SACRED HEART COLLEGE (AUTONOMOUS)

Tirupattur – 635 601, Tamil Nadu, S.India

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Ready for Every Good Work

A Don Bosco Institution of Higher Education, Founded in 1951 * Affiliated to Thiruvalluvar University, Vellore * Autonomous since 1987

Accredited by NAAC (4th Cycle – under RAF) with CGPA of 3.31 / 4 at 'A+' Grade

Sacred Heart College (Autonomous), Tirupattur District

1.2.1 List of New Courses

B.Sc. Chemistry

Year / Semester	Part	Subject	Title of the Paper	Hrs / Week	Credits	Exam hours	Max Marks		
							CIA	Sem	Total
I Year / I Semester	I	Tamil	Tamil - I	5	3	3	25	75	100
	II	English	English - I	5	3	3	25	75	100
	II		Communicative English		1				
	III	Core	General Chemistry - I	4	4	3	25	75	100
	III	Core	General Chemistry - II	3	3	3	25	75	100
	III	Core Practical	Volumetric Analysis	3	3				
	III	Allied	Allied Mathematics - I	6	4	3	25	75	100
	IV		FC	2	1				
	IV		Religion & Ethics - I	2	1	3	25	75	100
I Year / II Semester	I	Tamil	Tamil - II	5	3	3	25	75	100
	II	English	English - II	5	3	3	25	75	100
	II		Communicative English		1				
	III	Core	General Chemistry - III	4	4	3	25	75	100
	III	Core	General Chemistry - IV	3	3	3	25	75	100
	III	Core Practical	Volumetric Analysis	3	3	3	40	60	100
	III	Allied	Allied mathematics - II	6	4	3	25	75	100
	IV		FC	2	1	3	40	60	100
	IV		Religion & Ethics - II	2	1	3	25	75	100
II Year / III Semester	I	Tamil	Tamil - III	5	3	3	25	75	100
	II	English	General English - III	5	3	3	25	75	100
	III	Core	Organic Chemistry - I	4	4	3	25	75	100
	III	Core	Analytical Chemistry - I	3	3	3	25	75	100
	III	Core Practical	Qualitative Inorganic Analysis	3	3				
	III	Allied	Allied Physics - I	6	4	3	25	75	100
	IV		FC	2	1				
	IV		Human Rights	2	1	3	25	75	100

	V		DEEDS						
	V		SHELTERS						
			Certificate course - I		2*				
II Year / IV Semester	I	Tamil	Tamil - IV	5	3	3	25	75	100
	II	English	English - IV	5	3	3	25	75	100
	III	Core	Inorganic Chemistry - I	4	4	3	25	75	100
	III	Core	Physical Chemistry - I	3	3	3	25	75	100
	III	Core Practical	Qualitative Analysis	3	3	4.5	40	60	100
	III	Allied	Allied Physics - II	6	4	3	25	75	100
	IV		FC	2	1		40	60	100
	IV		Environmental Studies	2	1	3	25	75	100
	V		DEEDS		2				
	V		SHELTERS		2				

III Year / V Semester	III	Core	Organic Chemistry - II	4	4	3	25	75	10
	III	Core	Inorganic Chemistry - II	4	4	3	25	75	10
	III	Core	Physical Chemistry - II	4	4	3	25	75	10
	III	Core	Analytical Chemistry -II	4	4	3	25	75	10
	III	Main Elective	Elective – I	4	2	3	25	75	10
	III	Main Elective	Elective – II	2	2	3	25	75	10
		SSP	Chemistry for Competitive Exam - I		1*				
	III	Core Practical	Gravimetric & Organic Analysis	3	3		40	60	10
	III	Core Practical	Physical Chemistry Practicals	3	3		40	60	10
		NME	Chemistry of Drugs and Disease	2	1		25	75	10
			Certificate Course - II		2*				
III Year / VI Semester	III	Core	Organic Chemistry - III	4	4	3	25	75	10
	III	Core	Inorganic Chemistry - III	4	4	3	25	75	10
	III	Core	Physical Chemistry - III	4	4	3	25	75	10
	III	Subject Skill (SS-I)	Paper - I	5	4	3	25	75	10
	III	Subject Skill (SS-II)	Paper - II	5	4	3	25	75	10
	IV	NME	Chemistry in Everyday Life	2	1	3	25	75	10
	III	SSP	Chemistry for Competitive Exam - II		1*				
	III	Core Practical	Gravimetric & Organic Analysis	3	3	6	40	60	10

