying of precipitate.

   1.5.2. Choice of the precipitant- Specific and Selective precipitants-, Anthranilicacid, Cupferon, Dimethylglyoxime, Ethylenediamine, 8-Hydroxyquinoline, Salicylaldoxime, - Use of masking agent.

   1.5.3. Crucibles- types, care and uses. Calculations in gravimetric analysis-use of gravimetric factor.

UNIT - II

Chromatographic Techniques

2.1.Column Chromatography- principle, types of adsorbents, preparation of the column, elution, recovery of substances and applications.

2.2. TLC- principle, choice of adsorbent and solvent, preparation of chromatoplates, R_f-values, factors affecting the R_f-values. Significance of R_f-values.

2.3. Paper Chromatography- principle, solvents used, development of chromatogram, ascending, descending and radial paper chromatography. Paper electrophoresis- separation of amino acids and other applications.

2.4. Ion-exchange chromatography- principle- types of resins- requirements of a good resin- action of resins- experimental techniques- separation of Na-K, Ca-Mg, Co-Ni, and Chloride-Bromide. Analysis of milk and apple juice.

2.5. Gas Chromatography (GC)- principle- experimental techniques- instrumentation and applications.

2.6. High Pressure Liquid Chromatography (HPLC)- principle- experimental techniques- instrumentation and advantages.

2.7. Purification Techniques

Purification of organic compounds- solvent extraction Soxhlet extraction, crystallization- fractional crystallization and sublimation- principle- technique and advantages.

Purification of liquids-distillation, fractional distillation, vacuum distillation- steam distillation-azeotropic distillation, criteria of purity- melting point, boiling point, refractive index and density.

UNIT- III

Electro Analytical Method

3.1 Polarography- principle, concentration polarization, dropping mercury electrode (DME)- advantages and disadvantages- migration, residual, limiting and diffusion currents- Use of supporting electrolytes-Ilkovic equation (derivation not required) and significance- experimental assembly- current voltage curve-oxygen wave-influence of temperature and agitation on diffusion layer. Half wave potential ($E_{1/2}$)- Polarography as an analytical tool in quantitative and qualitative analysis.

3.2. Amperometric titrations – Basic principle – titrations- advantages, disadvantages – applications.

3.3.Thermoanalytical Methods

Principle - thermogravimetric analysis and differential thermal analysis-discussion of various components with block diagram-TGA & DTA curves of $CuSO_4.5H_2O$, $MgC_2O_4.H_2O$ and $Ca(OOCCH_3)_2.H_2O$- Simultaneous DTA-TGA curves of $SrCO_3$ in air and $CaC_2O_4.H_2O$ in air and in CO_2- factors affecting TGA & DTA curves.

Thermometric titrations-principle- apparatus- applications.

UNIT IV

Infrared and Raman spectroscopy

4.1. Infrared spectroscopy-theory-instrumentation-block diagram-source-monochromator-cell- detectors and recorders- sampling techniques - stretching and bending vibrations-vibrational frequencies-vibrational modes of H_2O and CO_2 – study of hydrogen bonding.

Interpretation of IR spectra of Acetone, Anisole, Benzaldehyde, Ethyl acetate, Ethyl amine, Ethyl bromide, Toluene and Isopropyl phenyl ketone.

4.2.Raman Spectroscopy-Rayleigh and Raman scattering-stokes and antistokes lines-instrumentation - block diagram-differences between IR & Raman spectroscopy –mutual exclusion principle-applications.

Spectrophotometric and colorimetric analysis

4.3. UV-Visible sprectroscopy-Beer-Lambert's law– instrumentation – spectrophotometer-block diagram with description of components- types of electronic transitions-chromophore and auxochromes-absorption bands -factors affecting λ_{max} and intensity- applications

4.4. Colorimetry-principle-photoelectric colorimeter-estimation of Cu,Fe and Ni.

UNIT V

^{1}HNMR Spectroscopy

5.1. NMR Spectroscopy-principle of nuclear magnetic resonance – basic instrumentation- number of signals-chemical shift- shielding and deshielding-spin-spin coupling and coupling constants-TMS as NMR standard- Interpretation of NMR spectra of simple organic compounds such as Acetone, Anisole, Benzaldehyde, Ethyl acetate, Ethylamine, Ethyl Bromide, Toluene and Isopropyl phenyl ketone.

