



SOURASHTRA COLLEGE, MADURAI- 625004
(An Autonomous Institution Re-accredited with 'B' grade by NAAC)
B.Sc. CHEMISTRY - SYLLABUS
(Under CBCS w.e.f. 2017 - 2018 onwards)

276

I SEMESTER

| S. No | PART | Sub. Code | Subject Title | Hrs/ Wk | Exam hrs | C A | SE | Tot | Crd |
|-------|----------------------|-----------------------|-----------------------------|---------|----------|-----|----|-----|-----|
| 1 | PART - I | 17UACT11/ H11/S11 | Tamil/Hindi/ Sanskrit | 6 | 3 | 25 | 75 | 100 | 3 |
| 2 | PART - II | 17UACE11 | English | 6 | 3 | 25 | 75 | 100 | 3 |
| 3 | PART - III CORE | 17UCYC11 | Inorganic Chemistry - I | 5 | 3 | 25 | 75 | 100 | 4 |
| 4 | PART - III CORE | | Inorg. sm qual. Analysis | 2 | 0 | 0 | 0 | 0 | 0 |
| 5 | PART - III ALLIED | 17UMSA11/ 17UBYA11 | Maths/Botany | 6 | 3 | 25 | 75 | 100 | 5 |
| 6 | PART - IV SBS | 17UCYS11 | Laboratory techniques | 3 | 3 | 25 | 75 | 100 | 3 |
| 7 | PART - IV | 14UACVE1 | Value Education | 2 | 3 | 25 | 75 | 100 | 2 |
| Total | | | | 30 | | | | | 20 |

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held on 15-3-2017

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| | | |
|----------------------------|---------------------------------------|------------------------------------|
| PART - III CORE | Title : INORGANIC CHEMISTRY- I | Subject Code : 17UCYC11 |
| Semester : I | HOURS : 5 hours / Week | CREDITS :4 |

Objectives

To acquire the knowledge of constituents of atom, union of atoms, the position, properties and metallurgical process of elements. To understand chemistry of nucleus.

UNIT - I STRUCTURE OF ATOM (15 hrs)

An outline of constituents of atom (elementary idea) –Model of atom : Rutherford and its drawbacks - Quantum theory: Photoelectric effect – Compton effect - Bohr model of atom: postulates – Bohr's radius and energy of electron (no derivation) - Origin of hydrogen spectrum – dual character of electron – Heisenberg's uncertainty principle - Quantum numbers – Pauli's exclusion principle – Aufbau principle- Hund's rule – electronic configuration of atoms.

UNIT - II PERIODIC TABLE AND ATOMIC PROPERTIES (15 hrs)

Modern Periodic Table – its salient features – classification and characterization of s, p, d and f block elements – periodicity and its causes - atomic properties: atomic radii, ionic radii, ionization energy, electron affinity and electronegativity – Factors governing them and their periodic – scales of electronegativity : Pauling, Mulliken and Allred & Rochow – applications of electronegativity.

UNIT - III CHEMICAL BONDING (15 hrs)

Cause of chemical bonding - Octet rule - Ionic bond – Covalent bond – Valence Bond approach – its limitations – Fajan's rule – VSEPR theory : Postulates and applications – hybridization – sp , sp^2 , sp^3 , sp^3d and sp^3d^2 (BeF_2 , BCl_3 , CH_4 , PCl_5 , SF_6) – Molecular Orbital theory – LCAO method - MO diagram for homonuclear and heteronuclear diatomic molecules – H_2 , He_2 , Li_2 , Be_2 , B_2 , C_2 , N_2 , O_2 , F_2 , CO , NO and HF – determination of magnetic property and bond order.



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UNIT - IV NUCLEAR CHEMISTRY

(15 hrs)

Fundamental particles of nucleus – Nuclides – concept – isotope, isobar and isotones – nuclear forces – nuclear stability: Meson theory, Liquid drop model, shell model and n/p ratio – binding energy – mass defect – packing fraction – natural radioactivity - artificial radioactivity – nuclear reactions: spallation, nuclear fission and nuclear fusion – radioactive isotopes and its applications in medicine, agriculture, archaeology, biology and analytical chemistry.

UNIT - V METALLURGY

(15 hrs)

Occurrence of metals – minerals – ores - types of ores – various steps involved in metallurgy- concentration of ore : physical and chemical methods - calcination - roasting - reduction methods : smelting, alumino-thermic, air and electrolytic methods - refining methods : cupellation, electrolytic, zone refining and vapour phase method.

Extraction of Vanadium, Molybdenum and Tungsten from their ores.

Text books:

1. Principles of Inorganic Chemistry by Puri, Sharma & Kalia, Milestone publisher & distributor (2009).
2. Text book of Inorganic Chemistry by P. L. Soni and M. Katyal, 20th Edition, Sultan chand & Sons (2013).

Reference books:

1. Concise Inorganic Chemistry by J.D. Lee, 5th Edition, Wiley India (2009).
2. Modern Inorganic Chemistry by R.D. Madan S. Chand and Co. Ltd. (2012).
3. UGC Inorganic Chemistry-I by H. C. Khera, 3rd Edition, Pragati Prakashan (2012).



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|--------------------------|--|------------------------------------|
| PART - IV SBS | Title:LABORATORY TECHNIQUES - Principles & Practice | Subject Code : 17UCYS11 |
| Semester : I | HOURS : 3 hours / Week | CREDITS :3 |

Objectives

To get awareness on laboratory chemicals and safety, to acquire the thorough knowledge about solutions, to know the principles of inorganic qualitative analysis and knowledge about volumetric titrimetry principles.

To know about separation and purification techniques.

UNIT - I LABORATORY HYGIENE AND SAFETY (9 hrs)

Storage and handling of chemicals – Carcinogenic chemicals – Toxic and poisonous chemicals – Waste disposal – Fume disposal – General precautions for avoiding accidents – First aid techniques – Poisoning – methods to avoid poisoning – Treatment for specific poison–antidotes– Laboratory safety measures.

UNIT - II SOLUTIONS (9 hrs)

Ways of expressing concentration : molarity – molality - normality – percentage - numerical problems based on these. Acids and bases: Arrhenius, Bronsted and Lowry, Lewis and Lux-Flood – relative strength of acids and bases.pH of solutions: pH scale and numerical problems based on it. Buffer solutions: definition and types – calculation of pH by Henderson equation – biological importance.

UNIT - III INORGANIC QUALITATIVE ANALYSIS (9 hrs)

Aims of semi micro methods – Types of reactions – dry reactions – precipitation reactions – complexation reactions – oxidation and reduction reactions – Flame test, borax bead test, charcoal cavity test and cobalt nitrate test - chemistry of interfering anions and their removal in the analysis of cations: oxalate, borate, fluoride, phosphate and chromate – solubility product principle and its applications in the separation of cations.



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UNIT - IV VOLUMETRIC ANALYSIS (9 hrs)

TITRIMETRY : Titration – analyte and titrant – equivalence point – standard solutions: primary and secondary standards – volumetric titrations: types – acid-base titrations (choice of indicator and its theory) – redox titrations (permanganometry, iodometry and iodimetry) and complexometric titrations (EDTA only).

UNIT - V PURIFICATION TECHNIQUES (9 hrs)

Purification Methods: Types – criteria of purity - principle – detailed study of crystallisation – sublimation - distillation and its types (steam, fractional and reduced pressure distillations) – extraction techniques.

Text books:

1. Elements of Analytical Chemistry by R.Gopalan, P.S.Subramanian and K.Rengarajan, Sultan Chand & Sons, (2000)
2. Principles of Inorganic Chemistry by Puri, Sharma & Kalia, Milestone publisher & distributor (2009).

Reference books:

1. Vogel's textbook of Quantitative Inorganic Analysis 4th edition.(1978)
2. Essentials of Physical Chemistry by B.S.Bahl, Arun Bahl and G.T.Tuli - S.Chand and Co.Ltd., (2012)
3. Basic Principles of Practical Chemistry by V.Venkateswaran,R.Veerasingam & A.R.Kulandaivelu, Sultan Chand & sons, (2002)

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II SEMESTER

| S. No | PART | Sub. Code | Subject Title | Hrs/ Wk | Exam hrs | C A | SE | Tot | Crd |
|-------|----------------------|----------------------|-----------------------------|---------|----------|-----|----|-----|-----|
| 1 | PART - I | 17UACT21/ H21/S21 | Tamil/Hindi/ Sanskrit | 6 | 3 | 25 | 75 | 100 | 3 |
| 2 | PART - II | 17UACE21 | English | 6 | 3 | 25 | 75 | 100 | 3 |
| 3 | PART - III CORE | 17UCYC21 | Physical Chemistry -I | 5 | 3 | 25 | 75 | 100 | 4 |
| 4 | PART - III CORE | 17UCYCP1 | Inorg. sm qual. Analysis | 2 | 3 | 40 | 60 | 100 | 2 |
| 5 | PART - III ALLIED | 17UCYA21 | Maths/Botany | 6 | 3 | 25 | 75 | 100 | 5 |
| 6 | PART - IV SBS | 17UCYS21 | Applied chemistry - I | 3 | 3 | 25 | 75 | 100 | 3 |
| 7 | PART - IV | 14 UACES1 | EVS | 2 | 3 | 25 | 75 | 100 | 2 |
| Total | | | | 30 | | | | | 22 |

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|----------------------------|---------------------------------------|------------------------------------|
| PART - III CORE | Title : PHYSICAL CHEMISTRY – I | Subject Code : 17UCYC21 |
| Semester : II | HOURS : 5 hours / Week | CREDITS :4 |

Objectives

To acquire a thorough knowledge of the three states of matter with colloids and interaction of matter on surface.

UNIT – I GASEOUS STATE (15hrs)

Gas Laws – Ideal gas equation - kinetic theory of gases : Postulates – derivation of ideal gas laws – deviations - Vander Waals' equation - Maxwell distribution of molecular velocities (no derivation) - graphical representation – effect of temperature on various velocities – Law of corresponding states – Boyle and inversion temperatures of gases.

Mean free path – viscosity of gases – collision number – Brownian movement – Avogadro number – determination of avogadro number – Loschmidt number – principle of equipartition energy.

UNIT – II LIQUID STATE (15 hrs)

Intermolecular forces in liquids – dipole-dipole attractions, London forces and hydrogen bonding - Heat of vapourisation - Trouton's rule and its significance – molar volume and its applications – surface tension - effect of temperature on surface tension – parachor – atomic and structural parachors - their applications- viscosity – effect of temperature on viscosity – measurement of viscosity – Ostwald method - Reynold's number. Liquid Crystals – classification – smectic – nematic - cholesteric - disc shaped and polymer liquid crystals – LCDs and the Seven Segment cell - applications.

UNIT – III SOLID STATE (15 hrs)

Introduction – types of solids: amorphous and crystalline solids - size and shape of crystals – symmetry of crystals – law of rational indices - space lattice and unit cells – types of unit cells – Miller indices- Bragg's equation –derivation- measurement of diffraction angle : rotating crystal method– Ionic crystals : sodium chloride, caesium chloride – crystal defects : vacancy defect, interstitial defect and impurity defect.



