Rayat Shikshan Sanstha's

Karmaveer Bhaurao Patil College, Vashi, Navi Mumbai

(Autonomous College)

Department of Chemistry

T.Y.B.Sc Syllabus

Sr. No.	Heading	Particulars
1	Title of Course	T.Y.B.Sc Chemistry
2	Eligibility for Admission	S.Y.B.Sc Chemistry
3	Passing Marks	24 Marks
4	Ordinances/Regulations (if any)	
5	No. of Years/Semesters	One year/Two semester
6	Level	U.G.
7	Pattern	Semester
8	Status	Revised
9	To be implemented from Academic year	2020-2021

AC – /0 /2018
Item No.

Rayat Shikshan Sanstha's
KARMAVEER BHAURAO PATIL COLLEGE, VASHI.
NAVI MUMBAI
(AUTONOMOUS COLLEGE)

Sector-15- A, Vashi, Navi Mumbai - 400 703

Syllabus for T. Y. B. Sc. Chemistry

Program: B. Sc.

Course: T. Y. B. Sc. Chemistry

(Choice Based Credit, Grading and Semester System

with effect from the academic year 2020-2021)

Syllabus for T.Y.B.Sc. Chemistry

Objectives of the Course:

At the graduation in Chemistry a student should have: Acquired the knowledge with facts and figures related to various allied subjects in chemistry such as Organic, Inorganic, Physical, Analytical etc. Understood the basic concepts, fundamental principles, and the scientific theories related to various chemical phenomena and their relevancies in the day-to-day life. Acquired the skills in handling scientific instruments, planning and performing in laboratory experiments. Facts and figures or providing new solution to the problems. Realized how developments in chemistry subject helps in the development of other science subjects and vice-versa and how interdisciplinary approach helps in providing better solutions and new ideas for the sustainable developments. Developed scientific outlook not only with respect to science subjects but also in all aspects related to life. Imbibed ethical, moral and social values in personal and social life leading to highly cultured and civilized personality. Developed various communication skills such as reading, listening, speaking, etc., which will help in expressing ideas and views clearly and effectively. Realized that pursuit of knowledge is a lifelong activity and in combination with untiring efforts and positive attitude and other necessary qualities leads towards a successful life.

The major objectives of T.Y.B.Sc. Chemistry course are

• To infuse in the learner a spirit of inquiry into the fundamental aspects of the various core areas of Chemistry which they have learned in earlier four semesters.

• To make the learner proficient in analysing the various observations and chemical phenomena presented to him during the course.

• To make the learner capable of solving problems in the various units of this course

• To give the learner an opportunity to get hands on experience of the various concepts and processes in the various branches of chemistry

• To impart various skills of handling chemicals, reagents, apparatus, instruments and the care and safety aspects involved in such handling

• To make the learner capable of analysing and interpreting results of the experiments he conducts or performs

• To make the learner capable of acquiring or pursuing a source of livelihood like jobs in chemical industry

• To arouse the interest to pursue higher levels of learning in chemistry.

Scheme of examination for Each Semester:

Continuous Internal Evaluation: 40 Marks (Common written Test-20 Marks & 20 Marks for-

Assignment, Projects, Group discussion, Open book test, Online test etc.)

Semester End Examination: 60 Marks will be as follows -

I.	**Theory:** The Semester End Examination for theory course work will be conducted as per the following scheme.	
	Each theory paper shall be of two and half hour duration.	
	All questions are compulsory and will have internal options.	
	Q – I	From Unit – I (having internal options.) 15 M
	Q – II	From Unit – II (having internal options.) 15 M
	Q – III	From Unit – III (having internal options.) 15 M
	Q – IV	Questions from all the THREE Units with equal weightage of marks allotted to each Unit. 15 M
II.	**Practical**	The Semester End Examination for practical course work will be conducted as per the following scheme.

Sr. No.	**Particulars of Semester End Practical Examination**	**Marks%**
1	Laboratory Work	80
2	Journal	10
3	Viva	10
	TOTAL	**100**

Choice Based Credit, Grading and Semester System with effect from the academic year 2018-2019

T.Y.B.Sc. Chemistry
Semester – V

Course Code	Unit	Topics	Credits	L/Week
UGCH501 (Physical Chemistry)	I	MOLECULAR SPECTROSCOPY	2	1
	II	CHEMICAL THERMODYNAMICS		1
	III	NUCLEAR CHEMISTRY		1
	IV	SURFACE CHEMISTRY		1
UGCH502 (Inorganic Chemistry)	I	MOLECULAR SYMMETRY AND CHEMICAL BONDING	2	1
	II	SOLID STATE CHEMISTRY		1
	III	CHEMISTRY OF INNER TRANSITION ELEMENTS		1
	IV	SOME SELECTED TOPICS		1
UGCH503 (Organic Chemistry)	I	MECHANISM OF ORGANIC REACTIONS, PHOTOCHEMISTRY	2	1
	II	STEREOCHEMISTRY-I, PHOTOCHEMISTRY, AGROCHEMICALS, HETEROCYCLIC CHEMISTRY		1
	III	IUPAC, SYNTHESIS OF ORGANIC COMPOUNDS		1
	IV	SPECTROSCOPY-I, NATURAL PRODUCTS		1
UGCH504 (Analytical Chemistry)	I	INTRODUCTION TO QUALITY CONCEPTS,CHEMICAL	2	1
	II	CALCULATIONS AND SAMPLING		1
	III	CLASSICAL METHODS OF ANALYSIS (TITRIMETRY)		1
	IV	OPTICAL METHODS		1
UGCHDD505 (Drugs and Dyes)	I	GENERAL INTRODUCTION TO DRUGS	2	1
	II	ANTIHISTAMINIC DRUGS		1
	III	INTRODUCTION TO THE DYE-STUFF INDUSTRY		1
	IV	COLOUR AND CHEMICAL CONSTITUTION OF DYES		1
UGCHPP501 UGCHPI502 UGCHPO503 UGCHPA504 UGCHPD505	-	PRACTICAL COURSE	8	16

Note: 1. Blue Highlighted Topic / Course has focus on employability/ entrepreneurship/skill development

2. Yellow Highlighted Topic / Course is related to professional ethics, gender, human values, Environment & sustainability

3. Green Highlighted Topic / Course is related to local/national/regional & global development needs.

Choice Based Credit, Grading and Semester System with effect from the academic year 2018-2019

T.Y.B.Sc. Chemistry
Semester - VI

Course Code	Unit	Topics	Credits	L/Week
UGCH601 (Physical Chemistry)	I	ELECTROCHEMISTRY	2	1
	II	POLYMERS		1
	III	BASICS OF QUANTUM CHEMISTRY		1
	IV	NMR -NUCLEAR MAGNETIC RESONANCE		1
UGCH602 (Inorganic Chemistry)	I	THEORIES OF THE METAL-LIGAND BOND (I)	2	1
	II	THEORIES OF THE METAL-LIGAND BOND (II)		1
	III	ORGANOMETALLIC CHEMISTRY		1
	IV	SOME SELECTED TOPICS		1
UGCH603 (Organic Chemistry)	I	STEREOCHEMISTRY I, AMINO ACIDS & PROTEINS	2	1
	II	MOLECULAR REARRANGEMENTS CARBOHYDRATES		1
	III	SPECTROSCOPY II NUCLEIC ACIDS		1
	IV	POLYMER CATALYSTS AND REAGENTS		1
UGCH604 (Analytical Chemistry)	I	ELECTRO ANALYTICAL TECHNIQUES	2	1
	II	METHODS OF SEPARATION - II		1
	III	FOOD AND COSMETICS ANALYSIS		1
	IV	THERMAL METHODS AND ANALYTICAL METHOD VALIDATION		1
UGCHDD605 (Drugs and Dyes)	I		2	1
	II			1
	III			1
	IV			1
UGCHPP601 UGCHPI602 UGCHPO603 UGCHPA604 UGCHPD605	-	PRACTICAL COURSE	8	16

Note: 1. Blue Highlighted Topic / Course has focus on employability/ entrepreneurship/skill development
2. Yellow Highlighted Topic / Course is related to professional ethics, gender, human values, Environment &

sustainability

3. Green Highlighted Topic / Course is related to local/national/regional & global development needs.

T.Y.B.Sc Chemistry (Semester – V)

UGCH 501: PHYSICAL CHEMISTRY

Credits: 2

Lectures: 60

Learning objectives

UGCH 501	Physical Chemistry	Unit-I Molecular spectroscopy	1. Students should review basics of molecular spectroscopy, chemical thermodynamics, chemical kinetics, nuclear chemistry.[2] 2. Students must give outline of rotational, vibrational, Raman spectroscopy. [2] 3. Students should illustrate application of vibrational-rotational spectrum in determination of force constant and its significance. Infrared spectra of simple molecules like H_2O and CO_2. [3] 4. Students should justify Rotational and vibrational spectrum of a diatomic molecule. [4] 5. To know selection rule, energy levels rotational, vibrational and Raman spectroscopy. [2] 6. Students must generate knowledge through concepts like zero point energy, Rayleigh scattering, Stoke's lines, anti-Stoke's lines. [3]
		UNIT-II chemical thermodynamics And chemical kinetics	1. Student must give outline of Colligative properties, Elevation in boiling point of a solution, Depression in freezing point of a solution, Osmotic Pressure. [2] 2. Students must describe about vapour pressure and relative lowering of vapour pressure and also estimate elevation in boiling point, depression in freezing point of a solution. [3] 3. Students should solve thermodynamic derivation relating elevation in boiling point of the solution, the depression in the freezing point of a solution and molar mass of non-volatile solute. [5] 4. They should relate Beckmann Method and Rast Method, Berkeley and Hartley's Method. [3] 5. To illustrate collision theory of reaction rates. [2] 6. To distinguish between slow, fast and ultra-fast reaction[2]

		UNIT-III Nuclear chemistry	1. Students should memorize basic terms-radioactive constants (decay constant, half-life and average life) and units of radioactivity. [1] 2. Students should understand basics of radioactivity and detection and measurement of radioactivity. [2] 3. Students should justify application of use of radioisotopes as tracers. [3] 4. To generate knowledge through numerical. [5]
		UNIT IV surface chemistry and colloidal state	1. Student should interpret. Langmuir's adsorption Isotherm, B.E.T. equation for multilayer adsorption. **[2]** 2. Students should determine surface area of an adsorbent using B.E.T. equation. **[3]**

UNIT-I: MOLECULAR SPECTROSCOPY (15)

1.1 **Rotational Spectrum:** Introduction to dipole moment, polarization of a bond, bond moment, molecular structure, .Rotational spectrum of a diatomic molecule, rigid rotor, moment of inertia, energy levels, conditions for obtaining pure rotational spectrum, selection rule, nature of spectrum, determination of internuclear distance and isotopic shift.

1.2 **Vibrational spectrum:** Vibrational motion, degrees of freedom, modes of vibration, vibrational spectrum of a diatomic molecule, simple harmonic oscillator, energy levels, zero point energy, conditions for obtaining vibrational spectrum, selection rule, nature of spectrum.

1.3 **Vibrational-Rotational spectrum of diatomic molecule:** energy levels, selection rule, nature of spectrum, P and R branch lines. A harmonic oscillator energy levels, selection rule, fundamental band, overtones. Application of vibrational-rotational spectrum in determination of force constant and its significance. Infrared spectra of simple molecules like H_2O and CO_2.

1.4 **Raman Spectroscopy:** Scattering of electromagnetic radiation, Rayleigh scattering, Raman scattering, nature of Raman spectrum, Stoke's lines, anti-Stoke's lines, Raman shift, quantum theory of Raman spectrum, comparative study of IR and Raman spectra, rule of mutual exclusion- CO_2 molecule

UNIT–II:

2.1 CHEMICAL THERMODYNAMICS (10)

2.1.1 Colligative properties: Vapor pressure and relative lowering of vapor pressure. Measurement of lowering of vapor pressure - Static and Dynamic method.

2.1.2 Solutions of Solid in Liquid:

2.1.2.1 Elevation in boiling point of a solution, thermodynamic derivation relating elevation in boiling point of the solution and molar mass of non-volatile solute.

2.1.2.2 Depression in freezing point of a solution, thermodynamics

derivation relating the depression in the freezing point of a solution and the molar mass of the non-volatile solute. Beckmann Method and Rast Method.

2.1.3 Osmotic Pressure: Introduction, thermodynamic derivation of Van't Hoff equation, Van't Hoff Factor. Measurement of Osmotic Pressure - Berkeley and Hartley's Method, Reverse osmosis.

2.2 Chemical Kinetics (5)

2.2.1 Collision theory of reaction rates: Application of collision theory to 1. Unimolecular reaction Lindemann theory and 2. Bimolecular reaction. (Derivation expected for both)

2.2.2 Classification of reactions as slow, fast and ultra -fast. Study of kinetics of fast reactions by Stop flow method and Flash photolysis (No derivation expected).

UNIT–III: NUCLEAR CHEMISTRY (15)

3.1 Introduction: Basic terms-radioactive constants (decay constant, half-life and average life) and units of radioactivity

3.2 Detection and Measurement of Radioactivity: Types and characteristics of nuclear radiations, behavior of ion pairs in electric field, detection and measurement of nuclear radiations using G. M. Counter and Scintillation Counter.

3.3 Application of use of radioisotopes as Tracers: chemical reaction mechanism, age determination - dating by C^{14}.

3.4 Nuclear reactions: nuclear transmutation (one example for each projectile), artificial radioactivity, Q - value of nuclear reaction, threshold energy.

3.5 Fission Process: Fissile and fertile material, nuclear fission, chain reaction, factor controlling fission process. Multiplication factor and critical size or mass of fissionable material, nuclear power reactor and breeder reactor.

3.6 Fusion Process: Thermonuclear reactions occurring on stellar bodies and earth.

UNIT–IV:

4.1 SURFACE CHEMISTRY (6)

4.1.1 Adsorption: Physical and Chemical Adsorption, types of adsorption isotherms. Langmuir's adsorption isotherm (Postulates and derivation expected). B.E.T. equation for multilayer adsorption, (derivation not expected). Determination of surface area of an adsorbent using B.E.T. equation.

4.2 Colloidal State (4)

4.2.1 Introduction to colloids - Emulsions, Gels and Sols

4.2.2 Electrical Properties: Origin of charges on colloidal particles, Concept of electrical double layer, zeta potential, Helmholtz and Stern model. Electro-kinetic phenomena - Electrophoresis, Electro-osmosis, Streaming potential, Sedimentation potential; Donnan Membrane Equilibrium.