Mass spectroscopy

5.2. Mass spectroscopy-Basic principles- instrumentation-molecular ion peak, base peak, metastable peak, isotopic peak- their uses. Nitrogen rule- ring rule-fragmentation- Interpretation of mass spectra of simple organic compounds such as Acetone, Anisole, Benzaldehyde, Ethyl acetate, Ethylamine, Ethyl Bromide,Toluene and Isopropyl phenyl ketone.

309UCHT05 - APPLICATION ORIENTED SUBJECT -PAPER VII PHARMACEUTICAL ,INDUSTRIAL and AGRICULTURAL CHEMISTRY

UNIT-I

1.1.Definition of the terms-drug, pharmacophore, pharmacodynamics, pharmacopoea, pharmacology, bacteria, virus, fungus, actinomycetes, metabolites, antimetabolites, LD50, ED50.

1.2.Therapeutic index-their use in selecting drugs-Assay of drugs-various methods.

1.3. Antibiotics-Definition-classification as broad and narrow spectrum antibiotics-penicillin, ciphalosporin, ampicillin, erythromycin-structure and mode of action only (no structural elucidation, preparation, assay)

UNIT-II

2.1. Analgesics-definition and actions-narcotic and non narcotic-morphine and its derivatives-pethidine and methodone-pharmacological action-uses

2.2. Antipyretic analgesics-salicylic acid derivatives-methyl salicylate, aspirin, p-aminophenol derivatives-paraacetamol,

2.3. Antiseptics and disinfectants – definition and distinction-phenolic compounds-Dyes - crystal violet, acridine, Chloro compound-chlorhexidine, Cationic surfactants-Benzalkonium chloride, formaldehyde and nitrofurazone.

2.4. Anaesthetics-definition-classification-local and general-volatile, nitrous oxide, ether, chloroform, cyclopropane-uses and disadvantages – nonvolatile – intravenous - thiopental sodium, methohexitone, -local anaesthetics -cocaine and benzocaine.

2.5. Antianaemic drugs-iron, vitamin B12 and folic acid-mode of action

UNIT-III

3.1. Drugs affecting CNS-definition, examples for tranquilisers, sedatives, hypnotics and psychedelic drugs

3.2. Hypoglycemic agents-sulphonyl urea, biguanides.

3.3. Cancer therapy-mode of action of thiotepa, cyclophosphoramide..

3.4. AIDS-causes, prevention and control.

3.5. Indian medicinal plants and uses-tulasi , kilanelli, mango, semparuthi,adadodai and thoothuvalai

3.6.Essential oils, Isolation of essential oils from plants. Production of natural perfumes – flower perfumes – fruit flavours – artificial flavours.

3.7.Waxes, soaps and detergents – waxes – classification – some common waxes – manufacture of candles. Soaps and detergents – General consideration in soap making – manufacture of soaps and detergents – Action of soaps and detergents.

UNIT – IV

4.1.Water : Water treatment for domestic and Industrial purpose.

4.2.Fuels : Calorific value – requirement of a fuel – types of fuels. Refining crude petroleum – octane number – antiknocking compounds – lead tetra ethyl.

4.3.Industrial gases : Coal gas, producer gas, water gas, semi water gas – manufacture and industrial application, LPG – manufacture.

4.4.Bio gas – Gobar gas – production, composition – calorific value – renewable nature.

4.5. Industrial application

A brief treatment regarding composition, manufacture and uses of synthetic fibres, rubber, paints and varnishes, glass, cement and ceramics.