	III	Core Practical	Physical Chemistry Practicals	3	3	3	40	60	10
			Project*		2*				
			Total	180	148 +2+ 2*				

*** Extra credits**

Note:

- SSP/Project/Certificate course - optional

Abbreviations

FC	Foundation Course
Comm. Eng	Communicative English
ET	Ethics
RE	Religion
DEEDS	Dept. of extension and educational services.
HR	Human Rights
SSP	Self study paper
NME	Non-major Elective

List of Electives

Elective - I **4 Hours**

1. Pharmaceutical Chemistry
2. Clinical Biochemistry
3. Bio-Inorganic Chemistry

Elective - II **2 Hours**

1. Applied Chemistry
2. Protein Chemistry
3. Computer for Chemists

Subject Skill Papers **5 Hours**

1. Polymer Chemistry
2. Industrial and Environmental Chemistry
3. Green Chemistry
4. Materials Chemistry
5. Inorganic Materials of Industrial Importance
6. Reaction Mechanisms and Reagents in Organic Chemistry

Certificate Courses **2 Hours**

1. Organic Farming

2. Industrial Safety

Sacred Heart College (Autonomous), Tirupattur District

1.2.1 List of New Courses

Department: B. SC. CHEMISTRY

S. NO	COURSE CODE	COURSE NAME
1	CH314	Organic Chemistry- I
2	CH315	Analytical Chemistry- I
3	ACH307A	Allied Chem (Mat)- I
4	ACH307B	Allied Chem (Phy)- I
5	CH414	Inorganic Chemistry- I
6	CH415	Physical Chemistry- I
7	ACH408A	Allied Chem (Mat)- II
8	ACH408B	Allied Chem (Phy)- II

SYLLABUS

Semester–III CH 314 Organic Chemistry –I 4 Hrs/week (4 Credits)

Objectives

- To understand the structure, reaction mechanisms of carboxylic acids.
- To understand rearrangements in organic reaction mechanisms
- To study organo metallic compounds

Unit - I: Carboxylic Acids and their derivatives **12 hours**

1.1 Carboxylic acids (aliphatic and aromatic)-Structure-Nomenclature-salts of carboxylic acids-Industrial source. Preparation-Acidic and Alkaline hydrolysis of esters Reactions-Halogenation of aliphatic acids-Hell – Vohlard - Zelinsky Reaction

1.2 Carboxylic acid derivatives (aliphatic)-Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their inter conversion.

1.3 preparation and properties of Dicarboxylic acids (oxalic, malonic acids) – action of heat on aliphatic dicarboxylic acid, preparation and properties of phthalic acid.

1.4 Comparative study of nucleophilicity of acyl derivatives. Mechanism of Reformatsky Reaction and Perkin reaction.

Unit - II: Amines and Diazonium Salts **12 hours**

2.1 Amines (Aliphatic and Aromatic): (Upto 5 carbons) Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction.

2.2 Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2, Schotten – Baumann Reaction.

