Shri Sangameshwar Education Society's

Sangameshwar College [Autonomous] Solapur

(Affiliated to Punyashlok Ahilyadevi Holkar Solapur University, Solapur)

Kannada Linguistic Minority Institute

NAAC Accredited with 'A' Grade (III Cycle CGPA 3.39)

Academic Council 3(3.3)
10th August, 2021

UG Science Programme: B.Sc.-II to be implemented from A.Y. 2021-2022

System: Choice Based Credit System (CBCS) with SGPA and CGPA

B.O.S. in*: **CHEMISTRY**

Syllabus for: Discipline Specific Core Courses (DSC-C and DSC-D)

Structure and Examination for: Discipline Specific Core Courses (DSC-1C and DSC-1D)

Table-3

Semester	Course		Teaching Scheme/week			
			Course Code	Hours	Lectures	Credits
III						
	DSC-1C	Theory Paper-V: Organic Chemistry	2131301	4.8	6	4
		Theory Paper-VI: Inorganic Chemistry	2131302			
		Practical-II: Chemistry Practical	2131419	6.4	8	4
	SEC-1	Theory Paper-I: Gr. .A: Programming skill using C–I Gr. B: Soil Health Management	2131319 2131320	4.8	6	2
IV	AECC-C	ENVIRONMENTAL STUDIES	2131315	3.2	4	4
	DSC-1D	Theory Paper-VII: Physical Chemistry	2131401	4.8	6	4
		Theory Paper-VIII: Analytical & Industrial Inorganic Chemistry	2131402			
		Practical-III: Chemistry Practical	2131419	6.4	8	4
	SEC-2	Theory Paper-II: Gr. A: Programming skill using C–II Gr. B: Soil Health Management	2131428 2131429	4.8	6	2

Table-4

Semester	Course		EXAMINATION Marks			Credits
			CA	SEE	Total	
III	DSC-1C	Theory Paper-V: Organic Chemistry	15	35	50	2
		Theory Paper-VI: Inorganic Chemistry	15	35	50	2
	SEC-1	Theory Paper-I: Gr..A: Programming skill using C–I Gr. B: Soil Health Management Theory Paper-I:	15	35	50	2
IV	AECC-C	ENVIRONMENTAL STUDIES	15	35	50	4
	DSC-1D	Theory Paper-VII: Physical Chemistry	15	35	50	2
		Theory Paper-VIII: Analytical & Industrial Inorganic Chemistry	15	35	50	2
	SEC-2	Theory Paper-II: Gr. A: Programming skill using C–II Gr. B: Soil Health Management Theory Paper-II:	15	35	50	2
	DSC-1C & DSC-1D	Practical-II and III: Chemistry Practical	60	140	200	8

CA: Continuous Assessment SEE: Semester End Examination

Note:-

The above structure (Table-3 and Table-4) is for Sem-III and Sem-IV of the undergraduate B.Sc.-II programmes* under science faculty.

***B.Sc.-II** Select any three DSC form the four core courses opted at B.Sc.- I.

DSC: Discipline Specific Core Course AECC: Ability Enhancement Compulsory Course

SEC: Skill Enhancement Course

Passing in each course is compulsory including Environment Studies course.

SGPA/CGPA and Total Marks will be calculated excluding AECC course.

Passing in each course is compulsory. SGPA/CGPA and Total Marks will be calculated excluding AECC course.

Syllabus for:

DSC-1C Theory-I Title: Semester-III

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Paper –V

CHEMISTRY-V (2131301)

Title: Organic Chemistry

Hours: 36 Marks: 50

Credits: 2 Lecture: 45

Learning objective:

1. To learn the structure and reactivity of organic compounds.
2. To understand the various synthetic methods of alcohol, phenol, amines etc.
3. To learn the configuration of stereoisomers.
4. To understand Woodward Fischer rules to determine the structure of compounds.
5. To learn the calculation of numerical.

Unit 1: Stereochemistry 7

1.1 Geometrical isomerism: Introduction, Geometrical isomerism in aldoximes and ketoximes, configuration of ketoximes-Beckmann transformation (Mechanism & Proof are not expected) configuration of aldoximes.

1.2 Conformational Isomerism: Introduction, conformation of ethane and n-butane and their representation by using Saw-Horse, Fischer (dotted Wedge line) and Newmann's projection formulae.