UNIT – V

5.1.**Fertilizers** : Effect of Nitrogen, potassium and phosphorous on plant growth – commercial method of preparation of urea, triple superphosphate. Complex fertilizers and mixed fertilizers – their manufacture and composition. Secondary nutrients – micronutrients – their function in plants.

5.2.**Manures** : Bulky organic manures – Farm yard manure – handling and storage. Oil cakes. Blood meal – fish manures.

5.3.**Pesticides and Insectides** :

Pesticides – classification of Insecticides, fungicides, herbicides as organic and inorganic – general methods of application and toxicity. Safety measures when using pesticides.

Insecticides : Plant products – Nicotine, pyrethrin – Inorganic pesticides – borates. Organic pesticides – D.D.T. and BHC.

5.4.**Fungicides and Herbicides** :

Fungicide : Sulphur compounds, Copper compounds, Bordeaux mixture.

    d)   Herbicides : Acaricides – Rodenticides. Attractants – Repellants. Preservation of seeds.

PRACTICAL – II
309UCHP01 - ORGANIC PREPAERATIONS AND GERAVIMETRIC ANALYSIS
Organic preparations

1.Preparations involving the following :

   a) Oxidation of benzaldehyde

   b) Hydrolysis of Methyl salicylate or ethyl benzoate.

   c) Nitration – p-nitroacetanilide and m-dinitrobenzene

   d) Bromination – p- bromoacetanilide and tribromophenol

   e) Benzoylation –– β-naphthylbenzoate

   f) Diazotization – methyl orange.

        Not for examination – 3 (f)

GRAVIMETRIC ESTIMATIONS

1. Determination of percentage of water of hydration

2.Estimation of Barium as Barium sulphate

3.Estimation of Barium as Barium chromate

4.Estimation of Lead as Lead chromate

5.Estimation of Calcium as Calcium oxalate monohydrate

6.Estimation Chloride as Silver chloride.

7.Estimation of Sulphate as Barium sulphate.

8.Estimation of Nickel as Nickel dimethyl glyoxime complex

9.Estimation of Magnesium as Magnesium oxinate

10.Estimation Copper as Cuprous thiocyanate

       Not for Examination : 1,8,9 and10

\

<div align="center">

PRACTICAL – III

309UCHP02 - ORGANIC QUALITATIVE ANALYSIS AND PHYSICAL CHEMISTRY EXPERIMENTS

ORGANIC QUALITATIVE ANALYSIS

</div>

1. Determination of boiling point of liquids.

2. Analysis of organic compounds.

Characterisation of organic compounds by their functional groups and confirmation by preparation of derivative. The following functional groups may be studied.

Aldehydes, Ketones, carboxylic acids, aromatic primary and secondary amines, phenol, aromatic ester, amide, diamide, anilide, nitro compounds and monosaccharides

<div align="center">Physical Experiments</div>

1. Distribution Law :
   a) Partition coefficient of iodine between water and carbon tetrachloride.
   b) Equilibrium constant of the reaction $KI + I_2 \rightleftharpoons KI_3$

2. Kinetics
   a) Determination of rate constant – Acid catalysed hydrolysis of an ester (methyl acetate or ethyl acetate)
   b) Determination of rate constant for the reaction between potassium iodide and potassium persulphate.
   c) Determination of rate constant – acid catalysed iodination of acetone.

3. Molecular weight determination –Rast method

4. Heterogenous Equilibrium
   a) Upper critical solution temperature of phenol-water system.
   b) Effect of impurity on CST of phenol – water system and determination of concentration of sodium chloride / succinic acid.
   c) Simple eutectic system- Naphthalene – Diphenyl.
   d) Determination of transition temperature of hydrated salts – sodium thiosulfate, sodium acetate, strontium chloride and manganous chloride.

5. **Electrochemistry :**

a) Conductivity i) Determination of cell constant

ii) Equivalent conductance of strong and weak electrolytes

iii) Conductometric titration- acid base titration

iv) Dissociation constant of a weak acid

b) Potentiometry – Potentiometric titration – acid-base titration.