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UNIT – IV SURFACE CHEMISTRY (15 hrs)

Catalysis : Definition – characteristics of catalytic reactions –Homogeneous catalysis : Acid-base catalysis-enzyme catalysis-Michaelis-Menten equation-autocatalysis-Heterogeneous catalysis – surface catalytic reactions – promoters- catalytic poison – theories of catalysis .

Adsorption : Definition – various terms involved in adsorption – types of adsorption : physical and chemical adsorption – difference between them - factors influencing adsorption–Adsorption Isotherms: Freundlich adsorption isotherm and Langmuir adsorption isotherm- derivation - applications of adsorption.

UNIT – V COLLOIDS (15 hrs)

Definition – classification- lyophilic and lyophobic sols – comparison between them – preparation of sols – dispersion methods: Bredig's Arc , peptization methods – aggregation methods – Purification of sols: dialysis – Optical properties of sols:Tyndall effect – Kinetic properties of sols: Brownian movement – Electrical properties of sols : Electrophoresis – Gold number –Emulsions: definition – types – Gels: definition - types – applications of colloids .

Text books:

1. Principles of Physical Chemistry by B. R. Puri, L. R. Sharma & S. Pathania, Vishal Publishing Co. (2011).
2. Text book Physical Chemistry by P.L.Soni, O.P.Dharmarha & U.N.Dash,S.Chand,(2011)

Reference books:

1. Essentials of Physical Chemistry by B. S. Bahl, Arun Bahl and G. D. Tuli, S. Chand and Co. Ltd. (2012).
2. Advanced Physical Chemistry by D. A. Bajpai, S. Chand and Co. Ltd. 3rd Edition.
3. A text book of Physical Chemistry by S. Glasstone, Macmillan (India) Ltd. (1976).



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|--------------------------------|-----------------------------------|--|
| PART - IV SBS | Title: APPLIED CHEMISTRY-I | Subject Code : 17UCYS21 |
| Semester : II | HOURS : 3 hours / Week | CREDITS :3 |

Objectives

To know the chemistry of water, fertilizers, cement, ceramics, fireworks, explosives, paints and pigments.

UNIT – I WATER TREATMENT (9 hrs)

Characteristics of water – hardness of water: types – unit and its estimation – removal of hardness – industrial implications - elementary study of water parameters like acidity, alkalinity, pH, DO, TDS, BOD, COD- treatment of water for domestic supply – treatment of sewage water.

UNIT – II AGRO CHEMICALS (9 hrs)

Fertilizers : role of macro nutrients in plant growth- requisites of a good fertilizer — manufacture and uses of urea, super phosphate of lime, muriate of potash and mixed fertilizers - adverse effects of fertilizers on the environment. Pesticides: Definition and classification – Insecticides: Manufacture and uses of Bordeaux mixture, DDT, BHC - Modern insecticides : organophosphorous and carbamates.

UNIT –III SILICATE INDUSTRY (9 hrs)

Cement: composition – manufacturing process – setting of cement – white cement – concrete. Glass : Raw materials – manufacturing process – characteristics - types of glasses. Ceramics : Raw materials - Permeable and impermeable wares – manufacturing process - plasticity of clays – white pottery glazing - earthenwares and stonewares – optical fibres.

UNIT –IV MATCH INDUSTRY, PYROTECHNY AND EXPLOSIVES (9 hrs)

Match Industry: Classification - match head and striking surface – manufacture of safety matches- chemistry of lighting of match stick.

Pyrotechny: composition of fireworks – coloured smokes – coloured matches.

Explosives: Classification – preparation and applications of gun powder, smokeless powder, lead azide, mercury fulminate, TNT,GTN, picric acid and dynamite.

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UNIT –V PAINTS AND PIGMENTS

(9 hrs)

Paints : Ingradients - characteristics of good paint - manufacture – setting of paints - paint failure . Pigments: Elementary study of zinc white, lithophone, ultramarines, carbon black, red lead and chrome green. Varnishes : manufacture – enamels – lacquers – solvents and thinner – oils.

Text books:

1. Industrial Chemistry by B. K. Sharma Goel publishing House (2008).
2. Applied Chemistry by K. Bagavathi Sundari, MJP publishers (2008).

Reference books:

1. Fundamental concepts of Applied Chemistry by Jeyashree Ghosh, S. Chand and Co. Ltd. (2006).
2. Principles of Inorganic Chemistry by Puri, Sharma & Kalia, Milestone publisher & distributor (2009).
3. Text book of Inorganic Chemistry by P. L. Soni and M. Katyal, 20th Edition, Sultan chand & Sons (2013).

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|----------------------------|--|------------------------------------|
| PART - III CORE | Title : INORGANIC SEMI-MICRO QUALITATIVE ANALYSIS | Subject Code : 17UCYCP1 |
| Semester : II | HOURS : 2 hours / Week | CREDITS :2 |

Objectives

To practice the complete analysis of inorganic salt mixtures with its principles.

Analysis of salt mixture containing two anions of which one is an interfering ion and two cations by semi-micro method.

List of ions to be analysed:

Anions : carbonate, nitrate, bromide, chloride, sulphate, phosphate, borate, oxalate, fluoride, arsenite, arsenate and chromate

Cations : lead, bismuth, copper, cadmium, antimony, ferrous, ferric, aluminium, zinc, manganese, cobalt, nickel, calcium, barium, strontium, magnesium and ammonium

Distribution of Marks: Internal - 40 Marks
 External - 60 Marks

Internal

Class Experiments : 30 marks
 Viva-voce : 10 marks
 Total : 40 marks

External examination

Record Notebook : 10 marks
 Procedure writing : 10 marks
 Experiment : 40 marks
 Total : 60 marks

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III SEMESTER

| S.No | PART | Sub. Code | Subject Title | Hrs/Wk | Exam hrs | C A | SE | Tot | Crd |
|------|----------------------|----------------------|--|--------|----------|-----|----|-----|-----|
| 1 | PART – I | 17UACT21/ H21/S21 | Tamil/Hindi/ Sanskrit | 6 | 3 | 25 | 75 | 100 | 3 |
| 2 | PART – II | 17UACE31 | English | 6 | 3 | 25 | 75 | 100 | 3 |
| 3 | PART – III CORE | 17UCYC31 | Organic Chemistry -I | 5 | 3 | 25 | 75 | 100 | 4 |
| 4 | PART – III CORE | | Volumetric Estimation (Practicals) | 2 | 0 | 0 | 0 | 0 | 0 |
| 5 | PART – III ALLIED | 17UPSA31 | Allied subject – II Physics | 4 | 3 | 25 | 75 | 100 | 4 |
| 6 | PART – III ALLIED | | Allied subject - II Physics Practicals | 2 | 3 | 0 | 0 | 0 | 0 |
| 7 | PART – IV SBS | 17UCYS31 | Applied Chemistry - II | 3 | 3 | 25 | 75 | 100 | 3 |
| 8 | PART – IV NME | 17UCYN31 | CHEMISTRY IN EVERYDAY LIFE - I | 2 | 3 | 25 | 75 | 100 | 2 |
| | | | Total | 30 | | | | | 19 |

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|----------------------------------|------------------------------------|--|
| PART - III CORE | Title : ORGANIC CHEMISTRY-I | Subject Code : 17UCYC31 |
| Semester : III | HOURS : 5 hours / Week | CREDITS :4 |

Objectives

To have a thorough knowledge of basic principles of organic reactions, a detailed study of aliphatic hydrocarbons and aromatic hydrocarbons. To acquire the knowledge of various types of reactions in aromatic and aliphatic compounds with their orientation. To study a detailed and comparative study of halogenated and hydroxyl compounds of both aromatic and aliphatic nature.

Unit I Basic concepts of organic chemistry (15 hrs)

- Characteristics of organic compounds – catenation – classification of organic compounds –
homologous series – functional groups – nomenclature – IUPAC system – Empirical formula
– molecular formula – problems.
- Tetrahedral valency of carbon – homolytic and heterolytic fissions of C-C bond – formation
and stability of carbonium ions, carbanions and free radicals – electrophilic and nucleophilic
reagents.
- Electronic effects : inductive effect – mesomeric effect – electromeric effect - resonance
effect – hyperconjugation effect.
- Types of organic reactions – substitution – addition – elimination – rearrangement – examples (mechanism not required).

Unit II Aliphatic hydrocarbons (15 hrs)

- Alkanes** : Preparation by Sabatier-Senderen, Wurtz, Corey-House, Kolbe, Duma and reduction methods – General properties.
- Alkenes** : General methods of preparation - general properties – regioselectivity in addition reactions viz., syn- and anti, Markovnikov rule and Kharasch effect – detection and location of double bond – simple problems - preparation and properties of 1,3-butadiene.
- Alkynes** : General methods of preparation – properties - acidic character of acetylene – structure.

Unit III Aromatic compounds (15 hrs)

- Introduction – sources – characteristics . Benzene: structure – Kekule and Molecular orbital models. Aromaticity – Huckel's rule – its applications – Non aromatic and anti-aromatic compounds.
- Aromatic electrophilic substitution reactions – mechanisms, orientation effect and reactivity – Disubstitution : directive influence of substituents - Trisubstitution : rules and steric hinderence.
- Aromatic nucleophilic substitution : unimolecular, bimolecular and benzyne mechanisms.

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Unit IV Organo halogen compounds (15 hrs)

- Alkyl halides** : General methods of preparation – general properties – detailed mechanisms of nucleophilic substitution and elimination reactions. Fluorocarbons: Westron and Freon – preparation, uses and their impact on environment.
- Aryl halides** : Preparation by halogenation, Sandmeyer and Hunsdiecker reactions – general properties – halogenated insecticides: preparation, uses of BHC and DDT.
- Aralkyl halides** : Benzyl chloride – preparation and properties – comparison between aryl halide and aralkyl halide.

Unit V : Organo hydroxy compounds (15 hrs)

- Alcohols** : Preparation from alkenes by hydration, hydroboration-oxidation and oxymercuration-demercuration methods – general properties. Ethylene glycols: Preparation and properties – Glycerol : Preparation and properties – Nitroglycerins and their applications.
- Phenols** : General methods of preparation – properties – acidity of phenol and effect of substituents – reactions of analytical importance.
- Aromatic alcohol** : Benzyl alcohol - Preparation and properties – comparison with phenols.

Text books:

- Modern Organic Chemistry by M.K.Jain and S.C.Sharama,Vishal Publishing co.4thedn. (2014)
- A Text book of Organic Chemistry by K.S. Tewari and N. K. Vishnoi - Vikas Publishing House pvt. Ltd. 3rd Edn. (2006)

Reference books:

- Organic Chemistry by I.L.Finar (Volume I) Pearson Education Ltd. (2012)
- Advanced Organic Chemistry by Arun Bahl and B. S. Bahl, S. Chand Publishing (2014)
- Organic Chemistry by Bhupinder Mehta and Manju Mehta ,Eastern Economy Edition,(2010)



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| PART - IV SBS | Title : APPLIED CHEMISTRY - II | Subject Code : 17UCYS31 |
| Semester : III | HOURS :3 hours / Week | CREDITS :3 |

Objectives : *To know the chemistry of milk with their milk products, sugar, paper, petrochemicals and polymers.*

UNIT – I DAIRY CHEMISTRY (9 hrs)

Milk – constituents of milk – physical properties of milk – effects of heating - pasteurization and its types. Types of milk: homogenized milk – flavoured milk – vitaminised milk - toned milk and condensed milk. Milk products: Cream, Butter , Ghee , Ice cream and milk powder.