1.3 Conformational analysis of ethane and n-butane with the help of energy profile diagrams.

1.4 Nomenclature – D & L, R & S, E & Z systems.

Unit 2: Ultra-Violet (UV) Spectroscopy 8

2.1 Introduction to Spectroscopy

2.2 Beer – Lambert law (mathematical derivation not expected), Types of electronic transitions

2.3 Terms used in UV spectroscopy: Chromophore, Auxochrome, Bathocromic Hypsochromic, Hypochromic and Hyperchromic shifts, Effect of conjugation on position of UV and visible bands.

2.4 Calculation of λ_{max} by Woodward-Fieser rules for conjugated dienes and enones.

2.5 Applications of UV spectroscopy

Determination of structure and stereochemistry (cis and trans) spectral problems based on UV.

Unit3: Alcohols and Phenols **6**

3.1 Alcohols: Introduction, nomenclature and classifications with examples.

A. Ethylene glycol: Methods of formation from ethylene, ethylene dibromide and ethylene oxide. Physical properties & uses of ethylene glycol. Chemical reactions – reaction with HI, oxidation – (by lead acetate, HIO_4 and nitric acid), Pinacol formation, Pinacol-Pinacolone rearrangement and its mechanism.

B. Glycerol: Methods of formation from oil or fats, chemical properties of glycerol with electropositive metals, nitration, esterification. Uses of glycerol.

3.2 Phenols: Introduction

Reactions of phenol (carbolic acid) :

- Acylation and Fries rearrangement
- Ether formation and claisen rearrangement
- Reimer – Tiemann reaction and its mechanism.

Unit4: Aldehydes and Ketones **6**

4.1 Introduction, Nomenclature, structure and reactivity of the carboxyl group. Mechanism of nucleophilic additions to carbonyl group.

4.2 Study of following reactions with mechanism and applications

- Aldol condensation (base catalysed),
- Perkin reaction,
- Cannizzaro's reaction,
- Knoevenagel reaction
- Benzoin condensation.

Unit5: Amines **6**

5.1 Introduction, Nomenclature

5.2 Aliphatic amines: Methods of formation:

- Hofmann's ammonolysis method
- Reduction of nitro group and amides
- Reduction of nitriles (Mendius reaction)
- Hofmann's bromamide reaction
- Gabriel phthalimide synthesis.

Reactions of primary amines with

- alkyl halides,
- acid chlorides and anhydrides
- aldehydes and ketones.

5.3 Aromatic amines (Aniline):

Methods of formation from,

- chlorobenzene
- nitrobenzene
- phenol.

Reactions of aniline:

- Diazotization
- Action of benzoyl chloride
- Schiff's base
- Electrophilic substitution reactions of aniline

Unit 6: Ethers and Epoxides **6**

6.1 Ethers: Introduction, Nomenclature, Methods of formation of anisole by Williamson's synthesis and from diazomethane, chemical reactions of anisole with HI, Gravimetric estimation of $-OCH_3$ group by Ziesel's method (Related problems are expected based on % of $-OCH_3$ and number of $-OCH_3$ groups).

6.2 Epoxides: Introduction, Nomenclature, commercial method of preparation of ethylene oxide. Acid and base catalysed ring opening of ethylene oxide, reactions of Grignard and organolithium reagents with ethylene oxide.

Unit7: Carboxylic acids **6**

7.1 Introduction and classification

7.2 Hydroxy acids: Introduction

A. Malic acid: Methods of formation of malic acid from maleic acid and from α-bromo succinic acid. Reactions of malic acid – action of heat, oxidation reaction and reaction with HI, uses of malic acid.

B. Citric acid: Methods of formation of citric acid from glycerol. Reactions of citric acid: Acetylation, Reduction by HI, Action of heat. Uses of citric acid.

7.3 Unsaturated acids: Introduction

A. Acrylic acid: Methods of formation from acrolein and by dehydration of β-hydroxy propionic acid. Reactions of acrylic acid – Addition of H_2O, reduction by Na / C_2H_5OH.Uses of acrylic acid.

B. Cinnamic acid: Methods of formation from benzaldehyde using diethyl malonate and by using acetic anhydride and sodium acetate. Reactions of cinnamic acid – bromination, oxidation. Uses of cinnamic acid.

7.4 Dicarboxylic acids: Introduction

A. Succinic acid: Methods of formation from ethylene bromide, maleic acid. Reactions of succinic acid – action of heat, action of $NaHCO_3$, C_2H_5OH in presence of acid. Uses of succinic acid.

B. Phthalic acid: Methods of formation from o-xylene and naphthalene Reactions of phthalic acid –action of heat, reaction with sodalime, NH_3.Uses of phthalic acid.