4.2.3 Colloidal electrolytes: Introduction, micelle formation

4.2.4 Surfactants: Classification and applications of surfactants in detergents and food industry.

REFERENCES:

1. Physical Chemistry, Ira Levine, 5th Edition, 2002 Tata McGraw Hill Publishing Co.Ltd.
2. Physical Chemistry, P.C. Rakshit, 6th Edition, 2001, Sarat Book Distributors, Kolkota.
3. Physical Chemistry, R.J. Silbey, & R.A. Alberty, 3rd edition , John Wiley & Sons, [part 1]
4. Physical Chemistry, G. Castellan, 3rd edition, 5th Reprint, 1995 Narosa Publishing House.
5. Modern Electrochemistry, J.O.M Bockris & A.K.N. Reddy, Maria Gamboa - Aldeco 2nd Edition, 1st Indian reprint,2006 Springer
6. Fundamental of Molecular Spectroscopy, 4th Edn., Colin N Banwell and Elaine M McCash Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2008.
7. Physical Chemistry, G.M. Barrow, 6th Edition, Tata McGraw Hill Publishing Co. Ltd. New Delhi.
8. The Elements of Physical Chemistry, P.W. Atkins, 2nd Edition, Oxford Universtity Press Oxford.
9. Physical Chemistry, G.K. Vemullapallie, 1997, Prentice Hall of India, Pvt.Ltd. New Delhi.
10. Principles of Physical Chemistry B.R. Puri, L.R. Sharma, M.S. Pathania, VISHAL PUBLISHING Company, 2008.
11. Textbook of Polymer Science, Fred W Bilmeyer, John Wiley & Sons (Asia) Ple. Ltd., Singapore, 2007.
12. Polymer Science, V.R. Gowariker, N.V. Viswanathan, Jayadev Sreedhar, New Age International (P) Ltd., Publishers, 2005.
13. Essentials of Nuclear Chemistry, Arnikar, Hari Jeevan , New Age International (P) Ltd., Publishers, 2011.
14. Chemical Kinetics,K. Laidler, Pearson Education India, 1987.

T.Y.B.Sc Chemistry (Semester – V)

UGCH 502: INORGANIC CHEMISTRY

Credits: 2

Lectures: 60

Learning objectives

UGCH 502	Inorganic Chemistry	Unit I : Molecular Symmetry And Chemical Bonding	1. To know basics behind Symmetry in Chemistry.[2] 2. To Justify the Importance of Symmetry in Chemistry. [2] 3. To identify Symmetry elements and Symmetry operations and can co-relate them. [2] 4. To discuss the concept of a Point Group. 5. To Deduce point groups : (i)C_{2V} (ii) D_{2h} (iii) C_{2V} (iv) C_{3v} (v) C_{2h} and (vi) D_{3h} citing the appropriate examples. [2] 6. To distinguish between homonuclear and Heteronuclear diatomic molecules. [3] 7. To apply Molecular Orbital Theory for heteronuclear diatomic molecules and polyatomic species[3] 8. To construct molecular orbital energy level diagrams for Heteronuclear diatomic molecules with illustrating CO, NO and HCl. [3] 9. To appraise modified MO diagram for CO. [3] 10. To apply Molecular orbital theory for H_3 and H_3^+ ion and Draw their correlation diagram expected. [3] 11. To Apply symmetry concepts for linear and angular species predicting σ- bonding only with illustrating for i) BeH_2, ii) H_2O). [3]
		Unit II: Solid State Chemistry	1. To discuss the structure of solids. [2] 2. To describe various terms involved viz. crystal lattice, lattice point, unit cell and lattice constants[2] 3. To account for closest packing of rigid spheres for hcp and ccp sub lattices. [2] 4. To calculate packing density in simple cubic, bcc and FCC lattices. [4] 5. To investigate the relationship between density, radius of unit cell and lattice parameters. [5] 6. To compile Stoichiometric Point defects in solids annotating on Frenkel and Schottky defects. [3] 7. To solve the examples on packing density. [5]

			8. To validate the Discovery of superconductivity. [4] 9. To describe the terms like terms like superconductivity, transition temperature and Meissner effect. [2] 10. To sort Different types of super conductors viz. conventional superconductors, alkali metal fullerides and high temperature super conductors. [3] 11. To account for applications of superconductors. [3]
		Unit III: Chemistry of Inner Transition Elements	1. To account for Position of lanthanides and actinides in periodic table and their electronic configuration. [2] 2. To outline Chemistry of Lanthanides with reference to (i) lanthanide contraction and its consequences (ii) Oxidation states (iii) Ability to form complexes (iv) Magnetic and spectral properties. [3] 3. To investigate Occurrence, extraction of lanthanides. [3] 4. To research on separation of lanthanides by (i) Ion Exchange method and (ii) Solvent extraction method outline the Principles and techniques. [4] 5. List the applications of lanthanides. [1]
		Unit IV: SOME SELECTED TOPICS	1. To classify the solvents and underline importance of non-aqueous solvents. [2] 2. To interpret the Characteristics and examine liquid ammonia, dinitrogen tetra oxide as non-aqueous solvents with respect to: (i) acid-base reactions and (ii) redox reactions. [2] 3. To write the Electronic configurations of elements of Group 16 and to give main idea about trends in physical properties. [3] 4. To investigate the allotropes of Group 16 elements. [2] 5. To investigate the Manufacture of sulphuric acid by Contact process. [4] 6. To write the Electronic configuration of elements of Group-17 and to interpret the General characteristics and anomalous properties of fluorine. [1,2] 7. To compare acidity of oxy acids of chlorine w.r.t acidity, oxidizing properties. [2] 8. To predict structures on the main idea of VSEPR theory. [3]

UNIT-I: Molecular Symmetry and Chemical Bonding (15)

1.1 Molecular Symmetry

- 1.1.1 Introduction and Importance of Symmetry in Chemistry.
- 1.1.2 Symmetry elements and Symmetry operations.
- 1.1.3 Concept of a Point Group with illustrations using then following point groups: (i) C2V (ii) D2h (iii) C2V (iv) C3v (v) C2h and (vi) D3h

1.2 Molecular Orbital Theory for heteronuclear diatomic molecules and polyatomic species

- 1.2.1 Comparison between homonuclear and heteronuclear diatomic molecules.
- 1.2.2 Heteronuclear diatomic molecules like CO, NO and HCl, appreciation of modified MO diagram for CO.
- 1.2.3 Molecular orbital theory for H3 and H3+ (correlation diagram expected).
- 1.2.4 Molecular shape to molecular orbital approach in AB2 molecules. Application of symmetry concepts for linear and angular species considering σ- bonding only. (Examples like: i) BeH_2, ii) CO_2.

UNIT-II: SOLID STATE CHEMISTRY (15)

2.1 Structures of Solids (11)

- 2.2.1 Explanation of terms viz. crystal lattice, lattice point, unit cell and lattice constants.
- 2.1.2 Closest packing of rigid spheres (hcp, ccp), packing density in simple cubic, bcc and fcc lattices. Relationship between density, radius of unit cell and lattice parameters.
- 2.1.3 Stoichiometric Point defects in solids (discussion on Frenkel and Schottky defects expected).

2.2 Superconductivity (4)

- 2.2.1 Discovery of superconductivity.
- 2.2.2 Explanation of terms like superconductivity, transition temperature, Meissner effect.
- 2.2.3 Different types of super conductors viz. conventional superconductors, alkali metal fullerides, high temperature super conductors.
- 2.2.4 Brief application of superconductors.

UNIT-III: CHEMISTRY OF INNER TRANSITION ELEMENTS (15)

3.1 Introduction: Position in periodic table and electronic configuration of lanthanides and actinides.

3.2 Chemistry of Lanthanides with reference to (i) lanthanide contraction and its consequences (ii) Oxidation states (iii) Ability to form complexes (iv) Magnetic and spectral properties

3.3 Occurrence, extraction and separation of lanthanides by (i) Ion Exchange method and (ii) Solvent extraction method (Principles and technique)

3.4 Applications of lanthanides

UNIT – IV: SOME SELECTED TOPICS

4.1 Chemistry of Non-aqueous Solvents (5)

4.1.1 Classification of solvents and importance of non-aqueous solvents.

4.1.2 Characteristics and study of liquid ammonia, Acetic Acid as non-aqueous solvents with respect to : (i) acid-base reactions and (ii) redox reactions.

4.2 Comparative Chemistry of Group 16 (5)

4.2.1 Electronic configurations, trends in physical properties, allotropy

4.2.2 Manufacture of sulphuric acid by Contact process.

4.3 Comparative Chemistry of Group 17 (5)

4.3.1 Electronic configuration , General characteristics, anomalous properties of fluorine, comparative study of acidity of oxyacids of chlorine w.r.t acidity, oxidising properties and structures(on the basis of VSEPR theory)

4.3.2 Chemistry of interhalogens with reference to preparations, properties and structures (on the basis of VSEPR theory) .

REFERENCES

Unit-I

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   East west Press Pvt. Ltd., New Delhi.
6. Satya Prakash, G.D.Tuli, R.D. Madan , , Advanced Inorganic Chemistry.S. Chand & Co Ltd

Unit-II

1. Lesley E. Smart, Elaine A. Moore Solid State Chemistry: An Introduction, 2nd Edition CRC Press
2. C. N. R. Rao Advances in Solid State Chemistry
3. R.G. Sharma Superconductivity: Basics and Applications to Magnets
4. Michael Tinkham ,Introduction to Superconductivity: Vol I (Dover Books on Physics)
5. R. Gopalan, Inorganic Chemistry for Undergraduates, Universities Press India.
6. Richard Harwood, Chemistry, Cambridge University Press.
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Unit-III

1. Cotton, Wilkinson, Murillo and Bochmann, Advanced Inorganic Chemistry, 6th Edition.

2. Greenwood, N.N. and Earnshaw, Chemistry of the Elements, Butterworth Heinemann 1997.

3. Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.

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Unit-IV

1. B. H. Mahan, University Chemistry, Narosa publishing.

2. R. Gopalan, Inorganic Chemistry for Undergraduates, Universities Press India.

3. J. D. Lee, Concise Inorganic Chemistry, 4thEdn., ELBS,

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7. Richard Harwood, Chemistry, chapter 10 Industrial inorganic chemistry

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2004

T.Y.B.Sc Chemistry (Semester – V)

UGCH 503: ORGANIC CHEMISTRY

Credits: 2

Lectures: 60

Learning objectives

UGCH 503	Organic Chemistry	Unit-I	1. To explain basic term and concept required for organic substitution and pericyclic reactions.[2] 2. To describe, exemplify, classify, and distinguish thermal and photochemical reactions and Norrish type I and II cleavage. [2] 3. To know reactivity of heterocyclic compounds with various reagents and their applications. [2]
		Unit II	1. To reinforces the advantages and disadvantages of agrochemical. [3] 2. To frame molecular chirality and chirality without a stereogenic centre in biphenyl and cummulene compounds. [3]
		Unit III	1. To apply rules of IUPAC nomenclature to unknown compounds of Bicyclic, Biphenyls, cummulenes, quinoline and isoquinoline with two substitutions. [3] 2. To know and describe the principles of green chemistry and multicomponent synthesis to calculate the E-Factor, % atom economy[2]
		Unit IV	1. To plan organic synthesis by using green technology. [6] 2. To know basic concept ,theory and nature of UV-visible and mass spectrum[2] 3. To understand natural products like terpenoids cital, alkaloids, nicotine and harmones[2]

Semester - V
Course Code: UGCH503
Paper - III (**Organic chemistry**)

Unit I

1.1 Mechanism of organic reactions **(10 L)**

Determining mechanism of a reaction: Product analysis, Kinetic studies, Stereochemical outcome, Detection and trapping of intermediates, Crossover experiments, Kinetic isotope effect –primary kinetic & secondary kinetic isotope effect.

1.1.1 Neighbouring group participation in nucleophilic substitution reactions: participation of lone pair of electrons, kinetics and stereochemical outcome.

1.1.3 Mechanism and synthetic applications: Claisen condensation, Michael addition.

1.1.4 Pericyclic reactions, classification and nomenclature .

1.1.4.1 Electro cyclic reactions (ring opening and ring closing), cycloaddition, sigma tropic Rearrangement, group transfer reactions, cheletropic reaction (definition and one example of each type).

1.1.4.2 Pyrolytic elimination: Cope, Chugaev, pyrolysis of acetates.

1.2 Photochemistry **(05 L)**

1.2.1 Introduction: Difference between thermal and photochemical reactions. Jablonski diagram,singlet and triplet states, allowed and forbidden transitions, fate of excited molecules, photosensitization.

1.2.2.Photochemical reactions of olefins: photoisomerization, photochemical rearrangement of 1,4-dienes (di- π methane).

1.2.3. Photochemistry of carbonyl compounds: Norrish I, Norrish II cleavages. Photo reduction

(e.g. benzophenone to benzpinacol).

Unit II

2.1. Stereochemistry I **(05 L)**

2.1.1 Stereo selectivity and Stereo specificity: Idea of enantioselectivity (ee) and diastereoselectivity (de). Topicity-enantiotopic and diastereotopic atoms, groups and faces.

2.1.2 Chirality of compounds without a stereo genic center: cummulenes and biphenyls.

2.2. Carbanions and their reactions **(05L)**

Introduction, Formation and stability of Carbanion. Reactions involving carbanions and their mechanisms: Aldol, Claisen, Dieckmann and Perkin condensations. Synthesis and Synthetic applications of Malonic ester, Acetoacetic ester and Wittig reagent.

2.3.Heterocyclic chemistry: **(06 L)**

2.3.1 Reactivity of pyridine-N-oxide, quinoline and iso-quionoline.

2.3.2 Preparation of pyridine-N-oxide, quinoline (Skraup synthesis) and iso-quinoline(BischlerNapieralski synthesis).

2.3.3 Reactions of pyridine-N-oxide: halogenation, nitration and reaction with $NaNH_2$/liq.NH_3, n-BuLi.

2.3.4 Reactions of quinoline and isoquinoline; oxidation,reduction,nitration,halogenation and reaction with NaNH2/liq.NH3,n-BuLi.