2.3 Electrophilic substitution: nitration, bromination, sulphonation of aniline with mechanism.

2.4 Diazonium salts: Diazotization (mechanism), Preparation and properties.

Unit - III: Molecular rearrangements **12 Hours**

3.1 Molecular rearrangements: Classification – anionotropic and cationotropic,Inter molecular and intra molecular rearrangements

3.2 Mechanisms, evidences, migratory aptitude of the following rearrangements: carbon to carbon migration – Pinocol – pinocolone, Benzilic acid rearrangements

3.3 Carbon to Nitrogen migration – Beckmann, Hoffmann and Curtius rearrangement.

3.4 Carbon to oxygen and other migrations Baeyer- Villiger, Stevens rearrangement.

Unit - IV: Organometallics **12 hours**

4.1 Organometallic compounds: Formation and synthetic applications of organomagnesium compounds.

4.2 Formation and synthetic applications of organozinc compounds. Formation and synthetic applications of Organolithium compounds.

4.3 Reduction: Mechanism of reduction with sodium borohydride, lithium aluminium hydride.

4.4 Wolff-Kishner reaction, MPV reduction and Rosenmunds reduction.

Unit -V: Alkanes, cycloalkanes and active methylene compounds **12 hours**

5.1 **Alkynes**: General methods of Preparation and properties: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.

5.2 Reactions: formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$.

5.3 **Cycloalkanes** : Preparation and properties, Bayer's strain theory.

5.4 **Active methylene compounds:** Preparation and synthetic applications of acetoacetic ester, malonic ester and cyano acetic ester.

References

1. R. T. Morrison, and R. N. Boyd, *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), New Delhi, 2008.
2. I. L. Finar, *Organic Chemistry* Volume I, 6th edition, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), 1973.
3. I. L. Finar, Organic Chemistry Volume 2, 5th edition, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), 1956.
4. A. Bahl and B. S. Bahl, *Advanced Organic Chemistry*, S.Chand publications, New Delhi, 2006.
5. M. K. Jain and S.C. Sharma, *Modern Organic Chemistry*, 4th edition, Vishal publisher Co, Jalandar, 2009.

Learning Outcomes

- Design synthetics methods for the preparation of carboxylic acids, amines and diazonium salts, alkynes and cycloalkanes
- Identify different molecular rearrangements and the basis for such behavior with mechanism
- Sketch synthetic strategy using organometallic compounds

Semester – III CH 315 Analytical Chemistry–I 3 Hrs / week (3 Credits)

Objectives

- To learn the basic principles and applications of important analytical techniques
- To develop a sound knowledge in chemistry involved in an analysis

Unit - I: Separation Techniques **9 Hours**

1.1 Solvent Extraction-Principle-Extracting from solid-liquid phases-Soxhletextractor Extraction by chemically active solvents-Chromatography-types of chromatography.

1.2 Principle, techniques and applications of TLC, and Paper. Principle, techniques and applications of Column chromatography.

1.3 Gas-Liquid chromatography-Principle, Instrumentation, and applications.

Unit - II: Gravimetric Analysis **9 Hours**

2.1 Gravimetric analysis-Principle-Conditions of precipitation-choice of Precipitants. Inorganic and Organic Precipitants-specific and selective precipitants.

2.2 Masking agents-Precipitation from homogeneous medium-Post precipitation-Co-precipitation-Differences between post and Co-precipitation.

2.3 Principles of thermogravimetric analysis and instrumentation-Derivative thermogravimetry-Factors influencing thermogram.DTA-Principle and instrumentation-Applications: TGA-Calcium oxalate monohydrate-DTA-Calcium acetate monohydrate. Differential thermogravimetry, Principle and applications

Unit - III: Radioanalytical Techniques **9 Hours**

3.1 Radioactive decay process – photoelectric, Compton and ion-pair production effects the decay law and units of radioactivity