Course outcome:

After successful completion of this course students will be able to:-

1. Explain the structure and reactivity of various functional groups.
2. Reproduce various synthetic methods leading to alcohols, ethers, phenols, carboxylic acids and amines.
3. Calculate the number of alkoxy groups present in the molecule.
4. List out various applications of reactions of carbonyl compounds.
5. Apply Woodward Fischer rules to determine the structure of compounds.
6. Determine the configuration of stereoisomers.

Reference Books:

1. Organic Chemistry. Volume 1 – The fundamental principles by I.L. Finar.
2. Organic Chemistry. Volume 2 – Stereochemistry and the chemistry of natural. Products by I.L. Finar, Low-priced Edn. ELBS – Longman
3. Organic Chemistry. Volume I, II, III by S.M. Mukharjee, S.P. Singh and R.P. Kapoor.Wiley Eastern Limited.
4. Advanced Organic Chemistry by, B.S. Bahl, Arun Bahl. S.Chand & Company, Ltd.
5. Organic Chemistry by Morrison – Boyd.
6. A Text Book of Organic Chemistry by K.S. Tiwari. S.N. Meharotra. N.K. Vishnoi. Vikas Publication, Meerut.
7. Spectroscopic methods in Organic Chemistry by Williams and Fleming. Mc-Graw Hill.
8. Stereochemistry of Organic Compounds by E.L. Eliel. Orient Longman.
9. Stereochemistry of Organic Compounds by P.S. Kalsi. New Age International Ltd.
10. A Guide Book to Mechanism in Organic Chemistry by Peter Sykes.

11. Advanced Organic Chemistry, structure, reactions and mechanism by Jerry March. McGraw Hill Kogakusha, Ltd.

12. Spectroscopy of Organic Compounds by P.S. Kalsi.

13. Absorption spectroscopy of Organic molecules by V.M. Parikh.

14. College Organic Chemistry Part I & II by G.R. Chatwal.

15. Stereochemistry by Nasi Puri.

16. Organic synthesis by Smith.

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DSC-1C Theory-II Title: Semester-III

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Paper –VI

CHEMISTRY-VI (2131302)

Title: Inorganic Chemistry

Hours: 36 Marks: 50

Credits: 2 Lecture: 45

Learning objective:

1. To learn the meaning of coordination chemistry.
2. To understand the Werner's Theory of metal complexes and identify inner and outer orbital complex.
3. To know differentiate between metal chelate and metal complex.
4. To learn various types of nuclear reactions.
5. To learn the calculation of effective atomic number.

Unit1: Co-ordination Chemistry **16**

1.1 Definition and formation of co-ordinate covalent bond in BF_3: NH_3 and $[NH_4]^+$

1.2 Distinction between double salt and complex salt,

1.3 Werner's theory:

A. Postulates of theory,

B. Applications of theory: Theory applied to cobalt amine viz;

a].$CoCl_3.6NH_3$ b] $CoCl_3.5NH_3$, c] $CoCl_3.4NH_3$, d] $CoCl_3.3NH_3$

C. Limitations

1.4 IUPAC nomenclature of co-ordination compounds,

1.5 Description of terms- a] ligand, b]co-ordination number, c] co-ordination sphere, d] effective atomic number, e] Geometrical isomerism and optical isomerism in co-ordination compounds for CN = 4 and CN = 6.

1.6 Valence bond theory of transition metal complexes.

A .Introduction B. Postulates of VBT/ basic concepts of VBT C. Role of transition metal in the formation of complex D. Stepwise process of formation of complex : Salient features E. Applications : High spin and low spin complexes w.r.t. CN = 4 and CN = 6. F. Limitations of Valence bond theory.

Unit 2: Chelation **7**

2.1 A brief introduction w.r.t. ligand, chelating agent, chelation and metal chelate.

2.2 Structural requirements of chelate formation.

2.3 Difference between metal chelate and metal complex.

2.4 Classification of chelating agents (with specific illustrations of bidentate chelating agent).

2.5 Applications of chelation w.r.t. chelating agents: EDTA and DMG

Unit 3: Radioactivity and Nuclear Chemistry **7**

3.1 Introduction: Structure of Nucleus, Forces of Nucleus, Stability ratio of neutron & proton

3.2 Major Forms of Radioactivity- Alpha Particle (α), Beta Particle (β), Gamma Radiation (γ), Positron Emission (β+ decay)

3.3 A brief account for nuclear reactions

3.4 Nuclear Fission and Fusion

3.5 Radioactive Half Lives

3.6 Biological Effects of Radiation Exposure

3.7 Applications of Radioactive Isotopes

Unit 4: Study of d-block elements **15**

4.1 Introduction

4.2 Position of d-block elements in periodic table,

4.3 Names & electronic configuration of 1st, 2nd & 3rd three transition series.

4.4 General Characteristics of 3 d-block elements w.r.t. –

a) oxidation state b) colour c) Magenetic behavior (spin only formula) d) catalytic properties and e) tendency to form complexes.