Unit III

3.1 IUPAC **(05 L)**

IUPAC Systematic nomenclature of the following classes of compounds (including compounds upto two substituents / functional groups):

3.1.1. Bicyclic compounds – spiro, fused and bridged (upto 11 carbon atoms) – saturated and unsaturated compounds.

3.1.2. Biphenyls

3.1.3. Cummulenes with upto 3 double bonds

3.1.4. Quinolines and isoquinolines

3.2 Synthesis of organic compounds (10L)

3.2.1 Green chemistry and synthesis: Introduction: Twelve principles of green chemistry, concept of atom economy and E-factor, calculations and their significance, numerical examples.

Use of following in the green synthesis

i) Green reagents: dimethyl carbonate.

ii) Green starting materials : D-glucose

iii) Green solvents : supercritical CO2

iv) Green catalysts: Bio catalysts.

3.2.2. Multicomponent Synthesis with examples (no mechanism) : Mannich reaction , Biginelli reaction. Ugi -4CC- reaction Synthesis

3.2.3.Use of PTC, crown ether , ultrasound, and solid supported reagents in the green synthesis

Unit IV

4.1 Spectroscopy I (05 L)

4.1.1. UV – Visible spectroscopy: Basic theory, solvents, nature of UV-Visible spectrum, concept of chromophore, auxochrome, bathochromic and hypsochromic shifts, hyperchromic and hypochromic effects, chromophore-chromophore and chromophore-auxochrome interactions.

4.1.2. Calculation of absorption maxima for dienes, conjugated polyenes (cyclic and acyclic), carbonyl and unsaturated carbonyl compounds, substituted aromatic compounds by Woodward-Fieser rules (using Woodward-Fieser tables for values for substituents).

4.1.3 Mass spectrometry: Basic theory. Nature of mass spectrum. General rules of fragmentation. Importance of molecular ion peak, isotopic peaks, base peak, nitrogen rule, rule of 13 for determination of empirical formula and molecular formula. Fragmentation of alkanes and aliphatic carbonyl compounds.

4.2. Natural Products: (10L)

4.2.1.Terpenoids: Introduction, Isoprene rule, special isoprene rule and the gem-dialkyl rule.

4.2.2 Citral: a) Structural determination of citral. b) Synthesis of citral from methyl

heptenone.

4.2.3. Alkaloids Introduction and occurrence. Hofmann's exhaustive methylation and degradation in: N – substituted monocyclic amines.

4.2.4 Nicotine: Synthesis of nicotine from nicotinic acid , Harmful effects of nicotine.

4.2.5. Hormones: Introduction, structure of adrenaline (epinephrine), physiological action of adrenaline. Synthesis of adrenaline from a) Catechol b) p-hydroxybenzaldehyde (Ott's synthesis) , structure of Thyroxine and its physiological action

References: Unit I

1. A guidebook to mechanism in Organic Chemistry, 6th edition, Peter Sykes, Pearson education, New Delhi
2. Organic Reaction Mechanism, 4th edition, V. K. Ahluwalia, R. K. Parashar, Narosa Publication.
3. Organic reactions & their mechanisms,3rd revised edition, P.S. Kalsi, New Age International Publishers.
4. M.B.Smith and J. March, Advanced organic chemistry- reactions mechanism and structure, 5 th edition.
6. Organic Chemistry, 7th Edition, R.T. Morrison, R. N. Boyd & S. K. Bhattacharjee, Pearson.
7. Organic chemistry,8th edition, John McMurry

References: Unit II

1. L. Eliel , stereochemistry of carbon compounds, Tata McGraw Hill
2. Stereochemistry P.S.Kalsi , New Age International Ltd.,4th Edition
3. Stereochemistry by Nassipuri.
4. Insecticides & pesticides: Saxena A. B., Anmol publication.
5. Growth regulators in Agriculture & Horticulture: Amarjit Basra, CRC press 2000.
6. Agrochemicals and pesticides: A.Jadhav and T.V.Sathe.
7. Name Reactions in Heterocyclic Chemistry, Jie-Jack Li, Wiley-Interscience publications, 2005.
8. Handbook of Heterocyclic Chemistry, 2nd Edition, Alan R. Katritzky and Alexander F. Pozharskii, Elsevier Science Ltd, 2000.
9. Heterocyclic Chemistry, 5th Edition, John A. Joule and Keith Mills, Wiley publication,

2010.

10. Heterocyclic chemistry, 3rd Edition, Thomas L. Gilchrist, Pearson Education, 2007.

References: Unit III

1. Nomenclature of Organic Chemistry: IUPAC recommendations and preferred Names 2013, RSC publication.
2. IUPAC nomenclature by S. C. Pal.
3. Green chemistry an introductory text : Mike Lancaster.
4. Green chemistry: V. K. Ahluwalia (Narosa publishing house pvt. ltd.)
5. Green chemistry an introductory text : RSC publishing.
6. New trends in green chemistry V. K. Ahluwalia , M. Kidwai, Klumer Academic publisher
7. Green chemistry by V. Kumar. 6. Organic chemistry: Francis Carey
8. Organic chemistry: Carey and Sundberg.

References: Unit IV

1. Organic spectroscopy (Second edition),Jag Mohan ,Narosa publication
2. Spectroscopy, Pavia, Lampman, Kriz,Vyvyan.
3. Elementary organic spectroscopy (Third edition), Y.R.Sharma, S.Chand publication..
4. Introduction to spectroscopy (third edition), Pavia Lampman, Kriz,johnvondeling Emily Barrosse.
5. Organic chemistry Paula Y. Bruice, Pearson education.
6. Spectral identification of organic molecules by Silverstein. 7. Absorption spectroscopy of organic molecules by V.M.Parikh.
7. Chemistry of natural products by ChatwalAnand – Vol I and Vol II
8. Chemistry of natural products by O.P. Agarwal
9. Chemistry of natural products by MeenakshiSivakumar and SujataBhat.
10. Organic chemistry by Morrision and Boyd,7th edition.
11. Organic chemistry by I. L. Finar, Vol-I and Vol-II, 5th edition

ORGANIC CHEMISTRY PRACTICALS

COURSE CODE: USCHP503 **CREDITS: 02**

A) Separation of Binary solid-solid mixture (2.0 gms mixture to be given).

1. Minimum Six mixtures to be completed by the students.

2. Components of the mixture should include water soluble and water insoluble acids (carboxylic acid), water insoluble phenols(2-naphthol, 1-naphthol), water insoluble bases (nitroanilines) , water soluble neutral (thiourea) and water insoluble neutral compounds (anilides , amides, m-DNB, hydrocarbons)

3.After correct determination of chemical type, the separating reagent should be decided by the student for separation.

4. Follow separation scheme with the bulk sample of binary mixture.

5. After separation into component A and component B, one component (decided by the

examiner) is to be analyzed and identified with m.p..

B) Stoichiometric calculations for following preparations-

1. Nitrobenzene to M-dinitrobenzene
2. Salicylic acid to aspirine
3. Bromobenzene to p- nitrobromobenzene

References:

1. Practical organic chemistry – A. I. Vogel
2. Practical organic chemistry – H.Middleton.
3. Practical organic chemistry – O.P.Aggarwal

T.Y.B.Sc Chemistry (Semester – V)

UGCH 504: ANALYTICAL CHEMISTRY

Credits: 2

Lectures: 60

UGCH 504	Analytical chemistry	Unit I: introduction to quality concepts,chemical calculations and sampling	1. To understand concepts of quality, purpose, significance and difficulties encountered in sampling.[2] 2. To understand Importance of Quality concepts in Industry. [2] 3. To find out the Percent composition of elements in chemical Compounds. [3] 4. To know Purpose, significance and difficulties encountered in sampling. [4] 5. To understand the sampling methods of Solid, Liquid, Gas. [2]
		Unit II: classical methods of analysis (titrimetric)	1. To construction of the titration curves and calculation in case of one electron system. [5] 2. To understand the various types of titrations and use of indicators. [2] 3. To find the applications of Indicators. [3]
		Unit III: Optical methods	1. To understand the concept of Spectroscopy. [2] 2. To understand the principle and applications. [3] 3. Applications and quantifications. [3] 4. To understand Instrumentation. [2]
		Unit IV: Methods of separation - I	1. To understand the principle and applications. [2] 2. To understand Instrumentation. [2] 3. To find out the Qualitative and Quantitative Applications[3]

UNIT I: INTRODUCTION TO QUALITY CONCEPTS, CHEMICAL

UNIT I :

1.1 Quality in Analytical Chemistry (04 L)

1.1.1 Concepts of Quality, Quality Control and Quality Assurance

1.1.2 Importance of Quality concepts in Industry

1.1.3 Chemical Standards and Certified Reference Materials; Importance in chemical analysis and Quality of material: Various grades of laboratory reagents

1.2 Introduction to Spectrophotometry (06L)

Instrumentation of single beam colorimeter, Instrumentation of single and double beam spectrophotometer, Principle of additivity of absorbance and simultaneous determination, Spectrophotometric Titrations, Experimental Applications-Structure of organic compounds, Structure of complexes, Numerical Problems

1.3 Electrophoresis (05L)

Introduction, Principle and theory of electrophoresis, Different types of electrophoresis techniques, Moving Boundary Electrophoresis, Zone electrophoresis- Paper, Cellulose acetate and Gel electrophoresis, Applications of electrophoresis

UNIT II: CLASSICAL METHODS OF ANALYSIS (TITRIMETRY)

2.1 Redox Titrations (Numerical and word Problems are expected) (8)

2.1.1 Introduction

2.1.2 Construction of the titration curves and calculation of E_{system} in aqueous medium in case of: (1) One electron system (2) Multielectron system

2.1.3 Theory of redox indicators, Criteria for selection of an indicator. Use of diphenyl amine and ferroin as redox indicators

2.2 Complexometric Titrations (7)

2.2.1 Introduction, construction of titration curve

2.2.2 Use of EDTA as titrant and its standardization, absolute and conditional formation constants of metal EDTA complexes, Selectivity of EDTA as a titrant. Factors enhancing selectivity with examples. Advantages and limitations of EDTA as a titrant.

2.2.3 Types of EDTA titrations.

2.2.4 Metallochromic indicators, theory, examples and applications

UNIT III: OPTICAL METHODS

3.1 Atomic Spectroscopy: Flame Emission spectroscopy(FES) and Atomic Absorption Spectroscopy (AAS) (7)

3.1.1 Introduction, Energy level diagrams, Atomic spectra, Absorption and Emission Spectra

3.1.2 Flame Photometry - Principle, Instrumentation (Flame atomizers, types of

Burners, Wavelength selectors, Detectors)

3.1.3 Atomic Absorption Spectroscopy - Principle, Instrumentation (Source, Chopper, Flame and Electrothermal Atomiser)

3.1.4 Quantification methods of FES and AAS - Calibration curve method, Standard addition method and Internal standard method.

3.1.5 Comparison between FES and AAS

3.1.6 Applications, Advantages and Limitations, (specific applications from Vogel book Problems based on AAS and FES)

3.1.7 Interference in AAS/FES methods

3.2 Molecular Fluorescence and Phosphorescence Spectroscopy (4)

3.2.1 Introduction and Principle

3.2.2 Relationship of Fluorescence intensity with concentration

3.2.3 Factors affecting Fluorescence and Phosphorescence

3.2.4 Instrumentation and applications

3.2.5 Comparison of Fluorimetry and Phosphorimetry

3.2.6 Comparison with Absorption methods (Numerical Problems)

3.3 Turbidimetry and Nephelometry (4)

3.3.1 Introduction and Principle

3.3.2 Factors affecting scattering of Radiation: Concentration, particle size, wavelength, refractive index

3.3.3 Instrumentation and Applications

UNIT IV: METHODS OF SEPARATION - I

4.1 Solvent Extraction (6)

4.1.1 Factors affecting extraction: Chelation, Ion pair formation and Solvation

4.1.2 Graph of percent extraction versus pH. Concept of $[pH]_{1/2}$ and its significance (derivation not expected)

4.1.3 Craig's counter current extraction: Principle, apparatus and applications

4.1.4 Solid phase extraction: Principle, process and applications with special reference to water and industrial effluent analysis.

4.1.5 Comparison of solid phase extraction and solvent extraction.

4.1.6 Extracting reagents

4.2 High Performance Liquid chromatography (HPLC) (6)

4.2.1 Introduction and Principle Instrumentation- components with their significance: Solvent Reservoir, Degassing system, Pumps-(reciprocating pumps, screw driven- syringe type pumps, pneumatic pumps, advantages and disadvantages of each pump), Precolumn, Sample injection system, HPLC Columns, Detectors(UV - Visible detector, Refractive index detector), plate theory for Principal of HPLC,

4.2.2 Qualitative and Quantitative Applications of HPLC

4.3 High Performance Thin Layer Chromatography (HPTLC) (3)

4.3.1 Introduction and Principle Stationary phase, Sample application and mobile phase
4.3.2 Detectors a) Scanning densitometer- Components. Types of densitometer- Single beam and Double beam b) Fluorometric Detector
4.3.3 Advantages, disadvantages and applications
4.3.4 Comparison of TLC and HPTLC

REFERENCES

1. 3000 solved problems in Chemistry, David E.Goldberg,PhD.,Schaums Outline Unit/s: (1.2)
2. A guide to Quality in Analytical Chemistry: An aid to accreditation, CITAC and EURACHEM, (2002), Unit/s (1.1)
3. A premier sampling solids, liquids and gases, Smith Patricia I, American statistical association and thesociety for industrial and applied mathematics, (2001)Unit/s (1.3)
4. Analytical Chemistry, Gary.D Christan, 5th editionUnit/s (4.1,4.2,4.3)
5. Analytical Chemistry Skoog, West ,Holler,7th Edition:Unit/s (2.1)
6. Analytical Chromatography, Gurdeep R Chatwal, Himalaya publication Unit/s (4.1,4.2,4.3)
7. Basic Concepts of Analytical Chemistry, by S M Khopkar, new Age International (p) Limited Unit/s (4.1,4.2,4.3)
8. Chemical methods of separation, J A Dean, Van Nostrand Reinhold, 1969 Unit/s (4.1,4.2,4.3)
9. Fundamentals of Analytical Chemistry by Skoog and West , 8th EditionUnit/s (4.1,4.2,4.3)
10. Handbook of quality assurance for the analytical chemistry laboratory, 2ndEdn., James P. Dux Van Nostr and Reinhold, 1990 Unit/s (1.1)
11. High Performance Thin Layer Chromatography by Dr P.D. Sethi, CBS Publisher and Distribution Unit/s(4.1,4.2,4.3)
12. High Performance Thin Layer Chromatography in Food analysis, by Prem kumar, CBS Publisher and distributer Unit/s (4.1,4.2,4.3)
13. Instrumental methods of Analysis, by Dr Supriya S Mahajan, Popular Prakashan Ltd Unit/s (4.1,4.2,4.3)
14. Instrumental methods Of Analysis, by Willard Merritt Dean, 7thEdition, CBS Publisher and distribution Pvt Ltd Unit/s (3.1,3.2,3.3)
15. Instrumental Methods of Chemical Analysis by B.K. Sharma Goel Publishing HouseUnit/s (4.1,4.2,4.3)
16. Principles of Instrumental Analysis , 5th Edition, By Skoog, Holler, Nieman Unit/s (4.1,4.2,4.3)(3.1,3.2,3.3)
17. Quality control and Quality assurance in Analytical Chemical Laboratory, Piotr Konieczka and Jacek Namiesnik, CRC press (2018) Unit/s (1.1)
18. Quality in the Analytical Chemistry Laboratory, Elizabeth Prichard, Neil T. Crosby, Florence Elizabeth Prichard, John Wiley and Sons, 1995 Unit/s (1.1)