UNIT – II SUGAR TECHNOLOGY (9 hrs)

Sources – manufacture of cane sugar: Extraction of juice, purification by defecation, sulphitation and carbonation, concentration, crystallization, separation and refining – manufacture of sucrose from beet root - testing of sugar.

UNIT –III PAPER INDUSTRY (9 hrs)

Introduction – various raw materials – manufacture of pulp: mechanical and chemical process – rag pulp – beating, refining, filling, sizing and colouring – manufacture of paper - calendering.

UNIT –IV PETROCHEMICALS (9 hrs)

Crude oil – fractional distillation - chemicals from crude oil – natural gas – LPG – aviation fuel – fuels used in locomotives – trucks and ships – fuels used in light commercial vehicles – octane number and cetane number – anti knocking agents.

UNIT –V POLYMER CHEMISTRY (9 hrs)

Introduction – classification of polymers - Natural polymers : rubber, starch, proteins and cellulose - Synthetic polymers: polymerization and its types – Techniques of polymerization: bulk and emulsion polymerization – Plastics: thermosetting and thermoplastics – preparation and uses of bakelite, nylon 6 6, teflon and epoxy resin.

Text books:

1. Industrial Chemistry by B. K. Sharma Goel publishing House (2008).
2. Applied Chemistry by K. Bagavathi Sundari, MJP publishers (2008).

Reference books:

1. Fundamental concepts of Applied Chemistry by Jeyashree Ghosh, S. Chand and Co. Ltd. (2006).
 2. Advanced Organic Chemistry by Arun Bahl and B. S. Bahl, S. Chand Publishing (2014)
 3. Food Science by Norman N.P. & Joseph H.H, 5th edition ,CBS pub.& dist.,(1997)
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IV SEMESTER

| S.No | PART | Sub. Code | Subject Title | Hrs/Wk | Exam hrs | C A | SE | Tot | Crd |
|------|----------------------|----------------------|--|--------|----------|-----|----|-----|-----|
| 1 | PART – I | 17UACT21/ H21/S21 | Tamil/Hindi/ Sanskrit | 6 | 3 | 25 | 75 | 100 | 3 |
| 2 | PART – II | 17UACE41 | English | 6 | 3 | 25 | 75 | 100 | 3 |
| 3 | PART – III CORE | 17UCYC41 | Inorganic Chemistry - II | 5 | 3 | 25 | 75 | 100 | 4 |
| 4 | PART – III CORE | 17UCYCP2 | Volumetric Estimation (Practicals) | 2 | 3 | 40 | 60 | 100 | 2 |
| 5 | PART – III ALLIED | 17UPSA41 | Allied subject-II Physics | 4 | 3 | 25 | 75 | 100 | 4 |
| 6 | PART – III ALLIED | 17UPSAP1 | Allied subject-II Physics Practicals | 2 | 3 | 40 | 60 | 100 | 2 |
| 7 | PART – IV SBS | 17UCYS41 | Pharmaceutical Chemistry | 3 | 3 | 25 | 75 | 100 | 3 |
| 8 | PART – IV NME | 17UCYN41 | CHEMISTRY IN EVERYDAY LIFE - II | 2 | 3 | 25 | 75 | 100 | 2 |
| 9 | PART-V | | Extension Activities | | | | | 100 | 1 |
| | | | Total | 30 | | | | | 24 |

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| PART - III CORE | Title : INORGANIC CHEMISTRY-II | Subject Code : 17UCYC41 |
| Semester : IV | HOURS : 5 hours / Week | CREDITS :4 |

Objectives : *To acquire the knowledge of chemistry of s, p and d-block elements for their general characteristics with comparative studies among group elements and applications of the industrially important compounds.*

Unit –I s - Block Elements

(15 hrs)

- Hydrogen:** Occurrence – preparation- isotopes & its applications – hydrides – types- preparation –properties – uses.
- Group 1 Elements:** General characteristics : Electronic configuration, metallic character, flame colouration, oxidation state and reducing property – Anomalous properties of Lithium –Diagonal relationship and resemblance of Li & Mg – causes – Preparation, Properties and uses of Lithium carbonate, Sodium hydroxide and Potassium iodide.
- Group 2 Elements:** General characteristics : Electronic configuration, metallic character, flame colouration, oxidation state and reducing property – Anomalous behaviour of Be – Diagonal relationship of Be & Al. - Preparation and properties and uses of Beryllium chloride, Magnesium sulphate, Calcium carbide and Barium sulphate – Uses of Radium salts.

Unit –II p - Block Elements – I

(15 hrs)

- Group 13 Elements:** General characteristics : Electronic configuration, metallic character, oxidation states, formation of trihalides and hydrides - Diagonal relationship of B & Si - Preparation, properties and uses of Diborane, Borax, Borazine and $AlCl_3$ – Structure of Diborane, BF_3 and $AlCl_3$ – Ceramics industry : manufacture of Whiteware.
- Group 14 Elements:** General characteristics : Electronic configuration, allotropy, metallic and non-metallic character, oxidation states and catenation – allotropes of carbon – detailed study of Carbides and Silicates – Preparation, properties and uses of Silicones, Carborundum, Stannous chloride, Red Lead and White Lead.

Unit –III p - Block Elements – II

(15 hrs)

- Group 15 Elements:** General characteristics : Electronic configuration, metallic and non-metallic character, allotropy, oxidation states and catenation - Nitrides: classification - Allotropic modifications of phosphorus – Difference between red and white phosphorus – metalloid character of Arsenic – alloys of bismuth – preparation, properties and uses of microcosmic salt, Graham's salt and tartar emetic.
- Group 16 Elements:** General characteristics : Electronic configuration, metallic and non-metallic character, atomicity, polymorphism, catenation and oxidation states – Anomalous behavior of oxygen - Uncommon feature of liquid sulphur- unique feature of SF_4 – preparation, properties and uses of Caro's acid and Marshall's acid – Properties of selenium, Tellurium and Polonium.

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Unit –IV p - Block Elements – III

(15 hrs)

- Group 17 Elements:** General characteristics : Electronic configuration, colour, oxidation states, non-metallic character, electronegativity and electron affinity – isolation of fluorine – peculiarities of fluorine – oxyacids of halogens: preparation, properties and structure of hypochlorous acid and periodic acid - electropositive character of Iodine – interhalogens: types – preparation, properties & structure of ICl, BrF₃, ClF₅ and IF₇– pseudohalogens – preparation, properties of cyanogens and thiocyanogen.
- Group 18 Elements:** occurrence – isolation of noble gases from dry air – compounds of Xenon: preparation, properties and structure of XeF₄ and XeOF₄ – clathrates.

Unit –V d - Block Elements

(15 hrs)

- The Transition Elements:** Definition- metallic character- oxidation states- reducing properties – colour – magnetic properties- complex formation.
- First Transition Series:** Preparation, properties and uses of TiCl₄, V₂O₅, KMnO₄, K₃[Fe(CN)₆], Na₃[Co(NO₂)₆] and cupric acetate – Alloys of Nickel .
- Second Transition Series:** Preparation, properties of Mo₂O₅, molybdenum blues, pertechnic acid and pertechnetates, RuO₄, Wilkinson's catalyst– Role of AgBr in photography.
- Third Transition Series:** : Preparation and uses of Tungsten bronzes, cisplatin, Chloroplatinic acid, Colloidal gold and purple of cassius, Fulminating gold - distinction between AgCl & Hg₂Cl₂.

TEXT BOOKS:

- Principles of Inorganic Chemistry by Puri, Sharma and Kalia, Milestone Publisher (2013)
- Modern Inorganic Chemistry by R. D. Madan and Satya Prakash, S. Chand and Co, 3rd edn. (2014)

REFERENCE BOOKS:

- Advanced Inorganic Chemistry by F. A. Cotton and G. Wilkinson, John Wiley and sons Inc., 6th edn. (2006)
- Inorganic Chemistry: A Unified Approach by W.W. Porterfield, Academic Press, California 2nd edn (2005)
- Inorganic Chemistry by J. E. Huheey et. al, Pearson Education Pvt. Ltd., 4th edn. (2004)



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|--------------------------------|---|--|
| PART - IV SBS | Title : PHARMACEUTICAL CHEMISTRY | Subject Code : 17UCYS41 |
| Semester : IV | HOURS : 3 hours / Week | CREDITS :3 |

Objectives

To gain the knowledge of biochemistry aspects of drugs and their formulation with usage in various forms also in various fields like surgery. To have a complete knowledge about the analysis of blood and urine.

UNIT – I Study of drugs

(9 hrs)

- Introduction – Terminologies – micro-organisms, pharmacology, pharmacodynamics, pharmacokinetics, pharmacopoeia - Importance of drugs.
- Classification of drugs :- Biological and Chemical.
- Different dosage forms of drugs: tablet, capsules, ointment and liquid dosage forms

UNIT – II Pharmaceutical Aids

(9 hrs)

- Organic pharmaceutical aids: Preservatives, antioxidants, emulsifying agents, colouring, flavouring and sweetening agents, stabilizing agents, ointment bases, solvents. (Explanation of the above terms and examples)
- Organic diagnostic agents: Drugs used for X- ray contrast media (Barium sulphate, Sodium diatrizoate injection), drugs used to test organ function (Fluorescein Sodium, Sulphobromophthalein sodium), determination of blood volume and hemopoietic function.

UNIT – III Anaesthetics

(9 hrs)

- Anaesthetics – definition – mode of action – classification.
- General anaesthetics – Types - Inhalation anaesthetics , Intravenous anaesthetics and Basal anaesthetics (two examples for each category)
- Local anaesthetics – Types - Natural and Synthetic local anaesthetics (two examples for each category)



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UNIT – IV Chemotherapy

(9 hrs)

- a) Antibiotics - Definition – Classification - SAR and uses of fluoroquinolones
- b) Antipyretics, Analgesics and anti-inflammatory agents - an elementary idea
- c) Sulphonamide – Drug actions – structure, adverse effect and uses of Sulphanilamide, Prontosil
- d) Antimalarials - Study of Quinine and chloroquine
- e) Arsenical drugs - Study of Salvarson-606 and Neosalvarsan.

UNIT – V Clinical Chemistry

(9 hrs)

- a) Blood: composition – Blood grouping and Rh factor- anticoagulants
- b) Analysis of blood: Determination of Glucose by Folin and WU method – Estimation of cholesterol - Estimation of Haemoglobin concentration by Sahi method – Erythrocyte count by Haemocytometry
- c) Urine: Routine examination of urine - determination of glucose in urine by Benedict's reagent–
GTT .

Text books:

1. A Text book of Pharmaceutical Chemistry by Jayashree Ghosh, S.Chand & Co. Ltd,(2012)
2. Pharmaceutical Chemistry by S.Lakshmi, Sultan Chand & Sons, (2004)

Reference books:

1. Burger's Medicinal Chemistry by J. G. Cannon, John Wiley and Sons,Inc., 5th edn. (1995)
 2. Medicinal Chemistry by Ashutosh Kar, New Age International (P) Ltd. 5th edn. (2010)
 3. Industrial Chemistry– B.K.Sharma – Goel Publishing House. 13th Edition (2008)
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| PART - III CORE | Title : Lab: Volumetric Estimation | Subject Code : 17UCYCP2 |
| Semester : IV | HOURS : 2 hours / Week | CREDITS :2 |

Objective : *To practice the quantitative estimation of substances by titration methods.*

A double titration involving the making up of the solution to be estimated and the preparation of a primary standard solution.