4.5 Comparison of 1st transition series with 2nd & 3rd transition series w.r.t. –

a) electronic configuration b) reactivity c) stability of oxidation state d) magnetic behavior and e) stability of complexes, f)Atomic radii, g) Ionic radii, h) Ionization potential, i) Electronegativity and j) Electron affinity.

Course outcome:

After successful completion of this course students will be able to:-

1. Know the meaning of various terms involved in co-ordination Chemistry.
2. Apply Werner's Theory of metal complexes and identify inner and outer orbital complex.
3. Draw the geometrical and optical isomerism of complexes.
4. Calculate Effective Atomic Number.
5. Differentiate between metal chelate and metal complex, Classification of chelating agent.
6. Discuss various types of nuclear reactions.
7. Compare the transition series elements in case of their physical and chemical properties.

Reference Books:

1. Concise Inorganic Chemistry by J.D. Lee ELBS 4^{th} & 5^{th} Edn.
2. Basic Inorganic Chemistry by F.A. Cotton, G.Wilkinson and P.L. Gaus Wiley.
3. Concepts and Models of Inorganic Chemistry by B. Douglas. D. Mc. Daniel and J. Alexander, John Wiley.
4. Advanced Inorganic Chemistry by Satyaprakash, Tuli, Basu (S. Chand and Co.)
5. Inorganic Chemistry by Puri and Sharma (S. Chand & Co.)
6. Inorganic Chemistry by Agrawal.
7. Inorganic Chemistry by D.E. Shriver, P.W. Atkins and C.H. Longford, Oxford.
8. Selected topics in Inorganic Chemistry :Madan, Malik Tuli, S. Chand & Company.
9. Vogel's Text Book of Quantitative Inorganic Analysis–Bassett, Denny, Jeffery Mendham.
10. Basic concepts of Analytical Chemistry by S.M. Khopkar.
11. Inorganic Chemistry Principles of Structure and Reactivity by James by J. E Huheey, E. A Keiter& R. L Keiter& A. K. Medhi
12. Catalysis Science & Technology by J. R. Anderson and Michel Boudart
13. Advances in Catalysis by C. Song (Elsevier)

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DSC-1D Theory-I Title: Semester-IV

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Paper –VII

CHEMISTRY-VII (2131401)

Title: Physical Chemistry

Hours: 36 Marks: 50

Credits: 2 Lecture: 45

Learning objective:

1. To learn Miller and Weiss indices of particles.
2. To understand transport number and its application.
3. To know classification of crystal systems.
4. To learn Nernst distribution law.
5. To learn the calculation of thermodynamic problems and understand the feasibility.

Unit1: Electrochemistry 18

1.1 Introduction, conduction of electricity, Types of conductors: electronic and electrolytic.

1.2 Explanation of terms: Conductance, Specific resistance, specific conductance, Equivalent conductance, Molecular conductance.

1.3. Variation of specific and equivalent conductance with concentration, Equivalent conductance at infinite dilution.

1.4 Arrhenius theory of electrolytic dissociation, Onsager equation and its application (derivation not expected)

1.5 Theory of strong electrolytes, Debye-Huckel theory, Asymmetry and electrophoretic effect

1.6 Migration of ions, Hittorf's rule, Transport number, Determination of transport number by moving boundary method, factors influencing transport number: Nature of electrolyte, concentration, temperature, complex formation and Degree of hydration.

1.7 Kohlrausch law, Applications of Kohlrausch law:

i. Determination of relationship between ionic conductance, ionic mobility and transport number.

ii. Determination of equivalent conductance at infinite dilution of weak electrolytes.

iii. Determination of degree of dissociation of weak electrolyte.

iv. Determination of ionic product of water.

v. Determination of solubility of sparingly soluble salts.