19. Solvent extraction and ion exchange, J Marcus and A. S. Kertes Wiley INC 1969Unit/s (4.1,4.2,4.3)
20. Thin Layer Chromatography, A LAB. Handbook, Egon Stahl, Springer International Student

T.Y.B.Sc Chemistry (Semester – V)

UGCHDD 505: DRUGS and DYES

Credits: 2
Lectures: 60

UGCHDD 501	Drugs and Dyes	**Unit-I**	1. Be able to classify drugs based on various properties.[2] 2. To Describe the terms LD50, ED50 GI50 Therapeutic index. [2] 3. To explain the concepts of Receptors, Agonists, Antagonists, Drug-receptor interaction, Drug Potency and Pharmacopoeia. [3] 4. To create the synthesis of CNS drugs. [6] 5. To list the CNS drugs based on their pharmacological actions[1,2]
		Unit II	1. To identify Analgesics, Antipyretics and Anti-inflammatory Drugs and their various examples[4] 2. Be able to synthesize Tramadol, Aceclofenac, Cetrizene, Atenolol, Levodopa and Ambroxol along with their reaction mechanism[2] 3. Be able to classify cardiovascular,Antidiabetic and Antiparkinson drugs based on their pharmacological actions[2]
		Unit III	1. To understand the concepts of Colour,Chromophore and Auxochrome, Solubility, Linearity, Coplanarity, Fastness, Substantivity, Economic viability. [2] 2. Explanation of nomenclature or abbreviations of commercialdyes with at least one example suffixes – G, O, R, B, K, L, C, S H, 6B, GK, 6GK[2] 3. To understand the Natural and Synthetic Dyes along with examples. [2] 4. To know about types of fibres and Binding forces of dyes on substrate[2]
		Unit IV	1. To relate between colour and chemical constitution by application of Armstrong, Witt's and Valence Bond theory. [2] 2. To know about Unit Processeswith reaction conditions[2] 3. To synthesize dye intermediates along with their uses in dyestuff chemistry. [3]

UNIT I:

1.1 General introduction to drugs (8)

1.1.1 Definition of a drug, sources of drugs, requirements of an ideal drug, classification of drugs (based on therapeutic action)

1.1.2 Nomenclature of drugs: Generic name, Brand name, Systematic name

1.1.3 Definition of the following medicinal terms: Pharmacon, Pharmacology, Pharmacophore, Prodrug, Half - life efficiency, LD_{50}, ED_{50},GI_{50} Therapeutic Index.

1.1.4 Brief idea of the following terms: Receptors, Agonists, Antagonists, Drug-receptor interaction, Drug Potency, Bioavailability, Drug toxicity, Drug addiction, Spurious Drugs, Misbranded Drugs, Adulterated Drugs, Pharmacopoeia.

1.2 Routes of Drug Administration and Dosage Forms (3)

1.2.1 Oral and Parenteral routes with advantages and disadvantages.

1.2.2 Formulations & combination formulation, Different dosage forms (including Patches & Adhesives, emphasis on sustained release formulations and enteric coated tablets).

1.3 Pharmacodynamic agents (4)

1.3.1 CNS Drugs

Classification based on pharmacological actions: CNS Depressants & CNS Stimulants. Concept of sedation and hypnosis, anaesthesia.

- Phenytoin (Hydantoin)
- Trimethadione (Oxazolidinediones) (Synthesis from acetone)
- Alprazolam (Benzodiazepines)
- Levetiracetam (Pyrrolidines)
- Amphetamine (Phenethylamine) (Asymmetric synthesis from phenyl acetic acid)
- Chlorpromazine (Phenothiazines)

UNIT II:

2.1 Analgesics, Antipyretics and Anti-inflammatory Drugs. (4)

2.1.1 Analgesics and Antipyretics

- Morphine (Phenanthrene alkaloids)
- Tramadol (Cyclohexanols) (Synthesis from salicylic acid)
- Aspirin (Salicylates)
- Paracetamol (p-Amino phenols)
- Ambroxol (Cyclohexanol) (Synthesis from paracetamol)
- Salbutamol (Phenyl ethyl amines)
- Oxymetazoline (Imidazolines) Codeine Phosphate (Opiates)

2.1.2 Anti-inflammatory Drugs

Mechanism of inflammation and various inflammatory conditions.

- Steroids: Prednisolone, Betamethasone
- Sodium Diclofenac, Aceclofenac (N- Aryl anthranilic acids) (Synthesis from 2,6-dichlorodiphenyl amine)

2.2 Antihistaminic Drugs (2)

- Diphenhydramine (Ethanol amines)
- Cetirizine(Piperazine)(Synthesisfrom4 Chlorobenzhydrylchloride)
- Chlorpheniramine maleate (Ethyl amines)
- Pantoprazole (Benzimidazoles)

2.3 Cardiovascular drugs (3)

Classification based on pharmacological action

- Isosorbide dinitrate (Nitrates)
- Valsartan (Amino acids) (structure not expected)
- Atenolol (Aryloxy propanol amines) (Synthesis from 3-Hydroxy phenyl acetamide)
- Amlodipine (Pyridines)
- Frusemide /Furosemide (Sulfamoyl benzoic acid)
- Rosuvastatin (Pyrimidine)

2.4 Antidiabetic Agents (2)

General idea and types of diabetes; Insulin therapy

- Glibenclamide (Sulphonyl ureas)
- Metformin (Biguanides)
- Dapagliflozin (Pyranose)
- Pioglitazone (Thiazolidinediones) (Synthesis from 2-(5-ethylpyridin-2-yl) ethanol)

2.5 Antiparkinsonism Drugs (2)

Idea of Parkinson's disease.

- Procyclidine hydrochloride (Pyrrolidines)
- Ethopropazine hydrochloride (Phenothiiazines)
- Levodopa (Amino acids) (Synthesis from Vanillin)

2.6 Drugs for Respiratory System (2)

General idea of: Expectorants, Mucolytes, Bronchodilators, Decongestants, Antitussives

UNIT III:

3.1 Introduction to the dye-stuff Industry (5)

3.1.1 Dyes

Definition of dyes, requirements of a good dye i.e. Colour, Chromophore and Auxochrome, Solubility, Linearity, Coplanarity, Fastness, Substantivity, Economic viability. Definition of fastness and its properties and Mordants with examples Explanation of nomenclature or abbreviations of commercial dyes with at least one example suffixes - G, O, R, B, K, L, C, S H, 6B, GK, 6GK, Naming of dyes by colour index (two examples) used in dye industries.

3.1.2 Natural and Synthetic Dyes

Natural Dyes: Definition and limitations of natural dyes. Examples and uses of natural dyes w.r.t Heena, Turmeric, Saffron, Indigo, Madder, Chlorophyll -names of the chief dyeing material/s in each natural dye [structures not expected], Synthetic dyes: Definition of synthetic

dyes, primaries and intermediates. Important milestones in the development of synthetic dyes - Emphasis on Name of the Scientist, dyes and the year of the discovery is required. (Structure is not expected).

3.2 Substrates for Dyes: Types of fibers (3)

3.2.1 Natural: cellulosic and proteinaceous fibres, examples - wool, silk and cotton structures and names of dyes applied on each of them.

3.2.2 Semi - synthetic: definition and examples [structures not expected]

3.2.3 Synthetic: Nylon, Polyesters and Polyamides structures and names of dyes applied on each of them

3.2.4 Blended fabrics: definition and examples [structures not expected]

3.2.5 Binding forces of dyes on substrate: ionic forces, covalent linkages, hydrogen bonding, vander-walls forces

3.3 Classification of dyes based on applications and dyeing methods (7)

3.3.1 Dyeing methods

Basic Operations involved in dyeing process:

i. Preparation of fibres; ii. Preparation of dyebath; iii. Application of dyes iv. Finishing

Dyeing Method of Cotton Fibres: (i) Direct dyeing (ii) Vat dyeing (iii) Mordant dyeing; (iv) Disperse dyeing

3.3.2 Classification of dyes based on applicability on substrates (examples with structures)

(a) Acid Dyes- Orange II,
(b) Basic Dyes-methyl violet,
(c) Direct cotton Dyes- Benzofast Yellow 5GL
(d) Azoic Dyes - Diazo components; Fast yellow G, Fast orange R.
Coupling components. Naphthol AS, Naphthol ASG
(e) Mordant Dyes-Eriochrome Black A, Alizarin.
(f) Vat Dyes- Indanthrene brown RRD,
(g) Sulphur Dyes- Sulphur Black T (no structure)
(h) Disperse Dyes-Celliton Fast brown 3R,
(i) Reactive Dyes- Cibacron Brilliant Red B,

3.3.3 Optical Brighteners: General idea, important characteristics of optical brighteners and their classes [Stilbene, Coumarin, Heterocyclic vinylene derivatives, Diaryl pyrazolines, Naphthylamide derivatives] general structure of each class.

UNIT IV:

4.1 Color and Chemical Constitution of Dyes (4)

4.1.1 Absorption of visible light, Color of wavelength absorbed, Complementary color.

4.1.2 Relation between color and chemical constitution.

- Armstrong theory (quinonoid theory) and its limitations.
- Witt's Theory: Chromophore, Auxochrome, Bathochromic & Hypsochromic Shift, Hypochromic & Hyperchromic effect
- Valence Bond theory, comparative study and relation of colour in the following classes of compounds/dyes: Benzene, Nitrobenzene, Nitroanilines, Nitrophenols, Benzoquinones, Azo, Triphenyl

methane, Anthraquinones.

- Molecular Orbital Theory.

4.2 Unit process and Dye Intermediates (11)

4.2.1 A brief idea of Unit Processes

Introduction to primaries and intermediates

Unit processes: definition and brief ideas of below unit processes:

(a) Nitration (b) Sulphonation (c) Halogenation

(d) Diazotization: (3 different methods & its importance)

(e) Ammonolysis (f) Oxidation

NB: Definition, Reagents, Examples of each unit processes mentioned above with reaction conditions (mechanism is not expected)

4.2.2 Preparation of the Following Intermediates

Benzene derivatives: Benzenesulphonic acid; 1,3-Benzenedisulphonic acid; sulphanilic acid; o-, m-, p-chloronitrobenzenes; o-, m-, p-nitroanilines; o-, m-, p-phenylene diamines; Naphthol ASG

Naphthalene Derivative: Schaeffer acid; Tobias acid; Naphthionic acid; N.W. acid; cleve-6-acid; H-acid; Naphthol AS

Anthracene Derivative: 1-Nitroanthraquinone; 1-Aminoanthraquinone Anthraquinone-2-sulphonic acid; Benzanthrone.

REFERENCES

1. Foye's principles of medicinal chemistry. 6th Edition, Edited by Davis William & Thomas Lemke, Indian edition by B I Publication Pvt Ltd, Lippmcolt Williams & Wilkins.
2. Text book of organic medicinal & pharmaceutical chemistry. Wilson &Gisovolds, 11th Edition by John H Block, John M Beale Jr.
3. Medicinal chemistry. Ashutosh Kar, New Age International Pvt. Ltd Publisher. 4th edition.
4. Burger's Medicinal Chemistry, Drug Discovery and Development. Abraham and Rotella. Wiley
5. Medicinal chemistry. Ashutosh Kar, New Age International Pvt. Ltd Publisher. 4th edition.
6. Medicinal chemistry. V.K. Ahluwalia and Madhu Chopra, CRC Press.
7. Principle of medicinal chemistry. Vol 1 &2 S. S. Kadam, K. R. Mahadik, K. G. Bothara
8. The Art of Drug synthesis. Johnson and Li. Wiley, 2007.
9. The organic chemistry of drug design & drug action. 2nd ed. By Richard B Silvermann, Academic Press.
10. The Organic Chemistry of Drug Synthesis. Lednicer and Mitsher, Wliey.
11. Chemistry of Synthetic Dyes, Vol I - VIII, Venkatraman K., Academic Press 1972
12. The Chemistry of Synthetic Dyes and Pigments, Lubs H.A., Robert E Krieger Publishing Company, NY ,1995
13. Chemistry of Dyes and Principles of Dyeing, Shenai V.A., Sevak Publications, 1973

T.Y.B.Sc Chemistry (Semester – V)

UGCHPP 501: PHYSICAL CHEMISTRY PRACTICAL

Credits: 2
Lectures: 60

UGCHPP 501	Physical Chemistry Practical	1. To identify the order of reaction between $K_2S_2O_8$ and KI by fractional change method [4] 2. To illustrate the adsorption of acid on activated charcoal and test the validity of Freundlich adsorption isotherm [4] 3. To distinguish the solubility product and solubility of a salt potentiometrically using chemical cell. [2] 4. To evaluate the velocity constant of alkaline hydrolysis of ethyl acetate by conductometric method. [4] 5. To organize acidic and basic dissociation constants of an acid and hence to calculate isoelectric point. [5] 6. To investigate the molecular weight of compound by Rast Method. [5]

❖ Non-Instrumental

Colligative properties
To determine the molecular weight of compound by Rast Method
Chemical Kinetics
To determine the order between $K_2S_2O_8$ and KI by fractional change method. (six units and three units)
Surface phenomena
To investigate the adsorption of acetic acid on activated charcoal and test the validity of Freundlich adsorption isotherm.