LIST OF EXPERIEMENTS:

- I. **ACIDMETRY AND ALKALIMETRY**
 - 1. Estimation of Na₂CO₃
 - 2. Estimation of NaOH/KOH
 - 3. Estimation of Oxalic acid.
- II. **REDOX TITRATIONS**
 - a. **Permanganimetry**
 - 1. Estimation of ferrous ion
 - 2. Estimation of Oxalic acid
 - 3. Estimation of calcium(direct method)
 - b. **Dichrometry**
 - 1. Estimation of ferrous ion
 - 2. Estimation of ferric ion using external indicator
- III. **IODOMETRY AND IODIMETRY**
 - 1. Estimation of potassium dichromate
 - 2. Estimation of potassium permanganate
 - 3. Estimation of copper
- IV. **EDTA Titration**
 - 1. Estimation of Hardness of water using EDTA.
 - 2. Estimation of Calcium.
 - 3. Estimation of Magnesium

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 Distribution of Marks: Internal - 40 Marks External - 60 Marks

Internal

Class Experiments : 30 marks
 Viva-voce : 10 marks
 Total : 40 marks

External examination

Record Notebook : 10 marks
 Procedure writing : 10 marks
 Experiment : 40 marks
 Total : 60 marks

For Estimation, if the student has

- < 1% error - 40 marks
- 1-2% error - 30 marks
- 2-3% error - 20 marks
- 3-5%error - 10 marks
- > 5% error - 8 marks

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V - SEMESTER

| Sl. No | PART | Sub. Code | Subject Title | Hrs / Wk | Exam hrs | CA | SE | Tot | Crd |
|--------|-------------------|-----------|---|----------|----------|----|----|-----|-----|
| 1 | PART-III CORE | 17UCYC51 | Inorganic Chemistry - II | 5 | 3 | 25 | 75 | 100 | 5 |
| 2 | PART-III CORE | 17UCYC52 | Organic Chemistry – II | 5 | 3 | 25 | 75 | 100 | 5 |
| 3 | PART-III CORE | 17UCYC53 | Physical Chemistry – II | 6 | 3 | 25 | 75 | 100 | 5 |
| 4 | PART-III CORE | 17UCYCP3 | Physical Chemistry Experiments | 6 | 6 | 40 | 60 | 100 | 5 |
| 5 | PART-III CORE | 17UCYCP4 | Organic Estimation and preparation | 3 | 3 | 40 | 60 | 100 | 2 |
| 6 | PART-III ELECTIVE | 17UCYE51 | Analytical Chemistry and Computer applications in chemistry | 5 | 3 | 25 | 75 | 100 | 5 |
| 7 | SELF STUDY | 16USSS51 | Soft Skills | - | - | - | - | 100 | - |
| | | | Total | 30 | | | | | 27 |

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|----------------------------|--|------------------------------------|
| PART - III CORE | Title : INORGANIC CHEMISTRY – III | Subject Code : 17UCYC51 |
| Semester : V | HOURS : 5 hours / Week | CREDITS :5 |

Objectives

To acquire the knowledge of chemistry of f-block elements among the groups and detailed study of metal complexes involving bonding, structure and isomerism. To learn the essentials of organometallics compounds and importance of metal ions in biological aspects.

Unit –I Inner-transition elements (f-block Elements) (15 hrs)

(a) **The Lanthanide Series** : occurrence - electronic configuration – position in periodic table – oxidation states – magnetic properties – Lanthanide contraction – causes and its consequences – colour – complex formation – Extraction and uses of Lanthanides.

(b) **The Actinide Series** : trans-uranic elements : definition, sources and preparation - position in periodic table - electronic configuration – oxidation states – ionic radii - actinide contraction – colour – formation of complexes – properties - comparison with lanthanides – Extraction and uses of thorium.

Unit –II Coordination Chemistry – I (15 hrs)

Double salts and coordination compounds – terminology: coordination sphere, coordination number, ligand and its types – nomenclature - **Isomerism**: structural isomerism and stereo isomerism - stability: thermodynamic and kinetic stability - factors affecting the stability of metal complexes – Experimental determination of composition of complexes by Job's method – **Chelates**: classification – chelate effect and application of the formation of chelated complexes in analytical chemistry.

Unit –III Coordination Chemistry – II (15 hrs)

Werner's coordination theory: postulates and experiment evidence - Sidgwick's concept: EAN rule – applications and limitations - Valence Bond Theory: assumptions and illustration to 4- and 6- coordination ions - hybridization and geometry - limitations - Crystal Field Theory: salient features - orbital splitting as applied to octahedral, tetrahedral and square planar complexes - CFSE and its calculation - spectrochemical series- magnetic moments and color of transition metal complexes.



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Unit –IV Organometallic Chemistry (15 hrs)

Organometallic compounds: definition – classification - hapticity of ligands -18 electron rule and its exceptions– nomenclature - bonding in organometallic compounds – transition metal alkene complexes: Zeise's salt – preparation – properties – structure and bonding - Cyclopentadienyl complexes: ferrocene - preparation- properties - structure and bonding- catalytic activity of organometallic compounds - Wilkinson's catalyst in hydrogenation of alkene.

Unit –V Bioinorganic Chemistry (15 hrs)

Essential and trace elements: Introduction and their classification - Metalloporphyrins: definition - hemoglobin and myoglobin - structure and function - cooperative and non-cooperative binding - Hill constant -Bohr effect - CO poisoning of Hb - chlorophyll-structure and its functions.

Role of Na⁺ and K⁺ ions in biological system - Na-K pump- role of calcium in biology -rickets - osteoporosis - hypercalcemia and hypocalcemia - comparison of biochemistry of Ca²⁺ and Mg²⁺ - Biological role of elements viz., Fe, Cu, Zn, Ni, Cr, F, Cl, I.

Text books:

1. Principles of Inorganic Chemistry by B.R.Puri, L.R. Sharma and K.C.Kalia – Milestone Publishers 31st Edn. (2012)
2. Modern Inorganic Chemistry by R. D. Madan and Satya Prakash -S.Chand and Co, 3rd Edn. (2014)

Reference books:

1. Inorganic Chemistry by J. E. Huheey et. al,- Pearson Education Pvt. Ltd., 4th Edn. (2004)
2. Organometallic Compounds by Indrajeet Kumar – Pragati Prakasan,2nd Edn. (2010)
3. Bioinorganic Chemistry by K.Hussain Reddy,New age international,(2007)

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|----------------------------|---------------------------------------|------------------------------------|
| PART - III CORE | Title : ORGANIC CHEMISTRY – II | Subject Code : 17UCYC52 |
| Semester : V | HOURS : 5 hours / Week | CREDITS :5 |

Objectives

To learn the general behavior of organic reactions with mechanism of aliphatic and aromatic carbonyl compounds, organo acids such as aliphatic, aromatic carboxylic acids, sulphonic acids and dicarboxylic acid. To get hold of the knowledge of synthetic designing of various organic compounds using organometallics and active methylene compounds.

Unit –I ALIPHATIC CARBONYL COMPOUNDS (15 hrs)

(a) Preparation from nitriles, carboxylic acid, 1,3-dithianes, organometallics (magnesium, cadmium and lithium), hydrolysis, oxidation reactions & reduction reactions – structure and reactivity of carbonyl group - acidity of α -hydrogens.

Nucleophilic addition reactions (HCN, GR, ammonia and its derivatives) – relative reactivities of aldehydes and ketones in nucleophilic addition reactions - condensation reactions (aldol, Cannizzaro and Mannich) with their mechanisms – reaction with phosphine derivatives – oxidation reactions (including haloform reaction) - reduction reactions (MPV, Clemmensen, Wolf-Kishner, catalytic and metal hydrides) and polymerisation reactions – distinguishing reactions between aldehydes and ketones.

(b) preparation, properties and uses of acrolein, crotonaldehyde, acetylacetone.

Unit –II AROMATIC CARBONYL COMPOUNDS: (15 hrs)

(a) Preparation from carboxylic acids, Grignard reagent, nitrile (Stephen reaction) and electrophilic

substitutions of aromatic hydrocarbons (Gattermann, Gattermann-Koch, Reimer-Tiemann, Friedel-Crafts reactions), oxidation and reduction reactions - reactivity of carbonyl group and its

comparison with aliphatic aldehydes and ketones .

Nucleophilic addition reactions - condensation reactions (Cannizzaro, Claisen-Schmidt, Perkin,

Benzoin, Knoevenagel and Stobbe) with their mechanisms – electrophilic substitution reactions –

oxidation and reduction reactions.

(b) preparation, properties and uses of cinnamaldehyde, vanillin, phloroacetophenone.

Unit –III ORGANO ACIDS - I (15 hrs)

(a) **Aliphatic carboxylic acids** : Preparation by oxidation, hydrolysis, carbonylation and haloform reactions – acidic character – effect of substituents on acidic strength – chemical properties : reaction with bases, metals, reduction reactions, conversion into derivatives viz., acid chlorides, amides, esters, acid anhydrides, Hunsdiecker, Curtius and HVZ reactions, decarboxylation reactions.

(b) **Aromatic carboxylic acids** : Preparation by oxidation, hydrolysis, carbonylation and haloform reactions – acidic character – effect of substituents on acidic strength – chemical properties : reaction with bases, metals, conversion into derivatives viz., acid chlorides, amides, esters, acid anhydrides, decarboxylation, reduction and electrophilic substitution reactions.

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Unit –IV ORGANO ACIDS - II (15 hrs)

- (a) **Substituted Carboxylic acids** : Preparation, properties and uses of chloroacetic acid, lactic acid and pyruvic acid – distinction between among various halo acids, hydroxy acids and keto acids - preparation, properties and uses of salicylic acid.
- (b) **Aromatic sulphonic acids** : Preparation and properties of benzene sulphonic acid – comparison of acidity with carboxylic acid – electrophilic and nucleophilic substitution reactions – Preparation and properties of benzene sulphonyl chloride and sulphanilic acid –preparation and uses of saccharin, chloramine-T.
- (c) **Dicarboxylic acids** : General methods of preparation and properties of aliphatic saturated dicarboxylic acids (upto glutaric acid) – preparation and properties of maleic acid and fumaric acid – preparation of citric acid and its importance – preparation and properties of phthalic acid.

Unit –V STEREOCHEMISTRY (15 hrs)

- (a) **Optical isomerism** : optical activity – definition and its determination - asymmetry, dissymmetry and chirality – enantiomerism and diastereomerism - absolute and relative configurations – Cahn Ingold Prelog system of assigning R and S system – racemisation – resolution – asymmetric synthesis – Walden inversion – a brief study about the stereochemistry of allenes, spirans and biphenyl systems.
- (b) **Geometrical isomerism** : condition for existence – cis & trans system and syn & anti system – determination of configuration present in maleic acid and fumaric acid, aldoximes and ketoximes – E and Z nomenclature.