1.8 Numerical problems.

Unit 2: Distribution Law **7**

2.1 Introduction

2.2 (Thermodynamic statement and derivation of Nernst Distribution Law), its limitations and modification with respect to association and dissociation of solute in one of the solvents

2.3 Applications of distribution law in

i. Process of extraction (derivation expect)

ii. Determination of solubility

iii. Distribution indicators

iv. Determination of molecular weight

2.4 Numerical problems expected.

Unit3: The Solid State **10**

3.1 Introduction, space lattice, lattice sites, lattice planes, Unit Cell.

3.2 Laws of crystallography:

i. Law of constancy of interfacial angles.

ii. Law of rational indices

iii. Law of crystal symmetry.

3.3 Weiss indices and Miller indices.

3.4 Various crystal systems and classification

3.5 Cubic lattice and types of cubic lattice, planes or faces of a simple cubic system, spacing's of lattice planes.

3.6 Diffraction of X-rays, Derivation of Bragg's equation.

3.7 Determination of crystal structure of NaCl and KCl on the basis of Bragg's equation.

3.8 Numerical problems.

Unit 4: Thermodynamics **10**

4.1 Brief account of first and second law of Thermodynamics

4.2 Molar heat capacities; at constant volume and constant pressure, Relation between Cp & Cv, Enthalpy of a system: change in enthalpy and its unit, Relation between ΔH and ΔE, calculation of ΔE and ΔH.

4.3 Concept of entropy, Entropy as a state function: Definition, mathematical expression, unit, physical significance of entropy.

4.4 Entropy change in mixing of gases.

4.5 Entropy change in physical transformations:

i. Fusion of a solid.

ii. Vaporization of a liquid.

iii. Transition from one crystalline form to another.

4.6 Third law of thermodynamics, Absolute entropy and Evaluation of absolute entropy, use of absolute entropies: Determination of entropy changes in chemical reactions.

4.7 Numerical problems.

Course outcome:

After successful completion of this course students will be able to:-

1. Determine Miller and Weiss indices of particles.
2. Classify the crystal systems.
3. Explain transport number and applications.
4. Solve the thermodynamic problems and understand the feasibility.
5. Calculate interplanar distance.
6. Illustrate Hittorf's rule and its applications.
7. Recall Nernst distribution law.

Reference Books:

1. Elements of Physical Chemistry: S. Glasstone and D. Lewis (D.VanNostrand Co. Inc)
2. Physical Chemistry: W.J. Moore (Orient Longman)
3 Principles of Physical Chemistry: Maron & Prutton (Oxford IVthEdn.)
4. Chemistry Principle &Applications : P.W. Atkins, M.J. Clugsto, M.J. Fiazer, R.A.Y. Jone (Longman)
5. Physical Chemistry : G.M. Barrow (Tata Mc-Graw Hill)
6. Essentials of Physical Chemistry: B.S. Bahl& G.D. Tuli (S. Chand)
7. Physical Chemistry: Daniels – Alberty.
8. Principles of Physical Chemistry: Puri – Sharma (S. Nagin)
9. Basic Chemical Thermodynamics: V.V. Rao.
10. Physical Chemistry Through problems: Dogra and Dogra (Wiley Eastern Ltd.,)
11. Physical Chemistry: S. Glasstone.
12. Text book of Physical Chemistry – S. Glasstone (2nd Edn. Mac Millan)
13. Elements of Physical Chemistry – P. Atkins & J. Paula (Oxford IVthEdn.)
14. Principles of Physical Chemistry: B. R. Puri, L. R. Sharma and M. S. Pathania
15. Electrochemistry: S. Glasstone

16. Kinetics and mechanisms of chemical transformations: Rajaram and Kuriacose.

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DSC-1D Theory-II Title:

Semester-IV Paper –VIII

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CHEMISTRY-VIII (2131402)

Title: Analytical & Industrial Inorganic Chemistry

Hours: 36 Marks: 50

Credits: 2 Lecture: 45

Learning objective:

1. To learn the terminology of volumetric and gravimetric analysis.
2. To understand the manufacturing process of sulphuric acid and ammonia.
3. To know the drug and cosmetic act 1940.
4. To learn the process of precipitation.

Unit1: Volumetric Analysis 11

1.1 Introduction, Terminology: Titrant; Titrand, standard solution; Titration Indicator; Equivalence point; End point. Primary standard, Secondary standard. Strength of solution, volumetric analysis & their types.