❖ Instrumental

Potentiometry
To determine the solubility product and solubility of AgCl potentiometrically using chemical cell.
Conductometry
To determine the velocity constant of alkaline hydrolysis of ethyl acetate by conductometric method.
pH-metry
To determine acidic and basic dissociation constants of amino acid and hence to calculate isoelectric point.

REFERENCES

1. Practical Physical Chemistry 3rd edition A.M.James and F.E. Prichard, Longman publication
2. Experiments in Physical Chemistry R.C. Das and B. Behra, Tata Mc Graw Hill
3. Advanced Practical Physical Chemistry J.B.Yadav, Goel Publishing House
4. Advanced Experimental Chemistry. Vol-I b J.N.Gurtu and R Kapoor, S. Chand and Co.
5. Experimental Physical Chemistry by V.D.Athawale.
6. Senior Practical Physical Chemistry By: B. D. Khosla, V. C. Garg and A. Gulati, R Chand and Co.2011

T.Y.B.Sc Chemistry (Semester – V)

UGCHPI 502: INORGANIC CHEMISTRY PRACTICAL

Credits: 2
Lectures: 60

UGCHPI 502	Inorganic Chemistry Practical	1. To carry out different inorganic complex preparations involving basic skills.[3] 2. To determine the of percentage purity of the given water soluble salt and qualitative detection w.r.t added cation and/or anion. [4]

I. Inorganic preparations

1. Preparation of Potassium diaquobis- (oxalato)cuprate (II)
2. Preparation of Ferrous ethylene diammonium sulphate.
3. Preparation of bisacetylacetonatocopper(II)

II. Determination of percentage purity of the given water soluble salt and qualitative detection w.r.t added cation and/or anion (qualitative analysis only by wet tests). (Any three salts of transition metal ions)

REFERENCES

1. Vogel Textbook of Quantitative Chemical Analysis G.H. Jeffery, J. Basset.

T.Y.B.Sc Chemistry (Semester – V)

UGCHPO 503: ORGANIC CHEMISTRY PRACTICAL

Credits: 2
Lectures: 60

UGCHPO 503	Organic Chemistry Practical	1. To carry out separation of binary solid-solid mixture[4] 2. To able to analyse separated binary mixture. [4]

Separation of Binary solid-solid mixture (2.0 gms mixture to be given).

1. Minimum Six mixtures to be completed by the students.
2. Components of the mixture should include water soluble and water insoluble acids (carboxylic acid), water insoluble phenols (2-naphthol, 1-naphthol), water insoluble bases
   (nitroanilines), water soluble neutral (thiourea) and water insoluble neutral compounds (anilides , amides, m-DNB, hydrocarbons)

After correct determination of chemical type, the separating reagent should be decided by the student for separation.

3. Follow separation scheme with the bulk sample of binary mixture.
4. After separation into component A and component B, one component (decided by the examiner) is to be analyzed and identified with melting point

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2. Practical organic chemistry - H.Middleton.
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T.Y.B.Sc Chemistry (Semester – V)

UGCHPA 504: ANALYTICAL CHEMISTRY PRACTICAL

Credits: 2
Lectures: 60

UGCHPA 504	Analytical Chemistry Practical	1. To understand Spectrophotometric estimation of fluoride.[2] 2. To Estimate of magnesium content in Talcum powder. [4] 3. To Determination of COD of water sample. [4] 4. To determine the amount of sulphate in given water sample turbidimetrically. [4] 5. To determine the amount of persulphate in the given sample solution by back titration with standard Fe (II) ammonium sulphate solution. [4]

1. Spectrophotometric estimation of fluoride
2. Estimation of magnesium content in Talcum powder by complexometry, using standardized solution of EDTA
3. Determination of COD of water sample.
4. To determine potassium content of a Fertilizer by Flame Photometry (Calibration curve method).
5. To determine the amount of persulphate in the given sample solution by back

titration with standard Fe (II) ammonium sulphate solution.

6. To determine the amount of sulphate in given water sample turbidimetrically.

Note: Calculation of percent error is expected for all the experiments.

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2. Vogel's Textbook of Quantitative Chemical analysis, Sixth edition, J.Mendham et.al

T.Y.B.Sc Chemistry (Semester – V)

UGCHPD 505: DRUGS AND DYES PRACTICAL

Credits: 2

Lectures: 60

UGCHPD 505	Drugs and Dyes Practical	1. To Estimate Ibuprofen by back titration method.[4] 2. To Estimate Acid neutralizing capacity of a drug. [4] 3. To PrepareAspirin from salicylic acid. [3] 4. To Separate components of natural pigments by paper chromatography[3]

1. Estimation of Ibuprofen (back titration method)
2. Estimation of Acid neutralizing capacity of a drug
3. Preparation of Aspirin from salicylic acid.
4. Separation of components of natural pigments by paper chromatography (eg: chlorophyll)
5. Preparation of Dyes (any three) a. Phenyazo- β-napthol b. Magneson II c. Chrysoidine
6. Estimation of Dyes by reduction method using Titanu chloride (any Five)

a. Indigo carmine b. Amarnath c. Crystal Voilet

d. Eosine e. Methylene Blue f. Malachite Green

7. Estmation of coupling component by Diazonium salt solution (any Four)

a. R-Acid

b. B-Napthol

c. Resorcinol

d. J-acid

8. Chromatography

a. Separation of given mixture by Thin layer Chromatography (Two Mixture)

b. Separation of given mixture by Paper Chromatography (Two Mixture)

c. Separation of given mixture by Column Chromatography (Two Mixture)

9. Separation of Azo, Basic and Vat dyes by chemical method (Two Mixture)

II] Project:

Preparation of Orange II dye (semi-microscale1.0gms) and its use for dyeing different fabrics

T.Y.B.Sc Chemistry (Semester – VI)

UGCH 601: PHYSICAL CHEMISTRY

Credits: 2
Lectures: 60

UGCH 601	Physical Chemistry	UNIT I Electrochemistry	1. Students must recall about Activity and activity coefficient.[1] 2. Students should give outline of different electrochemical cells and derive equations associated with them. [1,2] 3. Students must compare Activity and Activity coefficient through Debye-Huckel limiting law. [3] 4. Students should relate Chemical cells with and without transference, Electrode Concentration cells, and Electrolyte concentration cells with and without transference. [4] 5. Students should illustrate Decomposition Potential and Overvoltage. [4]
		UNIT II Polymers	1. Students should memorize Basic terms of polymers. [1,2] 2. Students should give classification of polymers, antioxidants and stabilizers. [2] 3. Students should demonstrate Molar masses of polymers and method of determining molar masses of polymers. [3,4] 4. Students should appraise antioxidants and stabilizers. [4]
		Unit III Basics of quantum chemistry and renewable energy resources	1. Students must quote basics of Quantum mechanics. [3] 2. Students should give account for Progressive and standing waves, Hamiltonian operator, Eigen function and Eigen value. [3] 3. Students should demonstrate the properties of wave function, concept of operator. [4] 4. Students should compile linear operator, Hamiltonian operator, Eigen function and Eigen value through numerical. [4] 5. Students should judge Solar cells and Hydrogen as a fuel for future. [4]
		UNIT IV NMR Nuclear Magnetic Resonance Spectroscopy	1. Students should restate Principle and instrumentation of NMR and ESR spectroscopy. [2] 2. Students should demonstrate value, dimensionless constant or electron g-

			factor, hyperfine splitting and ESR spectrum of hydrogen and deuterium. [4] 3. Students should appraise ESR spectrometer[4] 4. Students must recommend the NMR and ESR spectroscopy through problems. [3]

UNIT I:

1.1 Electrochemistry (7)

1.1.1 Activity and Activity Coefficient: Lewis concept, ionic strength, Mean ionic activity and mean ionic activity coefficient of an electrolyte, expression for activities of electrolytes. Debye- Huckel limiting law (No derivation).

1.1.2 Classification of cells: Chemical cells and Concentration cells. Chemical cells with and without transference, Electrode Concentration cells, Electrolyte concentration cells with and without transference (derivations are expected).

1.2 Applied Electrochemistry (8)

1.2.1 Polarization: concentration polarization and its elimination

1.2.2 Decomposition Potential and Overvoltage: Introduction, experimental determination of decomposition potential, factors affecting decomposition potential. Tafel's equation for hydrogen overvoltage, experimental determination of over –voltage.

UNIT II: POLYMERS (15)

2.1 Basic terms: macromolecule, monomer, repeat unit, degree of polymerization.

2.2 Classification of polymers: Classification based on source, structure, thermal response and physical properties.

2.3 Molar masses of polymers: Number average, Weight average, Viscosity average molar mass, Monodispersity and Polydispersity

2.4 Method of determining molar masses of polymers: Viscosity method using Ostwald Viscometer (derivation expected)

2.5 Light Emitting Polymers: Introduction, Characteristics, Method of preparation and applications.

2.6 Antioxidants and Stabilizers: Antioxidants, Ultraviolet stabilizers, Colourants, Antistatic agents and Curing agents.

UNIT III:

3.1 BASICS OF QUANTUM CHEMISTRY (10)

3.1.1 Classical mechanics: Introduction, limitations of classical mechanics, Black body radiation, photoelectric effect, Compton effect.

3.1.2 Quantum mechanics: Introduction, Planck's theory of quantization, wave particle duality, de -Broglie's equation, Heisenberg's uncertainty principle.

3.1.3 Progressive and standing waves- Introduction, boundary conditions, Schrodinger's time independent wave equation (No derivation expected), interpretation and properties of wave function.

3.1.4 Quantum mechanics: State function and its significance, Concept of operator's definition, addition, subtraction and multiplication of operators, commutative and non – commutative operators, linear operator, Hamiltonian operator, Eigen function and Eigen value.

3.2 Renewable Energy Resources (5)

3.2.1 Renewable Energy resources: Introduction

3.2.2 Solar energy: Solar cells, Photovoltaic effect, Differences between conductors, semiconductors, insulators and its band gap, Semiconductors as solar energy converters, Silicon solar cell

3.2.3 Hydrogen: Fuel of the future, production of hydrogen by direct electrolysis of water, advantages of hydrogen as a universal energy medium.

UNIT IV:

4.1 NMR -Nuclear Magnetic Resonance Spectroscopy (7)

4.1.1 Principle : Nuclear spin, magnetic moment, nuclear 'g' factor, energy levels, Larmor precession, Relaxation processes in NMR (spin -spin relaxation and spin - lattice relaxation).

4.1.2 Instrumentation: NMR Spectrometer

4.2 Electron Spin Resonance Spectroscopy (8)

4.2.1 Principle: fundamental equation, g-value –dimensionless constant or electron g-factor, hyperfine splitting.

4.2.2 Instrumentation: ESR spectrometer, ESR spectrum of hydrogen and deuterium.

Note : Numericals and Word Problems are Expected from

REFERENCES

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2. Physical Chemistry, P.C. Rakshit, 6th Edition, 2001, Sarat Book Distributors, Kolkota.

3. Physical Chemistry, R.J. Silbey, & R.A. Alberty, 3rd edition , John Wiley & Sons, Inc [part 1]

4. Physical Chemistry, G. Castellan, 3rd edition, 5th Reprint, 1995 Narosa Publishing House.

5. Modern Electrochemistry, J.O.M Bockris & A.K.N. Reddy, Maria Gamboa - Aldeco 2nd Edition, 1st Indian reprint,2006 Springer

6. Fundamental of Molecular Spectroscopy, 4th Edn., Colin N Banwell and Elaine M McCash Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2008.

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2007.

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(P) Ltd., Publishers, 2005.

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T.Y.B.Sc Chemistry (Semester – VI)

UGCH 602: INORGANIC CHEMISTRY

Credits: 2

Lectures: 60

UGCH 602	Inorganic Chemistry	Unit I : Theories of the Metal-Ligand Bond (I)	1. To memorise limitations of Valence Bond Theory. [1,2] 2. To account in detail Crystal Field Theory and the effect of crystal field on central metal valence orbitals in various geometries from linear to octahedral (from coordination number 2 to coordination number 6). [2] 3. To discuss splitting of *d* orbitals in octahedral, square planar and tetrahedral crystal fields. [4] 4. To interpret distortions from the octahedral geometry in terms of (i) effect of ligand field and (ii) Jahn-Teller distortions. [4] 5. To identify Crystal field splitting parameters Δ. [2] 6. To compute Crystal field splitting parameters Δ. [2] 7. To discuss the factors affecting Δ in octahedral complexes and Spectrochemical series. [2,3] 8. To define Crystal field stabilization energy (CFSE) and to compute CFSE for octahedral complexes with d^0 to d^{10} metal ion configurations. [2] 9. To discuss consequences of crystal field splitting on various properties such as ionic radii, hydration energy and enthalpies of formation of metal complexes of the first transition series. [2,3] 10. To list the limitations of CFT. [2] 11. To identify for covalence in metal complexes in terms of (i)Intensities of d-d transitions, (ii) ESR spectrum of $[IrCl_6]^{2-}$ (iii) Nephelauxetic effect. [2,3]
		Unit II : Theories of the Metal-Ligand Bond (II)	1. To memorise Molecular orbital Theory for coordination compounds. [1,2] 2. To identify the central metal orbitals and their symmetry suitable for formation of bonds with ligand orbitals. [2]

			3. construct ligand group orbitals. [2] 4. construct σ molecular orbitals for an ML_6 complex. [2] 5. Examine the effects of σ bonding on complexes. 6. To construct Molecular Orbitals Energy diagrams illustrating for $[FeF_6]^{-4}$, $[Fe(CN)_6]^{-4}$,$[FeF_6]^{-3}$, $[Fe(CN)_6]^{-3}$,$[CoF_6]^{-3}$, $Co(NH_3)_6$] [2] 7. To distinguish thermodynamic and kinetic perspectives of metal complexes giving examples. [2] 8. To know Stability constants, stepwise and overall stability constants and to generate their interrelationship. [2] 9. To discuss factors affecting thermodynamic stability. [2] 10. To compare Inorganic and organic reactions 11. To identify types of reactions in metal complexes. [2] 12. To account for Inert and labile complexes and deduce correlation between electronic configurations and lability of complexes. [2] 13. To investigate the mechanism for Acid hydrolysis, base hydrolysis and anation reactions. [2] 14. To identify the Origin of electronic spectra. 15. To predict the types of electronic transitions in coordination compounds: intra ligand, Charge transfer and intra-metal transitions. [2,4] 16. To restate Selection rules for electronic transitions. [3] 17. To know Electronic configuration and electronic micro states, Terms and Term symbols for transition metal ions. [3] 18. To formulate the rules to determine ground state term. [5] 19. To calculate terms for p^2 and d^1 electronic configurations. [5]
		Unit III: Organometallic Chemistry.	1. o account for general characteristics of various types of organometallic compounds citing .ionic, σ-bonded and electron deficient compounds. [2] 2. To inspect general synthetic methods of organometallic compounds illustrating (i) Oxidative-addition, (ii)Metal-metal exchange(transmetallation), (iii) Carbanion-haexchange, (iv) Metal-hydrogen exchange(metallation) and (v) Methylene-insertion reactions. [3] 3.