Text books:

1. Modern Organic Chemistry by M. K. Jain and S. C. Sharama -Vishal Publishing Co. 4th Edn. (2014)
2. Organic Chemistry by Bhupinder Mehta and Manju Mehta –Eastern Economy Edition,(2010)

Reference books:

1. Organic Chemistry by I.L.Finar (Vol. I & Vol.II) - Pearson Education Ltd. (2012)
2. A Text book of Organic chemistry by K.S. Tewari and N. K.Vishnoi - Vikas Publishing House pvt. Ltd. 3rd Edn. (2006)
3. Text Book of Organic Chemistry by P.L.Soni and H. M Chawla - Sultan Chand & sons 29th Edn. (2012)



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|----------------------------|--------------------------------------|------------------------------------|
| PART - III CORE | Title : PHYSICAL CHEMISTRY-II | Subject Code : 17UCYC53 |
| Semester : V | HOURS : 6 hours / Week | CREDITS :5 |

Objectives : To acquire the knowledge of analyzing various aspects of solid systems through phase rule and distribution law. To have a thorough knowledge of energetic and kinetics of reactions by detailed study of laws of thermodynamics and chemical kinetics.

Unit –I PHASE RULE & DISTRIBUTION LAW (18 hrs)

(a) **Phase rule:** Definition of the terms phase, component and degrees of freedom – conditions for equilibria between phases – derivation of Gibb's phase rule – eutectic point, congruent melting point and incongruent melting point .

One component system: H₂O, Sulphur and CO₂ systems – reduced phase rule - two component system: Lead – Silver, potassium iodide –water, Zinc – Magnesium and Sodium sulphate - water systems.

(b) **Distribution law:** statement – thermodynamic derivation – conditions – limitations – solvent extraction – applications.

Unit –II CHEMICAL KINETICS (18 hrs)

Introduction – rate of reaction – rate law and rate constant – order and molecularity – first order reactions – examples – rate equation – derivation - half life period - second order reactions - examples – rate equations – derivation - half life period - zero order and third order reactions - examples – rate equations (no derivation required) - determination of order of a reaction.

Influence of temperature on the rate of reaction – Arrhenius rate equation and its significance – theory of reaction rates – Bimolecular collision theory – Unimolecular reactions – Lindemann's hypothesis – Absolute Reaction Rate Theory - kinetics of fast reactions – flow methods for fast reactions – stopped flow method.

Unit –III THERMODYNAMICS – I (18 hrs)

(a) Introduction – energy and its units – mechanical work and heat – thermodynamic systems – properties of systems – state function and path function – thermodynamic processes.

(b) **First Law** : statement – mathematical formulation – changes in internal energy and enthalpy – heat changes at constant volume and at constant pressure – Cp, Cv relationship – work done in isothermal reversible expansion and compression of an ideal gas- calculation of ΔE , ΔH , q and w for isothermal and adiabatic expansion of an ideal gas – reversible

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adiabatic expansion (P, V and T relationships) – Joule – Thomson effect for an ideal gas – Joule-Thomson co-efficient in ideal and real gases – inversion temperature and significance.

(c) **Thermochemistry**: variation of enthalpies with temperature – Kirchoff's equation – Hess's law of heat summation - statement and applications.

Unit –IV THERMODYNAMICS - II (18 hrs)

(a) **Second Law of Thermodynamics** : Different ways of stating II law of thermodynamics – conversion of heat into work – Carnot's cycle – Carnot's theorem – thermodynamic efficiency - entropy – definition – derivation of the concept of entropy – entropy changes in reversible and irreversible processes – entropy change for an ideal gas - physical significance of entropy.

(b) Free energy function – Gibb's free energy – Helmholtz free energy – variation of free energy change with temperature and pressure – Gibb's -Helmholtz equation and its applications – Clapeyron-Clausius equation and its applications – Maxwell's relationships.

(c) **Chemical Potential** : Definition – significance – Gibb's-Duhem equation – variation of chemical potential with temperature and pressure.

Unit –V THERMODYNAMICS – III (18 hrs)

(a) Application of thermodynamics to various types of equilibria - equilibrium constant and free energy changes – Van't Hoff reaction isotherm – Van't Hoff reaction isochore-thermodynamic interpretation of law of mass action and Lechatelier's principle.

(b) Nernst heat theorem and its applications – Third law of thermodynamics – statement-determination of absolute entropy

(c) Colligative properties – vapour pressure lowering – osmotic pressure(definition only) – depression of freezing point –elevation of boiling point -thermodynamic derivation.

TEXT BOOKS:

1. Principles of Physical Chemistry by B.R.Puri, L.R.Sharma and S.Pathania - Vishal Publishing Co. (2011)
2. Essentials of Physical Chemistry by B.S.Bahl, Arun Bahl and G.T.Tuli - S.Chand and Co.Ltd., (2012)

REFERENCE BOOKS:

1. A Textbook of Physical Chemistry by S.Glasstone - Macmillan (India) Ltd. (1976)
2. Advanced Physical Chemistry by D.A.Bajpai- S.Chand and Co.Ltd., 3rd Edn. 39th edition(2014).
3. Chemical Kinetics by K. J. Laidler, Pearson Edition (2008).

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|----------------------------|--|------------------------------------|
| PART - III CORE | Title : Lab: PHYSICAL CHEMISTRY EXPERIMENTS | Subject Code : 17UCYCP3 |
| Semester : V | HOURS : 6 hours / Week | CREDITS :5 |

Objectives:

To practice the kinetics, phase rule, electro analytical methods involved in the chemical reactions.

PHYSICAL CHEMISTRY EXPERIMENTS

1. Determination of molecular weight by Rast’s macro method.
2. Determination of molecular weight by Transition temperature method.
3. Phase Diagram involving a) simple eutectic. b) compound formation.
4. Heat of solution by solubility method.
5. Determination of strength of the given KI by Equilibrium constant method.
6. Conductometric titration- Strong Acid vs Strong Base.
7. Potentiometric Redox titrations: a) FeSO_4 vs KMnO_4 . b) FeSO_4 vs. $\text{K}_2\text{Cr}_2\text{O}_7$.
8. Colorimetric estimation of Nickel.
9. Colorimetric estimation of Iron.
10. Preparation of various Buffer mixtures and comparing their pH values with theoretical values using pH meter.
11. pH titration - Strong Acid vs Strong Base.
12. pH titration - Weak Acid vs Strong Base.
13. Determination of relative strength of acid catalysed hydrolysis of ester.
14. Determination of Co-efficient of Viscosity.
15. Determination of CST on Phenol-water system and effect on impurity on CST-strength of NaCl.

Distribution of Marks Internal – 40 Marks External – 60 Marks

External Examination

| | |
|----------------------------------|------------|
| Viva voce | - 10 marks |
| Record Notebook | - 10 marks |
| For completion of the experiment | - 20 marks |
| Graph | - 5 marks |
| Tabulation & Calculation | - 5 marks |
| Result | - 10 marks |

 Total 60 marks

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|----------------------------|--|------------------------------------|
| PART - III CORE | Title : Lab: ORGANIC ESTIMATION AND ORGANIC PREPARATION | Subject Code : 17UCYCP4 |
| Semester : V | HOURS : 3 hours / Week | CREDITS :2 |

Objectives

To practice the preparative method and quantitative estimation of organic substances.

ORGANIC ESTIMATION AND ORGANIC PREPARATION

I. ORGANIC ESTIMATION

1. Estimation of phenol.
2. Estimation of aniline.
3. Estimation of glycine.

II. ORGANIC PREPARATION

1. Preparation of p-bromo acetanilide from acetanilide (bromination)
2. Preparation of benzoic acid from benzamide.(hydrolysis)
3. Preparation of m-dinitrobenzene from nitrobenzene.(nitration)
4. Preparation of benzoic acid from benzaldehyde.(oxidation)
5. Preparation of benzoic acid from ethylbenzoate.(hydrolysis)

Distribution of Marks

Internal – 40 Marks

External – 60 Marks

External Examination

(Choice of choosing any one category of the above two

)

Record Note book - 10 marks

Organic Preparation - 50 marks

- Procedure - 10 marks
- Crude sample - 30 marks
- Recrystallisation - 10 marks

Organic Estimation – 50 marks

- Procedure - 10 marks
- Estimation - 40 marks
 - < 2% Error - 40 marks
 - 2-3% Error - 30 marks
 - 3-4% Error - 20 marks
 - 4-5% Error - 15 marks
 - > 5% Error - 10 marks

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| PART - III ELECTIVE | Title : ANALYTICAL CHEMISTRY AND COMPUTER APPLICATION IN CHEMISTRY | Subject Code : 17UCYE51 |
| Semester : V | HOURS : 5 hours / Week | CREDITS :5 |

Objectives

To learn the accuracy and analysis of quantitative data, separation and purification methods, quantitative estimation of complexes by photometric methods, principles of gravimetric estimation. To acquire the knowledge of spectroscopic methods used for analysis of organic substances. To expose the preliminary knowledge of computer programming using C language, particularly applicable for basic chemical concepts.

Unit –I DATA ANALYSIS & CHROMATOGRAPHY (15hrs)

(a) **Data Analysis** : Mean – median- precision & accuracy – confidence limits – ‘t’ test - Errors & its types – rules for improving accuracy of data – rejection and reporting of data – method of least squares – significant figures.

(b) **Chromatography** : Explanation – principle & terminology - classification – detailed study of column, paper, thin layer, gas and ion exchange chromatographic techniques – an elementary idea about HPLC.

Unit –II COLORIMETRY & GRAVIMETRY (15 hrs)

(a) **Colorimetry** : Principle – techniques for colour comparison – visual colorimetric methods: Duboscq colorimeter, Photoelectric colorimeter and Spectrophotometer – criteria for satisfactory colorimetric estimation – Estimation of Iron, Nickel and Chromium.

(b) **Gravimetry** : Principle - methods of obtaining precipitate – precipitants and its types – sequestering agents – solubility product and precipitation –theories of precipitation – Co-precipitation and Post-precipitation – digestion and its effect – general rules of precipitation - precipitation from homogeneous medium – washing and drying of precipitate.

Unit III SPECTROSCOPY - I (15 hrs)

Electromagnetic spectrum – Introduction.

UV-Visible spectroscopy: Principle – absorption law –measurement of absorption intensity – instrumentation – types of electronic excitation – transition probability – chromophore and auxochrome – absorption and intensity shifts – Woodward-Fieser rules

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for calculating absorption maximum for conjugated dienes and α,β unsaturated carbonyl compounds - applications.

IR spectroscopy: Principle – theory of molecular vibration – number of fundamental vibrations – vibrational frequency – factors influencing vibrational frequencies: Fermi resonance, electronic effects and hydrogen bonding — Instrumentation – Sampling techniques – Finger-print region - applications.

Unit –IV Spectroscopy – II (15 hrs)

PMR spectroscopy : Principle – Instrumentation – solvents and reference chemicals – number of signals - chemical shift – factors affecting chemical shift: shielding and deshielding effects – proton counting – splitting of signals – spin-spin coupling and coupling constant – applications of the following molecules: ethanol, toluene, ethyl acetate, acetophenone, p-anisidine, benzaldehyde and α -bromo butanoic acid.

Unit – V COMPUTER APPLICATION IN CHEMISTRY (15 hrs)

C language – History – Important features of 'C' – steps involved in a 'C' program - C tokens – Operators (Arithmetic, Assignment, Comparison, Logical) - Header Files: stdio.h – conio.h -math.h –data input – scanf function – data output – print function - Control Statements: If statement – If-else statement – Repetition Control Statements – While-loop statement – do-while statement.