1.2 Acid Base Titration

i) Introduction

ii) Theory of Acid-Base indicator:

A) Colour change Interval

B) Theories-Ostwald's theory &Quinoid theory,

iii) Neutralization curve and choice of indicator for following titrations :

A) Strong acid and Strong Base

B) Strong Acid and Weak Base

C) Weak Acid and Strong Base

1.3 Complexometric titration:

A) General account,

B) Types of EDTA Titrations,

C) Metallochromic Indicator w.r.t. Eriochrome Black-T

Unit 2: Gravimetric Analysis **11**

2.1 Introduction, Terminology :-Gravimetric analysis, Saturation, Super-saturation, Sol, Gel, Coagulation or Flocculation, Coagulation or Flocculation value, Peptisation, Precipitation, Precipitate, Precipitant, Solubility, Aging or digestion, Ignition,

2.2 General steps involved in gravimetry

2.3 Precipitation – A) Physical nature of Precipitate: Gelatinous, Curdy and Crystalline. B) Conditions of Precipitation

2.4 Process of precipitation – A) Nucleation B) Crystal growth C) Digestion

2.5 Co-precipitation and Post precipitation and their difference.

2.6 Role of Organic precipitants in gravimetric analysis,

2.7 Study of organic precipitants viz. A) DMG, B) Aluminon, C) 8- Hydroxyquinoline.

2.8 Advantages and disadvantages of organic precipitants.

Unit 3: Industrial heavy Chemicals **6**

3.1 Introduction

3.2 Physicochemical Principles & manufacture of following heavy chemicals:

i) Ammonia by Haber process

ii) Sulphuric acid by contact process.

iii) Nitric acid: Physicochemical principles involved, Manufacture of nitric acid by Ostwald's process, its uses.

Unit 4: Cement Industry **7**

4.1 History of origin of cement

4.2 Manufacture of Portland cement.

4.3 Raw materials in cement manufacture:

4.4 Various steps involved in cement manufacturing.

4.5 Manufacture of Portland cement

i) Dry Process, ii) Wet Process

4.6 Chemical Composition of Portland cement

4.7 Hydration of cement and properties of hydrated cement compounds.

Unit 5: Introduction to pharmaceutical inorganic chemistry **10**

5.1 Pharmaceutical chemistry, Importance of inorganic pharmaceuticals.

5.2 Classification of inorganic pharmaceuticals based on

i) Their uses ii) Their application in therapy

5.3 Pharmacopoeia, i) Monograph, ii) History of pharmacopoeia

5.4 Indian pharmacopoeia (Stepwise Brief Introduction)

5.4.1 Individual monograph (Few Critical Steps) – Title , Chemical formulae , Atomic and molecular weight , Definition, Content dose, Usual strength , Solubility, Test methods , Identification, Tests and assay , Tests Animals, Storage, Storage containers, Labeling,

5.5 The Drugs and Cosmetic Act 1940

i) Scope, ii) Objectives, iii) Features of drugs and cosmetics act 1940, iv) Standard of quality,

5.5.1 License to sell, stock, distribute drugs

5.5.2 Conditions for license

Course outcome:

After successful completion of this course students will be able to:-

1. Discuss terminologies in volumetric and gravimetric analysis.
2. Explain the process of manufacturing of sulphuric acid & ammonia.
3. Apply drug and cosmetic act 1940.
4. Explain manufacturing process of cement industry.
5. Analyze the process of precipitation.
6. Identify metal ion by using organic precipitate.

Reference Books:

1. Concise Inorganic Chemistry by J.D. Lee ELBS 4th & 5th Edn.
2. Basic Inorganic Chemistry by F.A. Cotton, G.Wilkinson and P.L. Gaus Wiley.
3. Inorganic Chemistry by Puri and Sharma (S. Chand & Co.)
4. Inorganic Chemistry by Agrawal.
5. Inorganic Chemistry by D.E. Shriver, P.W. Atkins and C.H. Longford, Oxford.
6. Vogel's Text Book of Quantitative Inorganic Analysis–Bassett, Denny, Jeffery Mendham.
7. Vogel's Qualitative Inorganic Analysis by G Svehla and B Sivasanka
8. Basic concepts of Analytical Chemistry by S.M. Khopkar.
9. Chemical Process Industries by R. N. Shreve & J. A. Brink (New York: Tata McGraw-HILL)
10. Portland Cement Industries by J. C. Witt (Chemical Publishing Co Inc., U.S.)
11. Portland Cement and Asphalt Concretes by Thomas D Larson (McGraw-HILL)
12. Concrete Properties and Manufacture by T.N. W. Akroyd
13. Cement Chemistry by H.F.W. Taylor (Thomas Telford)
14. Cement and Mortar Additives by L. F. Martin

15. Textbook of Pharmaceutical Inorganic Chemistry: Theory and Practical by V. N. Rajasekaran
16. Inorganic Medicinal and Pharmaceutical Chemistry by J. H. Block
17. Pharmaceutical Inorganic Chemistry by Alagarsamy V.
18. Pharmaceutical Chemistry Inorganic by G. R. Chatwal.
19. Industiral chemistry: B.K. Sharma.