Not for examination : 1(b), 2 (c),4(a) and 5(a) (iv)

TEXT BOOKS AND REFERENCE BOOKS

1. Inorganic Chemistry

   1) Philips and Williams, Inorganic Chemistry, Oxford University press, Vol I and II.

   2) Cotton and Wilkinson, Advanced Inorganic Chemistry Wiley Eastern Private Ltd.

   3) Lee Von Nastrand J.D. Concise inorganic Chemistry.

   4) Manku.G.S., Inorganic Chemistry Tata Mcgraw Hill.

   5) Soni.P.L, Text Book of Inorganic Chemistry, Sultan Chand & Sons.

   6) Puri and Sharma, Text book of Inorganic Chemistry-Vishal publishing co.

   7) Madan.R.D., Inorganic Chemistry, S. Chand & Co.,

   8) Dutta, Inorganic Chemistry, Science Book Association.

   9) Dara.S.S, A text book of Environmental Chemistry and Pollution control- S.Chand & Co.,

   10)   Dr. C.Murthy , A Text book of Environmental Sciences, Sultan Chand & Sons

   11)   Anil Kumar De, Text Book of Environmental Chemistry, New Age International Ltd.,

   12)   Starley E. Manahan, Environmental Chemistry Brooks / Cole publishing company, Monterey, California.