			o observe some chemical reactions of organometallic compounds viz.(i) Reactions with oxygen and halogens, (ii) Alkylation and arylation reactions (v) Complex formation reaction. [2] 4. To account for Ferrocene its synthesis,properties and structure. [2] 5. To Predict structure and bonding in Ferrocene on the basis of VBT. [4] 6. To compare between homogeneous and heterogeneous catalysis. [4] 7. To predict basic steps involved in homogeneous catalysis. [4] 8. To Investigate Mechanism of Wilkinson's catalyst in hydrogenation of alkenes. [3,4]
		Unit IV: Some Selected Topics.	1. To account for Types of metallurgies. [2] 2. o discuss general steps of metallurgy illustrating Concentration of ore, calcinations, roasting, reduction and refining. [2] 3. To investigate Metallurgy of copper with underlining occurrence, physicochemical principles, Extraction of copper from pyrites& refining by electrolysis. [2] 4. To Review Historical perspectives of Group 18 elements. [3] 5. To discuss general characteristics and trends in physical and chemical properties of elements of Group 18. [2,3] 6. To analyse isolation of noble gases. [4] 7. To account for Compounds of Xenon (oxides and fluorides) outlining preparation. [2,3] 8. To predict the structures Xenon oxides and fluorides on the basis of VSEPR theory. [4] 9. To list the uses of noble gases. [2,3] 10. To account for Essential and non-essential elements in biological systems. [2] 11. To discuss Biological importance of metal ions such as Na^+,K^+,Fe^{+2}/Fe^{+3} and Cu^{+2} and role of Na^+ and K^+ w.r.t ion pump. [2]

UNIT I: Theories of the metal-ligand bond (I) (15)

1.1 Limitations of Valence Bond Theory.

1.2 Crystal Field Theory and effect of crystal field on central metal valence orbitals in various geometries from linear to octahedral (from coordination number 2 to coordination number 6),

1.3 Splitting of *d* orbitals in octahedral, square planar and tetrahedral crystal fields,

1.4 Distortions from the octahedral geometry: (i) effect of ligand field and (ii) Jahn-Teller distortions.,

1.5 Crystal field splitting parameters Δ; its calculation and factors affecting it in octahedral complexes, Spectrochemical series.

1.6 Crystal field stabilization energy (CFSE), calculation of CFSE for octahedral complexes with d^0 to d^{10} metal ion configurations,

1.7 Consequences of crystal field splitting on various properties such as ionic radii, hydration energy and enthalpies of formation of metal complexes of the first transition series.,

1.8 Limitations of CFT: Evidences for covalence in metal complexes
(i) Intensities of d-d transitions, (ii) ESR spectrum of $[IrCl_6]^{2-}$ (iii) Nephelauxetic effect.,

UNIT II: Theories of the metal-ligand bond (II)

2.1 Molecular orbital Theory for coordination compounds. (4)

2.1.1 Identification of the central metal orbitals and their symmetry suitable for formation of bonds with ligand orbitals.
2.1.2 Construction of ligand group orbitals.
2.1.3 Construction of □-molecular orbitals for an ML_6 complex.
2.1.4 Effect of □-bonding on complexes.
2.1.5 Examples like $[FeF_6]^{-4}$, $[Fe(CN)_6]^{-4}$, $[FeF_6]^{-3}$, $[Fe(CN)_6]^{-3}$, $[CoF_6]^{-3}$, $[Co(NH_3)_6]^{+3}$

2.2 Stability of Metal-Complexes (4)

2.2.1 Thermodynamic and kinetic perspectives of metal complexes with examples.
2.2.2 Stability constants: stepwise and overall stability constants and their interrelationship.
2.2.3 Factors affecting thermodynamic stability.

2.3 Reactivity of metal complexes. (4)

2.3.1 Comparison between Inorganic and organic reactions.
2.3.2 Types of reactions in metal complexes.
2.3.3 Inert and labile complexes : correlation between electronic configurations and lability of complexes.
2.3.4 Ligand substitution reactions : Associative and Dissociative mechanisms.
2.3.5 Acid hydrolysis, base hydrolysis and anation reactions.

2.4 Electronic Spectra. (3)

2.4.1 Origin of electronic spectra
2.4.2 Types of electronic transitions in coordination compounds: intra ligand, Charge transfer and intra-metal transitions.
2.4.3 Selection rules for electronic transitions.
2.4.4 Electronic configuration and electronic micro states, Terms and Term symbols for transition metal ions, rules for determination of ground state term.
2.4.5 Determination of Terms for p^2 and d^1 electronic configurations.

UNIT III: Organometallic Chemistry

3.1 Organometallic Compounds of main group metal (6)

3.1.1 General characteristics of various types of organometallic compounds, viz.ionic, ?-bonded and electron deficient compounds.
3.1.2 General synthetic methods of organometallic compounds : (i) Oxidative-addition, (ii)Metal-metal exchange(transmetallation), (iii) Carbanion-halide exchange, (iv) Metal-hydrogen exchange(metallation) and (v) Methylene-insertion reactions.
3.1.3 Some chemical reactions of organometallic compounds: (i) Reactions with oxygen and halogens, (ii) Alkylation and arylation reactions (v) Complex formation reactions.

3.2 Metallocenes (5)

Introduction, Ferrocene : Synthesis, properties, structure and bonding on the basis of VBT.

3.3 Catalysis (4)

3.3.1 Comparison between homogeneous and heterogeneous catalysis
3.3.2 Basic steps involved in homogeneous catalysis
3.3.3 Mechanism of Wilkinson's catalyst in hydrogenation of alkenes.

UNIT IV: Some Selected Topics

4.1 Metallurgy (7)

4.1.1 Types of metallurgies.
4.1.2 General steps of metallurgy; Concentration of ore, calcinations, roasting, reduction and refining.
4.1.3 Metallurgy of copper: occurrence, physicochemical principles, Extraction of copper from pyrites& refining by electrolysis.

4.2 Chemistry of Group 18 (5)

4.2.1 Historical perspectives
4.2.2 General characteristics and trends in physical and chemical properties
4.2.3 Isolation of noble gases
4.2.4 Compounds of Xenon (oxides and fluorides) with respect to preparation and structure (VSEPR)
4.2.5 Uses of noble gases

4.3 Introduction to Bioinorganic Chemistry. (3)

4.3.1 Essential and non-essential elements in biological systems.

4.3.2 Biological importance of metal ions such as Na^{+},K^{+},Fe^{+2}/Fe^{+3} and Cu^{+2}(Role of Na^{+} and K^{+} w.r.t ion pump)

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Unit-I:

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3. R. Gopalan , V. Ramalingam Concise Coordination Chemistry , Vikas Publishing House;
4. Shukla P R, Advance Coordination Chemistry , Himalaya Publishing House
5. Glen E. Rodgers, Descriptive Inorganic, Coordination, and Solid-State Chemistry Publisher: Thomson Brooks/Cole

Unit-II:

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3. Twigg, Mechanisms of Inorganic and Organometallic Reactions Publisher: Springer
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Unit-IV

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2 D. F. Shriver and P. W. Atkins, Inorganic chemistry, 3rd edition, Oxford University Press
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T.Y.B.Sc Chemistry (Semester – VI)

UGCH 603: ORGANIC CHEMISTRY

Credits: 2

Lectures: 60

UGCH 603	Organic Chemistry	Unit-I	1. To understand stereoselectivity and streospecificity in substitution, elimination and addition reaction.[2] 2. To classify amino acids, polypeptides and protein structure and synthesis. [2] 3. To know, exemplify, and deduce the structure of the product and to write the mechanism of molecular rearrangements. [2]
		Unit II	1. To write, exemplify, classify, the carbohydrates, Construct the Haworth and chair structures of monosaccharides, write the streoisomers and various reactions of monosaccarides. [2,3]
		Unit III	1. To frame structure elucidation of simple organic compounds on basis of IR and PMR spectral data. [1,2] 2. To classify nucleic acids and structure of nucleotides and nucleosides in DNA and RNA. [4]
		Unit IV	1. To know, exemplify and classify polymers, to illustrate and discuss the stereochemistry of polymers, to write the synthesis of addition and condensation polymers. [1,2] 2. To know, describe and suggest catalysts and reagents with respect to function group transformation. [1,2]

UNIT I:

Unit I

1.1 Stereochemistry II (10 L)

1.1.1 Conformational analysis of medium rings: Eight to ten membered rings and their unusual properties, I-strain, transannular reactions

1.1.2 Stereochemistry of –

i) Substitution reactions :SNi (reaction of alcohol with thionyl chloride)

ii) Elimination reactions: E2–Base induced dehydrohalogenation of 1-bromo-1,2- diphenylpropane.

iii) Addition reactions to olefins: a) bromination (electrophilic anti addition) b) syn hydroxylation with OsO4 and KMnO4 c) epoxidation followed by hydrolysis.

1.2 Amino acids & Proteins (5 L)

1.2.1 α-Amino acids: General Structure, configuration, and classification based on structure and nutrition. Properties: pH dependency of ionic structure, isoelectric point and zwitter ion. Methods of preparations: Strecker synthesis, Gabriel phthalamide synthesis.

1.2.2 Polypeptides and Proteins: nature of peptide bond. Nomenclature and representation of

polypeptides (di-and tri-peptides) with examples Merrifield solid phase polypeptide synthesis. Protiens:general idea of primary,secondary,tertiary& quaternary structure.

Unit II

2.1 Molecular Rearrangements (5 L)

Mechanisms, stereochemistry (if applicable) and applications of the following :
Concerted rearrangements : Hofmann , Curtius rearrangement,Cationic rearrangements : Dienone-phenol, Wagner-Meerwein rearrangement,Anionic rearrangements : Wittig rearrangement

2.2 Carbohydrates (10 L)

2.2.1 Introduction: classification, reducing and non-reducing sugars, DL notation

2.2.2 Structures of monosaccharides: Fischer projection (4-6 carbon monosaccharides) and Haworth formula (furanose and pyranose forms of pentoses and hexoses) Interconversion: open chain and Haworth forms of monosaccharides with 5 and 6 carbons.

2.2.3 Stereoisomers of D-glucose: enantiomer, diastereomers, anomers, epimers.

2.2.4 Mutarotation in D-glucose with mechanism

2.2.5 Chain lengthening & shortening reactions: Modified Kiliani-Fischer synthesis (D-arabinose to D-glucose and D-mannose), Wohl method (D-glucose to D-arabinose)

2.2.6 Reactions of D-glucose and D-fructose: (a) Osazone formation (b) reduction: Hi/Ni, $NaBH_4$ (c) oxidation: bromine water, HNO_3, HIO_4 (d) acetylation (e) methylation:(d) and (e) with cyclic pyranose forms

Unit III

3.1 Spectroscopy II (10 L)

3.1.1 IR Spectroscopy: Basic theory, nature of IR spectrum, selection rule, fingerprint region.

3.1.2 PMR Spectroscopy: Basic theory of PMR, nature of PMR spectrum, chemical shift (δ unit), standard for PMR, solvents used. Factors affecting chemical shift: (1) inductive effect (2) anisotropic effect (with reference to C=C, C≡C, C=O and benzene ring). Spin- spin coupling and coupling constant. application of deuterium exchange technique. application of PMR in structure determination.

3.1.3 Spectral characteristics of following classes of organic compounds, including benzene and monosubstituted benzenes, with respect to IR and PMR: (1) alkanes (2) alkenes (3) alkynes (4) haloalkanes (5) alcohols (6) carbonyl compounds (7) ethers (8) amines (broad regions characteristic of different groups are expected). Problems of structure elucidation of simple organic compounds using individual or combined use of UV- Vis, IR, Mass and NMR spectroscopic technique are expected. (Index of hydrogen deficiency should be the first step in solving the problems).

3.2 Nucleic acids: (05L)

Selective hydrolysis of nucleic acids. Sugars and bases in nucleic acids. Structures of nucleosides an nucleotides in DNA and RNA. Structure of nucleic acids (DNA and RNA): Base pairing in nucleic acids. Importance of nucleic acids-self duplication, protein synthesis.

Unit IV

4.1 Polymer (8 L)

4.1.1 Introduction: terms monomer, polymer, homopolymer, copolymer, thermo plastics and thermosetting plastics

4.1.2 Preparation and uses of
Addition polymers: polyethylene, polypropylene, Teflon, polystyrene, PVC, Uses.
Condensation polymers: polyamides, polyurethanes, polycarbonates, phenol formaldehyde resins.

4.1.3 Stereochemistry of polymers: Tacticity

4.1.4 Additives to polymers: Plasticisers, stabilizers and fillers.

4.1.5 Recyclable polymers: Biodegradable polymers: Classification and uses.

4.1.6 Biomedical use of polymers.

4.2 Retrosynthetic analysis and applications (07)

Introduction, Different terms used – Disconnection, Synthons, Synthetic equivalence, FGI, TM. One group disconnection,Retrosynthesis and Synthesis of target molecules: Acetophenone, Crotonaldehyde, Cyclohexene, Benzylbenzoate, and Benzyl diethyl malonate.