C programs in Chemistry: RMS velocity, Normality, pH calculation from H^+ concentration and finding acidic , basic or neutral nature, Vander Waals constants and half life period.

Text books:

1. Elements of Analytical Chemistry by R.Gopalan,P.S.Subramanian & K.Rengarajan – Sultan Chand & sons- reprint of 3rd Edn.(2011)
2. Elementary Organic Spectroscopy by Y.R.Sharma – S Chand & Co,5th revised Ed.,(2013)
3. Computers for Chemists by Pundir and Bansal – Pragati Prakashan Publishers (2007)

Reference books:

1. Spectrometric identification of Organic Compounds by R.M.Silverstein and G.C.Bassler – Wiley,(1964)
2. Introduction to computers by N. Subramanian, Tata McGraw-Hill Publishing company Ltd. (1986)

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VI SEMESTER

| Sl. No | PART | Sub. Code | Subject Title | Hrs/ Wk | Exam hrs | CA | SE | Tot | Crd |
|--------|-------------------|-----------|--|---------|----------|----|----|-----|-----|
| 1 | PART-III CORE | 17UCYC61 | Physical Chemistry – III | 5 | 3 | 25 | 75 | 100 | 5 |
| 2 | PART-III CORE | 17UCYC62 | Organic Chemistry – III | 5 | 3 | 25 | 75 | 100 | 5 |
| 3 | PART-III CORE | 17UCYCP5 | Gravimetric Estimation and Inorganic complexes preparation | 5 | 6 | 40 | 60 | 100 | 4 |
| 4 | PART-III CORE | 17UCYCP6 | Organic Analysis | 3 | 3 | 40 | 60 | 100 | 2 |
| 5 | PART-III CORE | 17UCYCV1 | Objective Chemistry viva-voce | 2 | 3 | 50 | 50 | 100 | 2 |
| 6 | PART-III ELECTIVE | 17UCYE61 | Chemistry of Biomolecules | 5 | 3 | 25 | 75 | 100 | 5 |
| 7 | PART-III ELECTIVE | 17UCYE62 | Newer Aspects of Chemistry | 5 | 3 | 25 | 75 | 100 | 5 |
| 8 | SELF STUDY | 16UGKB61 | General Knowledge | - | - | - | - | 100 | - |
| | | | TOTAL | 30 | | | | | 28 |

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| PART - III CORE | Title : PHYSICAL CHEMISTRY-III | Subject Code : 17UCYC61 |
| Semester : VI | HOURS : 5 hours / Week | CREDITS :5 |

Objectives

To learn the preliminary idea about group theory and quantum mechanics.

To get exposed of the principles and applications of electrochemistry and theoretical aspects of molecular spectroscopy.

Unit –I QUNATUM MECHANICS & GROUP THEORY (15hrs)

(a) Quantum mechanics: Limitations of classical mechanics – Schrodinger wave equation – derivation – Eigen values and Eigen functions – significance of wave function and probability – particle in a one dimensional box and its derivation.

(b) Group Thoery: symmetry elements and its types - symmetry operations and the products of symmetry operations – Groups - properties and its types — group multiplication table – C_{2V} and C_{3V} - classes and sub groups. Point groups: explanation and classification - study of the following with examples: C_{2V} , C_{3V} , D_{2h} , and D_{6h} .

UNIT – II ELECTROCHEMISTRY – I (15 hrs)

Electrolytic conductance-Faraday's laws of electrolysis – specific conductance – equivalent conductance – molar conductance – variation of equivalent conductance with dilution – Electrolytes and its types – Arrhenius theory of ionization - postulates – limitations – degree of dissociation – factor influencing degree of dissociation – Ostwald's dilution law – theory of strong electrolytes – Debye-Huckel-Onsagar theory -Transport number – determination transport number : Moving boundary method – Kohlrausch's law of ionic mobilities – applications – applications of conductance measurements : conductometric titrations: neutralization and precipitation.

UNIT – III ELECTROCHEMISTRY – II (15 hrs)

Galvanic Cells –half reactions and reversible electrodes – single electrode potential – thermodynamics of reversible electrodes and cells - The Nernst equation – standard electrode potentials: electrochemical series – concentration cells: electrode and electrolyte concentration cells – types of concentration cells: concentration cells without and with transference – liquid junction potential –fuel cell: Hydrogen–Oxygen – applications of emf measurements : determination of pH using quinhydrone electrode –potentiometric titrations : acid – base, redox and precipitation.

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UNIT – IV PHOTOCHEMISTRY

(15 hrs)

Introduction – comparison of thermal reactions and photochemical reactions – consequences of light absorption :– laws of photochemistry : Grotthus–Draper law, Einstein law of photochemical equivalence – quantum efficiency – experimental determination of quantum efficiency – kinetics of photochemical reactions: formation of HCl, HBr and decomposition of HI – photochemical equilibrium – photosensitization - Jablonski diagram - photophysical processes: fluorescence - phosphorescence - chemiluminescence – bioluminescence -- flash photolysis.

UNIT – V SPECTROSCOPY AND ITS APPLICATIONS

(15 hrs)

- (a) Rotational spectra of diatomic molecules: rigid rotator – selection rule – determination of moment of inertia and bond length – intensities of spectral lines – effect of isotopic substitution.
- (b) Vibrational spectra : Hooke's law – simple harmonic oscillator - force constant – selection rule Vibrational rotational spectra: P,Q,R bands- applications of IR spectra.
- (c) Electronic spectra : Frank - Condon principle.
- (d) Raman spectra: Raman effect – stokes and anti stokes lines, quantum theory of Raman effect – comparison between IR and Raman spectra – applications of Raman spectra.

Text books:

1. Principles of Physical Chemistry by B.R.Puri, L.R.Sharma and S.Pathania - Vishal Publishing Co. (2011).
2. Essentials of Physical Chemistry by B.S.Bahl, Arun Bahl and G.T.Tuli - S.Chand and Co.Ltd., (2012).

Reference books:

1. A Textbook of Physical Chemistry by S.Glasstone - Macmillan (India) Ltd. (1976).
 2. Advanced Physical Chemistry by Gurdeep Raj - Krishna Prakashan Media (P) Ltd 39th Edn. (2014).
 3. Advanced Physical Chemistry by D.N. Bajpai- S.Chand and Co.Ltd., 3rd Edn.(1992).
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| PART - III CORE | Title : ORGANIC CHEMISTRY – III | Subject Code : 17UCYC62 |
| Semester : VI | HOURS : 5 hours / Week | CREDITS :5 |

Objectives

To learn the chemistry of nitro and amino containing compounds, polynuclear hydrocarbons, cycloalkanes and heterocyclic compounds. To get hold of the brief knowledge of stereoisomerism and molecular rearrangements.

Unit –I NITROGEN CONTAINING COMPOUNDS (15 hrs)

- (a) **Aliphatic nature** : (i) Preparation and properties of nitroethane and ethyl nitrite, ethylcyanide and ethyl isocyanide – elementary study of methyl isocyanate and its toxicity. (ii) Amines : Preparation of 1, 2, 3 amines by reductive amination, Hofmann degradation, Curtius, Leuckart, Gabriel Phthalimide and Hofmann elimination methods – basicity of amines – general chemical properties. (iii) Diazomethane : preparation and its synthetic applications.
- (b) **Aromatic nature** : (i) General methods of preparation and properties (due to nitro group and benzene ring and reduction reactions) of nitrobenzene. (ii) General methods of preparation and properties (due to amino group and benzene ring) of aniline including a detailed study of the basicity with the influence of substituents on N atom and in the ring. (iii) Benzenediazonium chloride : Preparation and synthetic applications.

Unit –II POLYNUCLEAR HYDROCARBONS (15 hrs)

- (a) **Isolated systems** : Preparation and properties of biphenyl, diphenylmethane and tririphenylmethane including the study of dyes viz., Malachite green, Pararosaniline, Rosaniline and crystal violet.
- (b) **Fused systems** : Isolation, synthesis, properties and structure of naphthalene and anthracene – preparation and properties of derivatives of naphthalene derivatives viz., naphthols, naphthylamines and naphthaquinones including the study of the dyes (Naphthol yellow S, Naphthol green Y, Maritius Yellow, Orange II, congo red and alizarin – **Phenanthrene** : properties and its importance.

Unit –III HETEROCYCLIC COMPOUNDS (15 hrs)

- (a) **Monocyclic systems**: Nomenclature. (i) Pyrrole, Furan and Thiophene: a comparative study of their preparation and general properties viz., electrophilic substitution, nucleophilic substitution, addition, acidic and basic characters, oxidation, reduction and their interconversion. (ii) Pyridine: synthesis and its general properties viz., basic character, electrophilic substitution, nucleophilic substitution, reduction and oxidation reactions. (iii) Comparative study of preparation of pyrazole, thiazole and oxazole and the study of their basic character.
- (b) **Condensed systems**: Preparation, and general properties of indole, quinoline and isoquinoline – preparation of purine and pyrimidine – importance of heterocyclic compounds in medicine and biochemistry.



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Unit – IV ORGANOMETALLIC & ACTIVE METHYLENE COMPOUNDS (15 hrs)

- (a) **Organometallic compounds** : Preparation, properties and synthetic applications of Grignard reagent, Frankland reagent, Gilman reagent and organo lithium compounds.
- (b) **Active methylene compounds** : Preparation, properties and synthetic applications of malonic ester and acetoacetic ester

Unit –V MOLECULAR REARRANGEMENTS AND CYCLOALKANES (15 hrs)

- (a) **Molecular rearrangements** : Definition and its types – detailed study of the following mechanisms of the rearrangements – Pinacol-pinacolone, Hofmann, Claisen, Fries, Beckmann, Baeyer-Villiger, and Wagner-Meerwin.
- (b) **Cycloalkanes** : General methods of preparation – properties – stability : Bayer's strain theory and its modification. Conformation : Definition – conformational analysis of ethane, n-butane, cyclohexane and methyl cyclohexane.

Text books:

1. Modern Organic Chemistry by M. K. Jain and S. C. Sharma - Vishal Publishing co. 4th Edn. (2014).
2. A Text book of Organic chemistry by K.S. Tewari and N. K. Vishnoi - Vikas Publishing House pvt. Ltd. 3rd Edn. (2006).
3. Text Book of Organic Chemistry by P.L.Soni and H. M Chawla - Sultan Chand & sons 29th Edn. (2012).

Reference books:

1. Organic Chemistry by I.L.Finar (Vol. I & Vol.II) - Pearson Education Ltd. (2012).
 2. Advanced Organic Chemistry: Reactions, Mechanisms and Structure by Jerry March, 4th Edn.
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| PART - III CORE | Title : Lab: GRAVIMETRIC ESTIMATION AND INORGANIC COMPLEXES PREPARATION | Subject Code : 17UCYCP5 |
| Semester : VI | HOURS : 5 hours / Week | CREDITS :4 |

Objectives : *To practice the preparative methods and estimation by gravimetric method of some inorganic compounds including complex*

GRAVIMETRIC ESTIMATION AND INORGANIC COMPLEXES PREPARATION

I. GRAVIMETRIC ESTIMATION

1. Estimation of Lead as lead chromate
2. Estimation of Barium as barium chromate
3. Estimation of Calcium as calcium oxalate monohydrate
4. Estimation of Nickel as Ni-DMG complex.
5. Estimation of Calcium as calcium carbonate.