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Practical Course:

DSC-1C & DSC-1D

CHEMISTRY PRACTICAL-II AND III (2131419)

Practical Examination held at the end of the year - 200 marks = (CA 60 + SEE 140)

A) Distribution of marks:

a) Physical: 35 marks

30 marks physical experiment + Oral -2 marks + Journal- 3 marks

b) Inorganic: 70 marks

Gravimetric analysis-50 marks + Preparation-15 marks / Volumetric estimation – 50 marks + Preparation- 15 marks / Semi-micro analysis 50 marks + Preparation- 15 marks , Journal 2 marks + Oral 2 marks

c) Organic: 35 marks

Organic qualitative Analysis 25 marks / Estimation 25 marks / Preparation 25 marks, Derivatives 5 marks + Oral 2 marks + Journal 3 marks

B) Duration of Examination – Two days, 6 hrs. per day

Continuous Assessment for Chemistry:

1) Each theory paper has 15 marks for continuous assessment
2) Practical paper has 60 marks for continuous assessment examination.
3) At the end of academic year i.e. semester IV the practical examination will be conducted.

Learning objective:

1. To develop the skill for handling the instrument.
2. To perform the kinetically experiments.
3. To understand the gravimetric analysis.
4. To learn the preparation of complexes.

5. To learn the qualitatively organic mixture identification.

Physical Chemistry Experiment:

A) Instrumental

1. Refractometry: To determine the specific and molar refractions of benzene, toluene and xylene by Abbe's refractometer and hence determine the refraction of $–CH_2$ group. (Densities should be determined by the students)

2. Polarimetry: To determine the specific rotation and find unknown concentration of sugar solution.
3. Conductometry: (any two)

   i. To determine degree of dissociation and dissociation constant of acetic acid at various dilutions and to verify Ostwald's dilution law conductometrically.

   ii. To determine the normality of the given strong acid by titrating it aginst strong alkali conductometrically.

   iii. To determine the equivalent conductance at infinite dilution of strong electrolyte at five different dilutions conductometrically. (e.g. any one from KCl, NaCl, KNO_3 and HCl) and verify Onsager equation.

4. pH Metery: (any One)
   i) Study the comparative pH of different soft drinks available in market.
   ii) Find the pH of different samples of potable water from different reservoirs.

B) Non-Instrumental

1. Chemical Kinetics (any three):
   i. To study the hydrolysis of methyl acetate in presence of HCl and H_2SO_4 and to determine the relative strength of acids.
   ii. To study the effect of acid strength (0.5M and 0.25M HCl) on hydrolysis of an ester.
   iii. To study the reaction between $K_2S_2O_8$ and KI (unequal concentration)
   iv. To study the reaction between $KBrO_3$ and KI (equal concentrations)
2. Viscosity (Any One):
   i) To determine the percentage composition of a given liquid mixture by viscosity method. (Density data be given)
   ii) To determine molecular weight of polyvinyl alcohol by viscometer method.

Inorganic Chemistry Experiment:

1. **Gravimetric Analysis:**
   i. Gravimetric estimation of Fe as Fe_2O_3 from a solution containing ferrous ammonium sulphate and free sulphuric acid.
   ii. Gravimetric estimation of Ba as $BaSO_4$ from a solution containing barium chloride and free hydrochloric acid.

2. Titrimetric Analysis:

i. Analysis of commercial vinegar – To determine the percentage of acetic acid is a given commercial sample of vinegar.

ii. To prepare standard solution of calcium chloride from calcium carbonate and determine the total hardness of given water sample.

iii. Quality control – To determine percentage purity of soda ash in the given sample.

iv. Fertilizer analysis: To determine the percentage of nitrogen present in a given sample of nitrogenous fertilizer.

3. Inorganic Preparations:

i. Ferrous Ammonium Sulphate (Mohr's salt)

ii. Preparation of tetrammine copper(II) sulpate

iii. Preparation of hexamine nickel (II) chloride.

4. Semi-micro Qualitative Analysis:

Cations: Cu^{++}, Al^{+++}, Fe^{+++}, Mn^{++}, Zn^{++}, Ni^{++}, Ba^{++}, Ca^{++}, Mg^{++}, NH_4^+ & K+

Anions: Cl^- , Br^-, I^-, SO_4^{2-}, NO_3^- & CO_3^{2-}

Note: At least five mixtures to be completed.