References: Unit I

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2. Stereochemistry P.S.Kalsi , New Age International Ltd.,4th Edition
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References: Unit II

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References: Unit IV

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4. Organic chemistry by Francis Carey – Mc GrawHill .
5. Organic chemistry by Carey and Sundberg, Part A & B

T.Y.B.Sc Chemistry (Semester – VI)

UGCH 604: ANALYTICAL CHEMISTRY

Credits: 2
Lectures: 60

UGCH 604	Analytical Chemistry	Unit-I: electro analytical techniques	1. To understand the principle and Instrumentation. [2] 2. To differentiate between potentiometry and voltammetry, Polarizableand non-polarizable electrodes. [2,3] 3. To know Basic principle of polarography H- shaped polarographic cell. [1,2] 4. To understand Rotating Platinum Electrode(Construction, advantages and limitations) [2]
		Unit II: methods of separation-ii	1. To understand the principle and Instrumentation. [2] 2. To use of detectors for analysis various types of sample. [2,3] 3. To understand the applications separation methods. [2] 4. To understand the qualitative and quantitative applications. [2]
		Unit III: food and cosmetics analysis	1. To understand the Food processing and preservation. [2] 2. To evaluate sodium benzoate by HPLC. [2,3] 3. To find out the food adulterants. [5] 4. To analyze cosmetics[4]
		Unit IV: thermal methods and analytical methodvalidation	1. To understand the basic principle and instrumentation of Thermal Methods. [2] 2. To find out the applications of Thermal Methods. [2] 3. To understand the need of method validation. [2] 4. To evaluate need for a validation of a method. [5]

UNIT I: Electro Analytical Techniques

1.1 Polarography (Numerical and word problems are expected) (11)

1.1.1 Difference between potentiometry and voltammetry, Polarizable and non-polarizable electrodes

1.1.2 Basic principle of polarography H shaped polarographic cell,

DME(construction, working, advantages and limitations)

1.1.3 DC polarogram: Terms involved - Residual current, Diffusion current, Limiting current, Half-Wave Potential Role and selection of supporting electrolyte, Interference of oxygen and its removal, polarographic Maxima and Maxima Suppressors. Qualitative aspects of Polarography: Half wave potential $E_{1/2}$, Factors affecting $E_{1/2}$ Quantitative aspects of polarography: Ilkovic equations: various terms involved in it (No derivation)

1.1.4 Quantification1) Wave height - Concentration plots (working plots/calibration) 2) Internal standard (pilot ion) method 3) Standard addition method

1.1.5 Applications advantages and limitations

1.2 Amperometric Titrations (4)

1.2.1 Principle, Rotating Platinum Electrode(Construction, advantages and limitations)

1.2.2 Titration curves with example

1.2.3 Advantages and limitations

UNIT II: Methods of Separation - II

2.1 Gas Chromatography (Numerical and word problems are expected) (9)

2.1.1 Introduction, Principle, Theory and terms involved

2.1.2 Instrumentation: Block diagram and components, types of columns, stationary phases in GSC and GLC, Detectors: TCD, FID, ECD

2.1.3 Qualitative, Quantitative analysis and applications

2.1.4 Comparison between GSC and GLC

2.2 Ion Exchange Chromatography (6)

2.2.1 Introduction, Principle.

2.2.2 Types of Ion Exchangers , Ideal properties of resin

2.2.3 Ion Exchange equilibria and mechanism, selectivity coefficient and separation factor. Factors affecting separation of ions

2.2.4 Ion exchange capacity and its determination for cation and anion exchangers.

2.2.5 Applications of Ion Exchange Chromatography with reference to preparation of demineralised water, Separation of amino acids

UNIT III: Food and Cosmetics Analysis

3.1 Introduction to food chemistry (10)

3.1.1 Food processing and preservation: Introduction, need, chemical methods, action of chemicals(Sulphur dioxide, boric acid, sodium benzoate, acetic acid, sodium chloride and sugar) and pH control Physical methods (Pasteurization and Irradiation)

3.1.2 Determination of boric acid by titrimetry and sodium benzoate by HPLC.

3.1.3 Study and analysis of food products and detection of adulterants 1) Milk: Composition & nutrients, types of milk (fat free, organic and lactose milk) Analysis of milk for lactose by Lane Eynon's Method 2) Honey:

CompositionAnalysis of reducing sugars in honey by Coles Ferricyanide method 3) Tea: Composition, types (green tea and mixed tea) Analysis of Tannin by Lowenthal's method 4) Coffee:Constituents and composition, Role of Chicory Analysis of caffeine by Bailey Andrew method

3.2 Cosmetics (5)

3.2.1 Introduction and sensory properties

3.2.2 Study of cosmetic products –

1) Face powder: Composition Estimation of calcium and magnesium by complexometric titration

2) Lipstick: Constituents Ash analysis for water soluble salts: borates, carbonates and zinc Oxide

3) Deodorants and Antiperspirants: Constituents, properties Estimation of zinc by gravimetry

UNIT IV: Thermal Methods and Analytical Method Validation

4.1 Thermal Methods (12)

4.1.1 Introduction to various thermal methods (TGA, DTA and Thermometric titration)

4.1.2 Thermogravimetric Analysis(TGA) Instrumentation-block diagram,thermobalance (Basic components: balance, furnace, temperature measurement and control, recorder) Thermogram (TG curve)for$CaC_2O_4..H_2O$ and $CuSO_4.5H_2O$. Factors affecting thermogram-Instrumental factors and Sample characteristics. Applications: Determination of drying and ignition temperature range. Determination of percent composition of binary mixtures (Estimation of Calcium and Magnesium oxalate)

4.1.3 Differential Thermal Analysis (DTA): Principle, Instrumentation, and Reference material used Differential thermogram (DTA curve) $CaC_2O_4.H_2O$ and $CuSO_4.5H_2O$ Applications Comparison between TGA and DTA.

4.1.4 Thermometric Titrations - Principle and Instrumentation Thermometric titrations of :

1) HCl v/s NaOH
2) Boric acid v/s NaOH
3) Mixture of Ca^{+2} and Mg^{+2} v/s EDTA
4) Zn^{+2} with Disodium Tartarate.

4.2 Analytical Method Validation 03L

4.2.1 Introduction and need for validation of a method

4.2.2 Validation Parameters: Specificity, Selectivity, Precision, Linearity, Accuracy and Robustness Note: Concept of sensitivity is to be discussed for all techniques and instruments mentioned in the syllabus.

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1. An Advance Dairy chemistry, V 3, P. F. Fox, P. L. H. McSweeney Springer Unit/s (3.1,3.2)

2. Analysis of food and Beverages, George Charalanbous, Academic press 1978 Unit/s (3.1,3.2)

3. Analytical Chemistry of Open Learning(ACOL),James W. Dodd & Kenneth H. Tonge Unit/s (4.1,4.2)

4. Analytical chemistry David Harvey The ,McGraw Hill Companies, Inc. Unit/s (4.1,4.2)

5. Analytical Chemistry, Gary.D Christan, 5th edition Unit/s (2.1,2.2)

6.Analytical chemistry, R. K. Dave.Unit/s (2.1,2.2)

7. Chemical methods of separation, J A Dean, Van Nostrand Reinhold, 1969 Unit/s (2.1,2.2)

8.Egyankosh.ac.in/bitstream/123456789/43329/1/Unit-8Unit/s (1.1,1.2,1.3)

9.Food Analysis, Edited by S. Suzanne Nielsen, SpringerUnit/s (3.1,3.2)

10. Food Analysis: Theory and practice, Yeshajahu Pomeranz, Clifton E. Meloan, Springer Unit/s (3.1,3.2)

11.Formulation and Function of cosmetics, Sa JellineckUnit/s (3.1,3.2)

12. Fundamentals of Analytical Chemistry, D .A. Skoog and D. M. West and F. J. Holler Holt., Saunders 6th Edition (1992) Unit/s (2.1,2.2)

13. Government of India publications of food drug cosmetic act and rules. Unit/s (3.1,3.2)

14.Harry's Cosmetology, Longman scientific co.Unit/s (3.1,3.2)

15. High Performance Thin Layer Chromatography in Food

analysis, by Prem kumar, CBS Publisher and distributerUnit/s (3.1,3.2)

16. Instrumental methods Of Analysis, by Willard Merritt Dean,

7thEdition, CBS Publisher and distribution Pvt Ltd Unit/s (1.1,1.2,1.3) (4.1,4.2,4.3)

17. Introduction to Polarography and Allied Techniques, By Kamala Zutshi, New Age International, 2006. Unit/s (1.1,1.2,1.3)

18.Modern cosmetics, E. Thomessen Wiley Inter scienceUnit/s (3.1,3.2)

19. Principles of Instrumental Analysis , 5th Edition, By Skoog, Holler, Nieman Unit/s (4.1,4.2,4.3)

20. Principles of Polarography by Jaroslav Heyrovský , Jaroslav Kůta, 1st Edition, Academic Press, eBook ISBN: 978148326478 Unit/s (1.1,1.2,1.3)

21. Solvent extraction and ion exchange, J Marcus and A. S. Kertes Wiley INC 1969 Unit/s (2.1,2.2,)

T.Y.B.Sc Chemistry (Semester – VI)

UGCH 605: DRUGS and DYES

Credits: 2

Lectures: 60

UGCHDD 601	Drugs and Dyes	**Unit-I**	1. To know about Drug Discovery, Design and Development. [1,2] 2. To develop the drug using Structure activity relationship (Sulphonamides). [4] 3. To understand the effect Structure modification on potency of drugs. [2] 4. To know about chemotherapeutic agents with respect to their chemical structure[2] 5. Be able to synthesize Levofloxacin, Albendazole and Fluconazole[6]
		Unit II	1. To know about Antiamoebic, Antitubercular, Antileprotic, Antileprotic and Anti-HIV Drugs[2] 2. To understand actions of Chemotherapeutic Agents, Antibiotics and antivirals, Antimalarials, Antitubercular and Antileprotic Drugs, Anti-HIV Drugs. [2] 3. To know concepts of Drug Intermediates: Synthesis and uses[2] 4. To understand concepts of Drugs and Environmental Aspects. [2]
		Unit III	1. To classify dyes based on Chemical Constitution[3] 2. To understand the impact of the textile and leather dye Industry on the environment[2] 3. To know the process and working of effluent treatment plants (ETP) [2] 4. To know thetoxicity of dyes with respect to foods[2]
		Unit IV	1. To know Non-textile uses of dyes, Pigments, Dyestuff Industry. [2] 2. To compare between FDA and FSSAI regulations[2,3] 3. To know about the future aspects of the Dye

			industry. [1,2] 4. To list out Strengths, Weaknesses, Opportunities and Challenges of the Dyestuff industry in India. [2]

UNIT I:

1.1 Drug Discovery, Design and Development (6)

1.1.1 Discovery of a Lead compound: Screening, drug metabolism studies and clinical observation, Lipinski's rule of 5

1.1.2 Medicinal properties of compounds from Natural Sources: Anti- infective and anticancer properties of Turmeric (Curcumin)

1.1.3 Development of drug: The Pharmacophore identification, modification of structure or functional group, Structure activity relationship (Sulphonamides).

1.1.4 Structure modification to increase potency: Homologation, Chain branching and Extension of the structure.

1.1.5 Computer assisted drug design.

1.2 Drug Metabolism (3)

Introduction, Absorption, Distribution, Bio-transformation, Excretion Different types of chemical transformation of drugs with specific examples.

1.3 Chemotherapeutic Agents (6)

Study of the following chemotherapeutic agents with respect to their chemical structure, chemical class, therapeutic uses, side effects and introduction to MDR wherever applicable.

1.3.1 Antibiotics and antivirals: Definition

- Amoxicillin (□- lactum antibiotics)
- Cefpodoxime (Cephalosporins)
- Doxycycline (Tetracyclines)
- Levofloxacin (Quinolones) (Synthesis from 2,3,4 - Trifluro -1-nitrobenzene)
- Aciclovir/Acyclovir (Purines)

1.3.2 Antimalarials: Types of malaria; Symptoms; Pathological detection during window period (Life cycle of the parasites not to be discussed)

- Chloroquine (3-Amino quinolones)
- Artemether(Benzodioxepins)

1.3.3 Anthelmintics and AntiFungal agents (Drugs effective in the treatment of Nematodes and Cestodes Infestations)

- Diethyl carbamazine (Piperazines)
- Albendazole(Benzimidazoles) (Synthesis from 2-Nitroaniline)
- Clotrimazole (Imidazole)
- Fluconazole (Triazole) (Synthesis from 1- Bromo - 2,4-difluorobenzene)

UNIT II:

2.1 Antiamoebic Drugs (1)

Types of Amoebiasis - Metronidazole, Ornidazole, Tinidazole (Imidazole)
Synthesis of Metronidazole from glyoxal by Debus- Radziszewski imidazole synthesis route. Following combination therapy to be discussed: Ciprofloxacin-Tinidazole.

2.2 Antitubercular and Antileprotic Drugs (3)

Types of Tuberculosis; Symptoms and diagnosis of Tuberculosis. Types of Leprosy. General idea of Antibiotics used in their treatment.

- PAS (Amino salicylates)
- Isoniazide (Hydrazides)
- Pyrazinamide (Pyrazines)
- (+) Ethambutol (Aliphatic diamines) (Synthesis from 1- Nitropropane)
- Dapsone(Sulphonamides)(Synthesis from 4- Chloronitrobenzene)
- Clofazimine (Phenazines)
- Bedaquiline (Quinoline)

Following combination therapy to be discussed:

- Rifampin + Ethambutol + Pyrazinamide
- Rifampin + Isoniazide + Pyrazinamide

2.3 Anti-Neoplastic Drugs (2)

Idea of malignancy; Causes of cancer. Brief idea of Immuno Stimulants &Immuno depressants

- Lomoustine (Nitrosoureas)
- Anastrozole(Triazoles) (Synthesis from 3,5-bis (bromo methyl) toluene)
- Cisplatin (Chloro Platinum)
- Vincristine, Vinblastine, Vindesine) (Vinca alkaloids) (structure not expected)

2.4 Anti-HIV Drugs (1)

Idea of HIV pathogenicity, Symptoms of AIDS. AZT/Zidovudine, Lamivudine,DDI (Purines)

2.5 Drug Intermediates: Synthesis and uses (2)

- 2,3,6-Triamino-6- hydroxypyrimidine from Guanidine
- p-[2'-(5-Chloro-2-methoxy benzamido) ethyl]- benzenesulphonamide from Methyl-5-chloro-2- methoxybenzene
- 3-(p-Chlorophenyl)-3-hydroxypiperidine from 3-Chloroacetophenone
- p-Acetyl amino benzenesulphonyl chloride from Aniline
- Epichlorohydrine from propene

2.6 Nano particles in Medicinal Chemistry (4)

Introduction; Carbon nano particles (structures) and Carbon nano tubes:

- Functionalization for Pharmaceutical applications
- Targeted drug delivery
- In vaccine (Foot and mouth disease)
- Use in Bio-physical treatment.