II. INORGANIC COMPLEXES PREPARATION

1. Preparation of ammonium hexachlorostannate(IV)
2. Preparation of Sodium nitroprusside.
3. Preparation of Tetraamminecopper(II) sulphate
4. Preparation of Potassium trioxalatochromate(III)
5. Preparation of Potassium trioxalatoaluminate (III).

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|-----------------------------|---------------------|--|
| Distribution of Marks | Internal – 40 Marks | External – 60 Marks |
| <u>External Examination</u> | | |
| Record Note book | - 10 marks | |
| Viva voce | - 10 marks | |
| Inorganic Preparation | - 15 marks | Procedure - 5 marks Crude sample - 10 marks |
| Gravimetric Estimation | -25 marks | Procedure - 5 marks Estimation - 20 marks |
| ----- | | < 2% Error - 20 marks |
| | 60 marks | 2-3% Error - 15 marks |
| ----- | | 3-5% Error - 10 marks |
| | | > 5% Error - 8 marks |

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| PART - III CORE | Title : Lab: ORGANIC ANALYSIS | Subject Code : 17UCYCP6 |
| Semester : VI | HOURS : 3 hours / Week | CREDITS :2 |

Objectives : To analyze the functional group of organic compounds and preparation of solid derivative.

ORGANIC ANALYSIS

Analysis of the given organic compound containing one or two functional groups and confirmation by the preparation of a solid derivative.

Functional groups to be analysed : acids, phenols, aldehydes, ketones, esters, nitro compounds, amines (primary, secondary and tertiary), amides, anilides, aliphatic diamide, side chain and nuclear halogen compounds, aliphatic diamide containing sulphur and monosaccharides.

| Distribution of Marks | Internal – 40 Marks | External – 60 Marks |
|-----------------------------|---------------------|---------------------|
| <u>External Examination</u> | | |
| Record Notebook | - 10 marks | |
| Preliminary reactions | - 15 marks | |
| Elements present | - 9 marks | |
| Aliphatic or aromatic | - 3 marks | |
| Saturated / Unsaturated | - 3 marks | |
| Functional group | - 15 marks | |
| Derivative | - 5 marks | |
| | ----- | |
| | 60 marks | |
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| PART - III ELECTIVE | Title : CHEMISTRY OF BIOMOLECULES | Subject Code : 17UCYE61 |
| Semester : VI | HOURS : 5 hours / Week | CREDITS :5 |

Objectives

To gain the knowledge of Biomolecules in the aspects of steroids, hormones, nucleic acids, amino acids, proteins, enzymes, carbohydrates, alkaloids and terpenes.

Unit –I CARBOHYDRATES (15 hrs)

- (a) Biological importance – Classification – analytical tests.
- (b) **Monosaccharides:** Glucose and Fructose – preparation, properties, structure (open chain configuration and ring structure), mutarotation, epimerization and interconversion – ascending and descending of aldose and ketose.
- (c) **Disaccharides:** Sucrose – manufacture, properties, structure and uses – a brief study about lactose. **Polysaccharides:** A general study of starch and cellulose – Industrial applications of cellulose derivatives.

Unit – II ALKALOIDS AND VITAMINS (15 hrs)

(a) **Alkaloids :** Introduction - biological importance - occurrence – extraction - general methods of determining the structure - general properties. Isolation, properties, uses, constitution and synthesis of nicotine, atropine and quinine.

(b) **Vitamins :** Introduction - classification - source, structure (only), biological role, daily requirement and deficiency manifestation of vitamins A, D, E, K, C and B complex (B1, B2, B3, B6, B12 and niacin).

Unit – III TERPENES AND LIPIDS (15 hrs)

(a) **Terpenes :** Introduction - biological importance – isoprene rule – classification - isolation and extraction of terpenes - general methods of determining the structure - Isolation, structure, synthesis and uses of citral, menthol and camphor. **Polyterpene:** an elementary study of natural rubber

(b) **Lipids :** Introduction - biological functions – classification. Simple lipids : Fats and oils – composition – isolation - general properties – hydrolysis, hydrogenation, hydrogenolysis and trans-esterification – Flavour changes in oils and fats – analytical characterization of fats and oils – Acid value, RM value, saponification value and iodine number. A brief study about compound lipids.

Unit - IV AMINO ACIDS, PROTEINS AND ENZYMES (15 hrs)

- (a) **Amino acids :** Introduction - Essential and non-essential amino acids -classification - synthesis by Gabriel, Strecker and Erlenmeyer methods – isoelectric point - zwitter ion - general chemical properties. Peptides : introduction - synthesis by carbobenzoxy method and Sheehan method.



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- (b) **Proteins** : Introduction - classification by chemical, composition and molecular shape - isolation - determination of structure by terminal residue analysis - types of structures - general properties - analytical reactions.
- (c) **Enzymes**: Introduction – classification – sources – mode of action – salient characteristics – uses.

Unit - V STEROIDS, HORMONES AND NUCLEIC ACIDS (15 hrs)

(a) **Steroids** : Introduction - biological importance - classification - biosynthesis - occurrence,

properties, structure (no elucidation), tests and physiological activity of cholesterol.

(b) **Hormones** : Introduction - chemical classification - biosynthesis - structure (no elucidation)

and biological importance of thyroid, pituitary, pancreatic and sex hormones - distinction with steroids.

(c) **Nucleic acids** : Introduction – constituents of nucleic acids – Ribonucleosides and ribonucleotides – composition of RNA and DNA - the double helical structure of DNA (Watson-Crick model).

Text books:

1. A Text book of Organic chemistry by K.S. Tewari and N. K. Vishnoi - Vikas Publishing House Pvt. Ltd. 3rd Edn. (2006).
2. Modern Organic Chemistry by M. K. Jain and S. C. Sharama - Vishal Publishing Co. 4th Edn. (2014).

Reference books:

1. Natural Products Chemistry by Jagdamaba Singh, S. M. Ali and Jaya Singh – Pragati Prakashan First edn. (2010).
2. Outlines of Biochemistry by E.E. Conn, P.K. Stumpf, G. Bruening and R. H. Doi – Wiley-India 5th Edn. (2007).
3. Organic Chemistry by I.L. Finar (Vol. I & Vol. II) - Pearson Education Ltd. (2012).



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| PART - III ELECTIVE | Title : NEWER ASPECTS OF CHEMISTRY | Subject Code : 17UCYE62 |
| Semester : VI | HOURS : 5 hours / Week | CREDITS :5 |

Objectives

To acquire the recent advancements in chemistry in the field of green chemistry, nanomaterials and supramolecular chemistry.

Unit –I Green Chemistry – I

(15 hrs)

Definition – the need for green chemistry – goals of green chemistry – limitations of obstacles – twelve principles of green chemistry – concept of atom economy – rearrangement, addition, substitution and elimination reactions – green solvents – supercritical CO₂, ionic liquids as green solvents, use of H₂O as solvent.

Unit II Green Chemistry – II

(15 hrs)

Designing a green synthesis – choice of starting materials – choice of reagents – choice of catalysts – choice of solvents – examples of green synthesis: synthesis of adipic acid, synthesis of BHT, synthesis of Urethane – Microwave assisted reactions in water – Microwave assisted reactions in organic solvents – Ultra sound assisted reactions : esterification, saponification, Substitution, oxidation, cannizzaro reactions.

Unit III Nano technology-I

(15 hrs)

Nanomaterials: Introduction - Characterization - Synthesis by chemical methods viz., Thermolysis, Sonochemical Approach, Reduction by hydrogen, Reduction by methanol, Borohydride reduction and alkali metal reductions – Biosynthesis of Nano particles.

Unit IV Nano technology-II

(15 hrs)

Synthesis of Nanosized semiconductors by precipitation methods and thermal decomposition of complex precursors – Synthesis of ceramics by physical methods viz., Gas condensation method and Laser method and chemical methods (Sol-Gel synthesis) - Applications of Nanomaterials.

Unit V Supramolecular Chemistry

(15 hrs)

- Introduction – Host – guest chemistry. Theory and Examples.
- Organic host molecules - Cyclodextrins:** Introduction - properties - structure – applications in organic selective and specific reactions. Fullerenes : Introduction - types - structure - applications.
- Inorganic host molecules - Clay:** types and applications. Zeolite : types – modifications of zeolites – applications.

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Text Books :

1. Green chemistry by V.K.Ahluwalia, M.Kidwai- Anamaya publishers, Revised Edn. (2004).
2. Nanotechnology by S. Shanmugam –MJP Publishers-(2011).
- Supramolecular Chemistry by J.W.Steed and J.K.Atwood –Wiley Sons Ltd.,Second Edn. (2009).

Reference books:

1. Green Chemistry –Environment Friendly Alternatives by Rashmi Sanghi and M M Srivastava - Narosa Publishing House,(2003).
 2. Nano: The Essentials of Understanding Nanoscience and Nanotechnology by T .Pradeep- Tata Mc Graw Hill Publishing Company Ltd.,1st Edn.(2007).
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| PART - III CORE | Title : Objective Chemistry (viva-voce) | Subject Code : 17UCYCV1 |
| Semester : VI | HOURS : 2 hours / Week | CREDITS :2 |

Objectives : *To refresh all the aspects of chemistry studied during three years of course.*

Unit –I Physical Chemistry (6 hrs)

Basic laws pertained gaseous states – crystals - Energetics and dynamics of chemical reactions – photo chemical reactions – electrochemical cells –knowledge of liquid crystals – radioactivity – colloidal states.

Unit II Organic Chemistry (6 hrs)

Common names and IUPAC names of organic compounds – electronic effects – stereochemistry - petroleum and its products – use of reagents such as organometallics, active methylene compounds in the synthesis of various compounds – utility of natural products such as steroids, alkaloids, vitamins etc.- common name reaction

Unit III Inorganic Chemistry (6 hrs)

Atomic structure and chemical bonding – acids and bases –types of reactions – periodic table and properties – minerals and common inorganic substances used in day to day life – uses of coordination compounds

Unit IV Analytical Chemistry (6 hrs)

Knowledge of preparation of solutions using various concepts -types of reactions involved in the analysis of raw materials used in industries - assay determination – knowledge of indicators – electronic instruments including spectrometers used in analysis and their utility.

Unit V Pharmaceutical Chemistry (6 hrs)

Important terms and their explanation - knowledge of drugs commonly used for various diseases - preliminary ideas about formulation of various drugs viz. tablets, syrups, injections, etc. Organic pharmaceutical aids: Preservatives, antioxidants, emulsifying agents, colouring, flavouring and sweetening agents, stabilizing agents, ointment bases, solvents.

Reference Books :

1. A Text book of Organic chemistry by K.S. Tewari and N. K. Vishnoi - Vikas Publishing House pvt. Ltd. 3rd Edn. (2006).
2. Essentials of Physical Chemistry by B.S.Bahl, Arun Bahl and G.T.Tuli - S.Chand and Co.Ltd., (2012).
3. Principles of Inorganic Chemistry by Puri, Sharma & Kalia, Milestone publisher & distributor (2009).
4. Analytical Chemistry by Gurdeep R.Chatwal – Himalaya Publishing House, 1st Edn.(2008).
5. A Text book of Pharmaceutical Chemistry by Jayashree Ghosh, S.Chand & Co. Ltd, (2012).