Organic Chemistry Experiment:

A) Organic Qualitative Analysis:

Identification of at least six organic compounds with reactions.

1. Acids: succinic acid, phthalic acid, salicylic acid, aspirin
2. Phenols: α– naphthol, o-nitrophenol, p-nitrophenol
3. Bases: o-, m-, and p-nitroanilines N, N-dimethylaniline
4. Neutral: urea, acetanilide, carbontetrachloride, bromobenzene, methylacetate, nitrobenzene, naphthalene, anthracene, acetophenone, ethylmethyl ketone.

Note: A systematic study of an organic compound involves the following operations which should be taught in details with reactions in the determination of elements and functional group.

1) Preliminary tests and physical examination
2) Determination of type
3) Determination of physical constant
4) Detection of elements
5) Determination of functional group
6) A search into the literature
7) Special test if any
8) Summary

9) Result.

B) Organic Quantitative Analysis:

i. Estimations (Any Two)

1. Estimation of ethyl benzoate.
2. Estimation of acetone
3. Estimation of ibuprofen from ibuprofen tablet

ii. Organic Preparations (Any Two)

1. Preparation of phthalimide from phthalic anhydride.
2. Preparation of p-bromoacetanilide from acetanilide.
3. Preparation of Benzoic acid from cinnamic acid

Preparation of Derivatives (Any two)

1. Picrate derivative of phenol
2. Nitro derivative of nitrobenzene
3. Anhydride derivative of acid

Course outcome:

After successful completion of this course students will be able to:-

Physical

1. Evaluate molar and normal solution of various concentrations.
2. Determine specific rotations and percentage of optically active Substance by polarimetrically.
3. Examine the second order reaction.
4. Improve the conductometric titrations.
5. Determine the atomic refraction of C, H and Cl by refractometry.

Inorganic

1. Examine gravimetric and volumetric analysis of commercial samples.
2. Prepare a various inorganic complexes and determine its % purity.
3. Detection of inorganic mixtures by using qualitative analysis.

Organic

1. Prepare phthalimide from phthalic anhydride.
2. Identify the given organic compound.
3. Carry out nitration of nitro compound.
4. Recrystallize the given compound.
5. Perform bromination of acetanilide.
6. Analyze pharmaceutical Ibuprofen tablet quantitatively.

Reference Books:

Physical Chemistry

1) Practical book of Physical Chemistry: Nadkarni, Kothari &Lawande.

2) Experimental Physical Chemistry: A. Findlay.

3) Systematic Experimental Physical Chemistry: S.W. Rajbhoj, Chondhekar (Anjali Pub.)

4) Experiments in Physical Chemistry: R.C.Das and B. Behra. (Tata Mc. Graw Hill)

5) Advanced Practical Physical Chemistry: J. B. Yadav (Goel Publishing House)

6) Practical Physical Chemistry: B. D. Khosala (R. Chand & Sons.)

7) Experiments in Chemistry: D. V. Jagirdar

Inorganic Chemistry

1. Quantitative Inorganic Chemistry – A.I. Vogel.
2. Practical Chemistry – Physical – Inorganic – Organic and Vice-voce by BalwantRai Satija. Allied Publishers Pvt. Ltd.
3. Inorganic Qualitative Analysis – A.I. Vogel.
4. Basic Concepts in Analytical Chemistry – S.M. Khopkar.
5. Vogel's Text Book of Quantitative Inorganic Analysis – Bassett, Denny, Jeffery Mendham.

(Note: Preparation should be taken in semester-III)

Organic Chemistry

1) Vogel's Text Book of Quantitative Chemical Analysis, (Longman) ELBS. Edition

2) Vogel's Text Book of Qualitative Chemical Analysis, (Longman) ELBS. Edition

3) Hand book of Organic Qualitative Analysis: Clarke

4) Comprehensive Practical Organic Chemistry - Quantitative Analysis by V.K. Ahluwalia, Sunita Dhingra, University Press. Distributor - Orient Longman Ltd.,

5) Comprehensive Practical Organic Chemistry preperation and Quantitative Analysis.: V.K. Ahluwalia, Renu Agarwal, University Press. Distributor - Orient Longman Ltd.,

6) A laboratory Hand-Book of organic Qualitative Analysis and separation: V. S. Kulkarni, Dastane Ramchandra and Co. Pune

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