Gold nano particles in treatment of: Cancer; Parkinsonism; Alzheimer. Silver nano particles: Antimicrobial activity.

2.7 Drugs and Environmental Aspects

- Impact of Pharma-industry on environment,
- International regulation for human experimentation with reference to: "The Nuremberg Code" and "The Helsinki Declaration".

UNIT III:

3.1 Classification of Dyes based on Chemical Constitution and Synthesis of Selected Dyes (Synthesis of the dyes marked with * is expected) **(12)**

- Nitro Dye: Naphthol Yellow S
- Nitroso Dye: Gambine Y
- Azo dyes:
  - Monoazo dyes: Orange IV *(from sulphanilic acid) & Eriochrome Black T* (from β- naphthol)
  - Bisazo dyes: Congo Red* (from nitrobenzene)
  - Trisazo Dye: Direct Deep Black EW* (from benzidine)
- Diphenylmethane dye: Auramine O* (from N,N-dimethyl aniline)
- Triphenylmethane dye:
  - Diamine series: Malachite Green* (from benzaldehyde)
  - Triamine series: Acid Magenta
  - Phenol series: Rosolic acid
- Heterocyclic Dyes:
  - Thiazine dyes: Methylene Blue
  - Azine dyes: Safranin T* (from o-toluidine)
  - Xanthene Dyes: Eosin* (from phthalic anhydride)
  - Oxazine Dyes: Capri Blue
  - Acridine Dyes: Acriflavine
- Quinone Dyes:
  - Naphthaquinone: Naphthazarin
  - Anthraquinone Dyes: Indanthrene Blue* (from anthraquinone)
- Indigoid Dyes: Indigo* (from aniline + monochloroacetic acid)
- Phthalocyanine Dyes: Monastral Fast Blue B

3.2 Health and Environmental Hazards of Synthetic Dyes and their Remediation Processes (3)

3.2.1 Impact of the textile and leather dye Industry on the environment with special emphasis on water pollution

3.2.2 Health Hazards: Toxicity of dyes w.r.t food colours.

3.2.3 Effluent Treatment Strategies: Brief introduction to effluent treatment plants (ETP), Primary Remediation processes:(Physical Processes) Sedimentation, Aeration, Sorption (activated charcoal, fly ashetc.) Secondary Remediation processes: Biological Remediation, Biosorption, bioremediation and biodegradation. Chemical Remediation: Oxidation Processes (chlorination), Coagulation-flocculation-Precipitation

UNIT IV:

4.1 Non-textile uses of dyes (8)

4.1.1 Biomedical uses of dyes

- Dyes used in formulations (Tablets, capsules, syrups etc), Indigo carmine, Sunset yellow, Tartrazine
- Biological staining agents, Methylene blue, Crystal violet and Safranine T

- DNA markers, Bromophenol blue, Orange G, Cresol red
- Dyes as therapeutics, Mercurochrome, Acriflavine, Crystal Violet, Prontosil

4.1.2 Dyes used in food and cosmetics:
- Properties of dyes used in food and cosmetics
- Introduction to FDA and FSSAI
- Commonly used food colours and their limits

4.1.3 Paper and leather dyes
- Structural features of paper and leather
- Dyes applicable to paper and leather

4.1.4 Miscellaneous dyes
- Hair dyes
- Laser dyes
- Indicators
- Security inks
- Coloured smokes and camouflage colours

4.2 Pigments (3)

Definition of pigments, examples, properties of pigments, difference between dyes and pigments. Definition of Lakes and Toners

4.3 Dyestuff Industry - Indian Perspective (4)

4.3.1 Growth and development of the Indian Dyestuff Industry

4.3.2 Strengths, Weaknesses, Opportunities and Challenges of the Dyestuff industry in India

4.3.3 Make in India - Future Prospects of the Dye Industry

REFERENCES

1. Foye's principles of medicinal chemistry. 6th Edition, Edited by Davis William & Thomas Lemke, Indian edition by B I Publication Pvt Ltd, Lippmcolt Williams & Wilkins.
2. Text book of organic medicinal & pharmaceutical chemistry. Wilson &Gisovolds, 11th Edition by John H Block, John M Beale Jr.
3. Medicinal chemistry. Ashutosh Kar, New Age International Pvt. Ltd Publisher. 4th edition.
4. Burger's Medicinal Chemistry, Drug Discovery & Development. Abraham & Rotella. Wiley
5. Medicinal chemistry. Ashutosh Kar, New Age International Pvt. Ltd Publisher. 4th edition.
6. Medicinal chemistry. V.K. Ahluwalia and Madhu Chopra, CRC Press.
7. Principle of medicinal chemistry. Vol 1 & 2 S. S. Kadam, K. R. Mahadik, K. G. Bothara
8. The Art of Drug synthesis. Johnson and Li. Wiley, 2007.
9. The organic chemistry of drug design & drug action. 2nd ed. By Richard B Silvermann, Academic Press.
10. The Organic Chemistry of Drug Synthesis. Lednicer and Mitsher, Wliey.
11. Text book of drug design and discovery. Povl-Krog-Sgaard-Larsen,
12. Tommy Liljefors and ULF Madsen, 3rd Edition Taylor & Francis.

13. Bio-applications of nanoparticles. Edited by Warren C.W. Chan, Springer Publication.
14. Nanoparticle and technology for drug delivery (Drugs and pharmaceutical sciences). Ram B.Gupta& Uday B.Kompella Pub. Informa Healthcare.
15. Nano forms of carbon and its applications. Edited by Maheshwar Sharon and Madhuri Sharon.MonadNanotechPvt. Ltd.
16. Environmental Chemistry. A. K. De
17. Text Book on Law and Medicine. Chokhani and Ghormade. 2nd Edition. Hind Law House,Pune.
18. Essentials of Medical Pharmacology. K D Tripathi, Jaypee Brothers Medical publishers Pvt. ltd. Practical organic chemistry, Vogel.
19. Chemistry of Synthetic Dyes, Vol I - IV, Venkatraman K., Academic Press 1972
20. The Chemistry of Synthetic Dyes and Pigments, Lubs H.A., Robert E Krieger Publishing Company, NY ,1995
21. Chemistry of Dyes and Principles of Dyeing, Shenai V.A., Sevak Publications, 1973
22. Environmental Studies, Joseph Benny, Tata McGraw Hill Education, 2005
23. Fundamental Concepts of Environmental Chemistry, Sodhi. G. S., Alpha Science International, 2009
24. Planning Commission, Niti Aayog, FSSAI and FDA websites
25. Green Chemistry for Dyes Removal from Waste Water- Research Trends and Applications, Ed. Sharma S.K., Wiley, 2015
26. Environmental Pollution- Monitoring and Control, Khopkar S.M., New Age International (P) Ltd, New Delhi, 1982

T.Y.B.Sc Chemistry (Semester – VI)

UGCHPP 601: PHYSICAL CHEMISTRY PRACTICAL

Credits: 2

Lectures: 60

UGCHPP 601	Physical Chemistry Practical	1. To explain the interpretation of order of reaction graphically. [2] 2. To calculate the molecular weight of high polymer polyvinyl alcohol (PVA) by viscosity measurement. [2,3] 3. To detect the amount of halides in the mixture by potentiometric titration. [4] 4. To conclude with the determination of number of electrons in the redox reaction. [3] 5. To predict the amount of Fe(III) in the complex formation. [5]

Non-Instrumental

Chemical Kinetics

To interpret the order of reaction graphically from the given experimental data and calculate the specific rate constant.
(No fractional order)

Viscosity

To determine the molecular weight of high polymer polyvinyl alcohol (PVA) by viscosity measurement.

Instrumental

Potentiometry

To determine the amount of iodide, bromide and chloride in the mixture by potentiometric titration with silver nitrate.
To determine the number of electrons in the redox reaction between ferrous ammonium sulphate and cerric sulphate potentiometrically.

Conductometry

To titrate a mixture of weak acid and strong acid against strong base and estimate the amount of each acid in the mixture conductometrically.

Colorimetry

To estimate the amount of Fe(III) in the complex formation with salicylic acid by Static Method.

Reference:

1. Practical Physical Chemistry 3rd edition A.M.James and F.E. Prichard , Longman publication

2. Experiments in Physical Chemistry R.C. Das and B. Behra, Tata Mc Graw Hill

3. Advanced Practical Physical Chemistry J.B.Yadav, Goel Publishing House

4. Advanced Experimental Chemistry. Vol-I J.N.Gurtu and R Kapoor, S.Chand and Co.

5. Experimental Physical Chemistry By V.D.Athawale.

6. Senior Practical Physical Chemistry By: B. D. Khosla, V. C. Garg and A. Gulati, R Chand

T.Y.B.Sc Chemistry (Semester – VI)

UGCHPI 602: INORGANIC CHEMISTRY PRACTICAL

Credits: 2

Lectures: 60

UGCHPI 602	Inorganic Chemistry Practical	1. To carry out different inorganic complex preparations involving basic skills. [2,3] 2. To determine the of percentage purity of the given water soluble salt and qualitative detection w.r.t added cation and/or anion by wet tests. [3,4]

I. Inorganic preparations

1. Preparation of Tris(acetylacetonato) iron(III)
2. Green synthesis of bis(dimethylglyoximato) nickel(II) complex using nickel carbonate and sodium salt of dmg .
3. Preparation of potassium trioxalato aluminate (III)

II. Determination of percentage purity of the given water soluble salt and qualitative detection w.r.t added cation and/or anion (qualitative analysis only by wet tests). (Any three salts of main group metal ions)

Reference Books (practicals)

1.Vogel Textbook of Quantitative Chemical Analysis G.H. Jeffery, J. Basset.

2.Advanced experiments in Inorganic Chemistry., G. N. Mukherjee., 1st Edn., 2010., U.N.Dhur & Sons Pvt Ltd .

3.Vogel's. Textbook of. Macro and Semimicro qualitative inorganic analysis. Fifth edition

T.Y.B.Sc Chemistry (Semester – VI)

UGCHPO 603: ORGANIC CHEMISTRY PRACTICAL

Credits: 2

Lectures: 60

UGCHP 603	Organic Chemistry Practical	1. To Separate Binary liquid-liquid and liquid-solid mixtures. [4] 2. To carry out by distillation method using microscale technique. [4]

Separation of Binary liquid-liquid and liquid- solid mixture.

1. Minimum Six mixtures to be completed by the students.
2. Components of the liq-liq mixture should include volatile liquids like acetone, methylacetate, ethylacetate, isopropylalcohol, ethyl alcohol, EMK and non volatile liquids like chlorobenzene , bromobenzene, aniline, N,N dimethylaniline, acetophenone, nitrobenzene, ethyl benzoate.
3. Components of the liq- solid mixture should include volatile liquids like acetone, methylacetate, ethylacetate, ethyl alcohol, IPA, EMK and solids such as water insoluble acids, phenols, bases, neutral.
4. A sample of the mixture one ml to be given to the student for detection of the physical type of the mixture.
5. After correct determination of physical type, separation of the binary mixture to be carried out by distillation method using microscale technique.
6. After separation into component A and component B, the compound to be identified can be decided by examiner.

REFERENCES

1. Practical organic chemistry - A. I. Vogel
2. Practical organic chemistry - H.Middleton.
3. Practical organic chemistry - O.P.Aggarwal.

T.Y.B.Sc Chemistry (Semester – VI)

UGCHPA 604: ANALYTICAL CHEMISTRY PRACTICAL

Credits: 2
Lectures: 60

UGCHP 604	Analytical Chemistry Practical	1. To estimate Chromium in water sample spectrophotometrically by using Diphenyl carbazide. [4] 2. To estimate reducing sugar in honey by Willstatter method. [4] 3. Estimation of Mg+2 & Zn+2 by anion exchange resin using an anion exchange resin. [4] 4. To estimate acetic acid in Vinegar sample by using Quinhydrone electrode potentiometrically, [4] 5. Determination of phosphoric acid in cola sample pH metrically. [4]

1. Estimation of Chromium in water sample spectrophotometrically by using

Diphenyl carbazide.
2. Estimation of reducing sugar in honey by Willstatter method.
3. Estimation o Mg^{+2} & Zn^{+2} by anion exchange resin.using an anion exchange resin
4. Estimation of acetic acid in Vinegar sample by using Quinhydrone electrode potentiometrically.
5. Determination of phosphoric acid in cola sample pH metrically.

Note: Calculation of percent error is expected for all the experiments.

REFERENCES

1. Vogel's Textbook of Quantitative Chemical Analysis, 5thEdn., G. H. Jeffery, J Bassett, J Memdham and R C Denney, ELBS with Longmann (1989).
2. Vogel's Textbook of Quantitative Chemical analysis, Sixth edition, J.Mendham et.al
3. The chemical analysis of food and food products III edition Morris Jacob
4. The chemical analysis of food by David Pearson and Henry Edward

T.Y.B.Sc Chemistry (Semester – VI)

UGCHPD 605: DRUGS AND DYES PRACTICAL

Credits: 2

I] Preparations:

1. O-Methylation of β-naphthol.
2. Preparation of Paracetamol form p-aminophenol.
3. Preparation of Fluorescein
4. TLC of a mixture of dyes (safranine-T, Indigo carmine, methylene blue)
5. To determine percentage purity of calcium gluconate in a given drug by complexometric titration.
6. Determination of refractive index of following drugs by refractomer
   a. Methyl salicylate b. Euginol c. Cinnamon Oil

II] Preparation of monograph of any one drug from syllabus by I.P. method.
OR Industrial visit Report.
Project Work

Formulations: Preparation of representative examples of drugs in the following forms (Any seven) i) Glycerines: - Borax glycerine, Phenol ii) Syrups Simple syrup by IPS USP. - Lemon syrup iii) Oral solution -Sodium citrate and citric acid solution, KI oral solution .strong iodine solution iv)Emulsion - Cod liver oil emulsion, Turpentine Emulsion, Castor oil emulsion, Acacion emulsion v) Lotions - Calamine lotion, Zinc sulphate lotion vi) Ointments - Simple ointment, Sulphur ointment vii) Elixirs _ Simple elixi viii) Ear Drops _H2O2 ear drops, sodium bicarbonate ear drops.