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Department of Chemistry

**Chemistry papers offered to other B.Sc., courses as
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| PART - III ALLIED To B.Sc(PHY) | Title : GENERAL CHEMISTRY – I | Subject Code : 17UCYA31 |
| Semester : III | HOURS : 4 hours / Week | CREDITS :4 |

Objective

To acquire the knowledge of the theories of union of atoms, its rate of the reaction.
To have basic knowledge of gaseous state of the matter, carbon chemistry and metal complexes.

Unit – I Chemical Bonding

(12 hrs)

VB Theory: Postulates of VB theory – Application to the formation of simple molecules like H_2 and O_2 – overlap of atomic orbitals and its types - s-s, s-p and p-p overlap – Principle of hybridization – SP , SP^2 and SP^3 hybridisation – VSEPR theory and its applications .

M.O.Theory: Formation of M.O's by LCAO method – bonding, antibonding and non-bonding M.O's - M.O. diagram for H_2 , He_2 , O_2 and F_2 .

Unit-II Gaseous state

(12 hrs)

Postulates of kinetic theory of gases – derivation of expression for pressure of an ideal gas on the basis of kinetic theory – deducing the basis gas laws. Deviation of real gases from ideal behavior – derivation of vander Waals gas equation - explanation of behavior of real gases on the basis of vander Waals equation. Average, Root Mean Square and Most Probable Velocities (no derivations):definition,equations and their relationship.

Unit – III Chemical kinetics

(12 hrs)

Introduction – rate of reaction – rate law and rate constant – order and molecularity – first order reactions – examples – rate equation – derivation - half life period - second order reactions - examples – rate equations – derivation - half life period - zero order and third order reactions - examples – rate equations (no derivation required) - determination of order of a reaction.

Unit – IV Organic Chemistry

(12 hrs)

- Nature of valency of carbon in organic compounds – tetrahedral arrangement of valency of carbon – bond breaking and bond forming in organic reactions – homolytic cleavage – heterolytic cleavage – reaction intermediates – formation, stability and reactions of carbocation, carbanion and free radicals.
- Reagents: Nucleophilic and Electrophilic - types and examples.
- Type of reactions: substitution – addition – elimination – rearrangement and polymerization – illustration with examples.

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Unit –V Coordination Chemistry

(12 hrs)

Double salts and coordination compounds – terminology: coordination sphere, coordination number, ligand and its types – Werner's coordination theory: postulates - EAN rule – applications and limitations. Valence Bond Theory: postulates and applications to $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{CuCl}_4]^{2-}$, $[\text{Fe}(\text{CN})_6]^{3-}$, and $[\text{Fe}(\text{H}_2\text{O})_6]^{2-}$ complexes - **Chelates**: definition and its applications.

Text books:

1. Principles of Inorganic Chemistry by Puri, Sharma and kalia, Vishal Publishing co., (2016).
2. Elements of Physical Chemistry by Puri, Sharma and Pathania, Vishal Publishing co. (2005).

Reference books:

1. A Text book of Organic Chemistry by B.S.Bahl and Arun Bahl. S.Chand & Co. Ltd.(1996).
2. Modern Organic Chemistry by M. K. Jain and S. C. Sharama, Vishal Publishing co. 4th edn. (2014).
3. Principles of Physical Chemistry by Puri, Sharma and Pathania, Vishal Publishing co., (2011).



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|---|---------------------------------------|--|
| PART - III ALLIED To B.Sc(PHY) | Title : GENERAL CHEMISTRY – II | Subject Code : 17UCYA41 |
| Semester : IV | HOURS : 4 hours / Week | CREDITS :4 |

Objective : *To acquire the knowledge of solid state of matter and the basic concepts of spectroscopy. To impart the knowledge of electrochemical aspects of chemistry and some important polymers and industrially useful compounds.*

Unit-I Solid State (12 hrs)

Types of crystals – ionic, molecular, covalent and metallic crystals – structure of NaCl – structure of H₂O in the solid state – structure of diamond and graphite – metallic bond in metals – conductors, insulators and semiconductors – band theory.

Unit-II Electrochemistry (12 hrs)

Electrochemical cell – Nernst equation – convention regarding the sign of EMF of a cell – Electrodes – Reference electrodes – hydrogen and calomel electrodes – types of electrodes – metal-metal ion electrodes – metal-metal insoluble salt electrodes – metal- glass and ion selective electrodes – pH measurement using glass electrode – membrane potential – H₂-O₂ fuel cell.

Unit-III Polymer Chemistry (12 hrs)

Introduction: classification of polymers – natural and synthetic; thermoplastic and thermosetting. Types and mechanism of polymerization: addition, condensation and copolymerization. Techniques of polymerization : bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon and Epoxy resin.

Unit-IV Spectroscopy (12 hrs)

Basic principles of UV and IR spectroscopy – Identification of simple organic molecules: Ethylene, cis and trans butane, ethanol, dimethyl ether, acetaldehyde, acetone, methylamine and dimethylamine. NMR spectroscopy: Principle and spectrum of ethanol.

Unit-V Industrial Chemistry (12 hrs)

- Petroleum industry:** Composition of petroleum – Refining of petroleum – various fractions of refining and their uses.
- Silicate industry:** Cement and ceramics – raw materials and manufacture.
- Fertilizer industry:** Various types and artificial fertilizers – preparation and significance.

Text books:

- Elements of Physical Chemistry by Puri, Sharma and Pathania, Vishal Publishing Co. (2005).
- Modern Inorganic Chemistry by R. D. Madan and Satya Prakash, S. Chand and Co, 3rd edn. (2014).

Reference books:

- Essentials of Physical Chemistry by B.S.Bahl, G.D.Tuli and Arun Bahl, S.Chand & Co. Ltd. (2004).
- Industrial Chemistry– B.K.Sharma – Goel Publishing House. 13th Edition (2008).
- Elementary Organic Spectroscopy by Y. R. Sharma, S.Chand & Co. Ltd. (2012).

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| PART - III ALLIED To B.Sc(PHY) | Title : VOULMETRIC ANALYSIS | Subject Code : 17UCYAP1 |
| Semester:III& IV | HOURS : 2 hours / Week | CREDITS :2 |

Objective

To practice the quantitative estimation of substances by titration methods.

A double titration involving making up of the solution to be estimated or single titration involving making up of the solution to be estimated and the preparation of a primary standard.

A. ACIDIMETRY AND ALKALIMETRY

1. Titrations between a strong acid and strong base.
2. Titrations between a strong acid and weak base.
3. Titrations between a weak acid and strong base.

B. PERMANGANIMETRY

Titration between potassium permanganate and oxalic acid, ferrous sulphate and ferrous ammonium sulphate (Mohr's salt)

C. IODOMETRY

Titration of sodium thiosulphate with potassium permanganate and potassium dichromate.

Summative Examination at the end of semester IV

Max.marks-100

Distribution of Marks: Internal - 40 Marks
External - 60 Marks

Duration of Examination: 3 hrs

Internal

Class Experiments : 30 marks
 Viva-voce : 10 marks
 Total : 40 marks

External examination

Record Notebook : 10 marks
 Procedure writing : 10 marks
 Experiment : 40 marks
 Total : 60 marks

For Analysis, if the student has

- < 2% error - 40 marks
- 2-3% error - 30 marks
- 3-5% error - 20 marks
- > 5% error 10 marks

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| PART - IV NME-I To B.Sc(Maths) | Title : CHEMISTRY IN EVERYDAY LIFE - I | Subject Code : 17UCYN31 |
| Semester:III | HOURS : 2 hours / Week | CREDITS :2 |

Objective

To acquire the knowledge about the chemicals used in day-today life.

Unit I Petrochemicals (6 hrs)

Definition – origin – composition-chemicals from natural gas - petroleum - light naphtha - kerosene.
synthetic gasoline. LPG – biodiesel – gobar gas.

Unit II Food Chemistry (6 hrs)

Oils and fats – rancidity – refining – hydrogenation changes in vegetables on cooking – food processing food-additives – synthetic flavouring agents - food preservation and food adulteration.

Unit III Colloids (6 hrs)

Definition – types of colloidal systems – sols: definition – classification- dialysis – electrophoresis – electro osmosis – gold number. Emulsion and gel (definition only) – applications of colloids.

Unit IV Soaps and detergents (6 hrs)

Soaps: Composition – manufacture of soap – types of soaps.
Detergents: Definition - synthetic cleansing action of soaps and detergents.

Unit V Dyes (6 hrs)

Definition – classification of dyes – preparation and uses of the following dyes: methyl orange, malachite green, bismarck brown and Indigo dye

Text books :

1. Foods – facts and principles, N. Shakuntala and Co. Wiley eastern Ltd. 3rd edition (2008).
2. Industrial Chemistry– B.K.Sharma – Goel Publishing House. 13th Edition 2008.

Reference books:

1. Advanced Organic Chemistry by Bahl and Arun Bahl, S. Chand and Co. Ltd., New Delhi (2007).
2. Organic Chemistry by K.S. Tewari, Vikas Publications House Pvt. Ltd. (2006).
3. Medicinal Chemistry by Ashutosh Kar, New Age International (P) Ltd. 5th edn. 2010.

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| PART - IV NME-II To B.Sc(Maths) | Title : CHEMISTRY IN EVERYDAY LIFE - II | Subject Code : 17UCYN32 |
| Semester:IV | HOURS : 2 hours / Week | CREDITS :2 |

Objective

To acquire the knowledge about the chemicals used in day-today life and a complete analysis of water

Unit I Water analysis (6 hrs)

An elementary idea about the parameters: pH, acidity, alkalinity, Total dissolved salts(TDS), hardness, Dissolved oxygen(DO), Biochemical oxygen demand(BOD), Chemical oxygen demand(COD).

Unit II Match and Silicate industries (6 hrs)

Match industry: lucifer and safety matches – Pyrotechny: composition of fireworks – coloured smokes – coloured matches. Explosives – gun powder – Trinitrotoluene (TNT)
Silicate industry: Raw materials and manufacture of Cement, Glass and Ceramics.

Unit III Paints and Pigments (6 hrs)

Manufacture of paints and pigments – setting of paints – characteristics of a good paint – paint failure – varnishes – pigments – zinc white – lithophone – ultramarines – carbon black – red lead – chrome green.

Unit IV Corrosion (6 hrs)

Introduction – differentiate the dry and wet corrosion – factors influencing corrosion- corrosion control.

Unit V Some small scale chemical units (6 hrs)

Safety matches – agarbatties – naphthalene balls – wax candles – shoe polish – gum paste – chalk crayons - plaster of paris.

Text books :

1. Organic Chemistry by K.S. Tewari, Vikas Publications House Pvt. Ltd. (2006).
2. Engineering Chemistry by Jain and Jain, Dhanpat Raj Publishing Co. Pvt. Ltd. (2007).

Reference books:

1. Industrial Chemistry– B.K.Sharma – Goel Publishing House. 13th Edition 2008.
2. A Text book of Pharmaceutical Chemistry by Jayashree Ghosh, S.Chand & Co. Ltd, 2012.

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