II. Organic Chemistry

   1. Finar 1.L. Organic Chemistry, Vol I and II – ELBS.

   2. Morrison and Boyd, Organic Chemistry, Allyn and Bacon Inc.

   3. Solomons, T.W.G, Organic Chemistry, John Wiley.

   4. Bhal. B.S, and Arun Bhal, A Text book of Organic Chemistry.

   5. Soni.P.L., Text Book of Organic Chemistry, Sultan Chand and Sons.

6. Tiwari, Malhotra and Vishoni, Organic chemistry, Vol I and II , Vikas Publishing House.

7. Raj K. Bansal, A Text Book of Organic Chemistry, Wiley Eastern.

8. Singh, Mukarji and Kapoor, Organic Chemistry, Mac Millan.

9. Jain.M.K, Principles of Organic Chemistry-Vishal publishing Co.

10. Agarwal and Manivasagam -Reactions and Reagents- Pragati Prakashan

11. Kalsi.P.S, Stereo Chemistry conformation and mechanism, Wiley Eastern Ltd.,

12. Nasipuri.D, Stereo Chemistry of Organic Compounds, Wiley Eastern Ltd.,

III. Physical Chemistry

1. Glasstone.S, Text Book of Physical Chemistry, Mac Millian.

2. Glasstone and Lewis, Elements of Physical Chemistry, Mac Millan.

3. Maron and Lando, Fundamentals of Physical Chemistry, Collier, Mac Millan.

4. Castellan. G.W, Physical Chemistry, Naropa Publishing House.

5. Walter J. Moore, Physical Chemistry, Orient Longamann.

6. Rakshit.P.C, Physical Chemistry, Science Book Agency.

7. Bajapai. D.N, Advanced Physical Chemistry, S.Chand & Co.,

8. Gurudeep R. Chatwal, Physical Chemistry.

9. Jain. S, and S.P. Jauhar, Physical Chemistry – principles and problems, Tata McGraw Hill.

10. Glasstone, Thermodynamics for Chemists, Van Nostrand and Co.,

11. Rakshit, Thermodynamics, Science Book Agency.

12. Laidler.K.J, Chemical Kinetics, Harpet and Row New York.

13. Banwell, Fundamentals of Molecular spectroscopy Tata McGraw Hill.

14. Kundu and Jain, Physical Chemistry, S. Chand.

15. Text –book of physical chemistry, Vishal publishing Co

16. Nagi and Anand, Physical Chemistry – Wiley Estern.

17. Kapoor. K.L., Physical Chemistry, Mac, Millan.

18. Kuriacose and Rajaram, Chemical Thermodynmics, S. Nagin .

19. Latham.J.L, and Burgess.A.E, Chemical Kinectics, Butler worth.

V. Analytical Chemistry

1. Bassett.J, Denney.R.C, Jaffery.G.H and Mendhan.J, Vogel's Hand Book of Quantitative Inorganic Analysis ELBS – Longman.
2. Furniss. B.S, Hannaform. A.J, Rogers.V, Smith.P.W.G, and Tatchell.A.R, Vogel's Text Books of Practical Organic Chemistry.
3. Douglas A, Skoog and Donal M. West Hort, Fundamentals of analystical Chemistry Rinechan and Winston Inc., New York.
4. Janarthanam.P.B, Physico – Chemical Techniques of Analysis Vol I & II – Asian Publishing House Bombay.
5. William Kemp, Organic Spectroscopy – ELBS.
6. Venkateswaran.V, Veerasamy.R, and Kulandaivelu.R, Basic Principles of Practical Chemistry.
7. Sharma.Y.R, Elementary Organic Spectroscopy, Principles and applications- S. Chand & Co.,
8. Gopalan.R, Subramaniam.P.S, and Rengarajan.K, Elemants of Analytical Chemistry – Sultan Chand & Sons.
9. Ramachandra Sastry.A, Analytical Chemistry – K.C.S. Desikan & Co.
10. Walter E Harris Brgron Kratochvil-An introduction to Chemical Analysis.

V. Pharmaceutical Chemistry

1. Singh.H and Kapoor.V.K, Vallabh Prakashan Organic Pharmaceutical Chemistry – New Delhi.
2. Bentley and Drivers, Pharmaceutical Chemistry.
3. Allion Chidambaram, Pharmaceutical Chemistry.
4. Chatwal, Organic Pharmaceutical Chemistry.
5. Jayashree Ghosh, S, Pharmaceutical Chemistry – Chand & Co.,
6. Chatwal, Inorganic Pharmaceutical Chemistry.
7. Wealth of India Raw materials (all volumes)- CSIR Publications

VI. Industrial Chemistry

1. Sharma.B.K, Industrial Chemistry Goel Publishing House, Meerut.
2. Singh.P.P, T.M. Joseph and R.G. Dhavale, College Industrial Chemistry, Himalaya Publishing House Bombay.

3. Chakrabarthy, B.N. Industrial Chemistry – Oxford and IBH.
4. Jain and Jain, Industrial Chemistry.
5. Reinhold, Industrial Chemistry.

VII. Agricultural Chemistry

1. Brady.N.C, The Nature and properties of soils – Eruasia Publishing House (P) Ltd.,
2. Jones.V.S, Fertilizers and soil fertility – Prentice Hall of India, New Delhi.
3. Fracer.D.E.H, Chemistry of Pesticides – D.Van Nostrand Co.,

VIII. Polymer Chemistry

1. Polymer Chemisry – M.G.Arora-Anmol Publications.New Delhi.
2. Text-Book of Polymer Science-F.N. Billmeyer-New Age International
3. Polymer Chemistry-an introduction-M.P.Stevens-Oxford.
4. TextBook of Polymer Science, F.W.Billmeyer Jr.Wiley.
5. Polymer Science, V.R.Gowarker, N.V.Viswanathan and J.Sreedhar, Wiley – Eastern.

B.Sc.Chemistry

SUBJECT	PAPER	suggested PAPER CODE
Major	Paper-1	07PUCH 01
Major	Paper-2	07PUCH 02
Major	Paper-3	07PUCH 03
Major	Paper-4	07PUCH 04
Major	Paper-5	07PUCH 05
Major	Paper-6	07PUCH 06
Major	Paper-7	07PUCH 07
Major	Practical-I	07PUCHP 01

Major	Practical-II	07PUCHP 02
Major	Practical-III	07PUCHP 03
Major	Practical-IV	07PUCHP 04
Allied -I	Paper	07PUCHA01
Allied -II	Paper	07PUCHA02
Allied -I	Practical	07PUCHAP01
Allied -II	Practical	07PUCHAP02