3.2 Detection and measurement of radioactivity-counters and detectors

3.3 Isotopic dilution method-Principle-applications-Radioisotopes as tracers.

Unit - IV: Mass spectrometry **9 Hours**

4.1 Mass spectrometry-Principle-Instrumentation-Dampster spectrometer.

4.2 McLaffertary rearrangement - The Mass spectrum-fragmentation with illustration: CH_4, C_2H_5OH, CH_3COCH_3,

4.3 Determination of molecular formula and molecular weight: Example-Acetic acid.

Unit -V: X ray and Photo Electron Spectroscopy **9 Hours**

5.1 X-ray Spectroscopy- theory, Instrumentation and X-ray absorption, emission and diffraction

5.2 Bragg's equation and applications of x-ray spectroscopy.

5.3 Photo electron spectroscopy-Principle, Instrumentation and applications.

References

1. Gary D. Christian,; Purnendu K. Dasgupta,; Kevin A. Schug, *Analytical Chemistry*, 7th Edition;Wiley Global Education, 2013.
2. Douglas A. Skoog,; F. James Holler,; Stanley R. Crouch, *Principles of Instrumental Analysis*, 6th Edition;Cengage Learning, 2006.
3. John H Kennedy, *Analytical Chemistry: Principles*, 2nd Edition; Saunders College Pub, 1990.
4. Larry G. Hargis, *Analytical Chemistry: Principles and Techniques*, 1st Edition; Prentice Hall, 1988.
5. Reuben Alexander Day,; Arthur Louis Underwood, *Quantitative Analysis*, 6th Edition;Prentice Hall India Learning Private Limited, 1992.
6. S. M. Khopkar, *Basic Concepts of Analytical Chemistry*, 3rd Rev Edition; New Age Science Ltd, 2008.
7. Frank A. Settle, *Handbook of Instrumental Techniques for Analytical Chemistry*, 1st Edition; Prentice Hall, 1997.
8. R.Gopalan, P. S. Subramanian and K. Rengarajan, *Elements of analytical chemistry*, 3rd Edition, Sultan Chand, New Delhi, 2003
9. A. K. Srivatsava and P. C. Jain, *Chemical Analysis and Instrumental Approach*, 3rd Edition, S.Chand and Company Ltd., New Delhi, 2010.

Learning Outcomes

- Identify the suitable methods for separation; explain chemical analysis of compounds
- Outline the principle behind gravimetric analysis, radioanalytical techniques, mass spectrometry and list out their applications
- Outline the principle behind X-ray and photoelectron spectroscopy

Semester - III ACH 307 A Allied Chemistry - I (Mathematics) 4 Hrs/week 2 Credits

Objectives

- To make the students understand the mathematical applications of Chemistry
- To understand the fuel and water Chemistry

Unit - I: Basics of Volumetric Analysis **12 Hours**

1.1 Solutions, types, methods to express concentration of solutions, Normality, Molarity, mole and Mole fraction, ppm and percentage solutions. Raoult's law, deviations from Raoults law.
1.2 Primary standard, secondary standard, characteristic of primary standard, calculation of equivalent weights
1.3 Volumetric analysis, principle, types of titration, theory of indicators (acid base and redox),
1.4 Significant figures, types of errors(detereminate and indeterminate) in volumetric analysis

Unit - II: Mathematics in Chemistry – I **12 Hours**

2.1 Group theory – Rules, types, sub group, symmetry as elements in group theory
2.2 Matrix Representation of symmetry elements, similarity transformation and class.
2.3 Point group, Multiplication table for C_2V and C_3V.
2.4 Reducible and irreducible representation, reduction of reducible representation using similarity transformation and block diagonalization

Unit - III: Kinetics and Electrochemistry **12 Hours**

3.1 Differentiation – Rate of a reaction, rate law, rate equation for 1^{st} order kinetics, second order equation, half-life, determination of order by graphical and half-life.
3.2 Catalysis – catalyst, characteristics of catalyst – auto catalyst – enzyme catalyst – promoters – catalytic poisoning – Active centers – Distinction between homogeneous and heterogeneous catalysis – Industrial applications of catalysts.
3.3 pH and determination by indicator method – Buffer solutions – Buffer action – Derivation of Henderson equation.
3.4 Specific conductance, equivalence conductance and molar conductance-variation of equivalence conductance with dilution-Conductometric Titrations.

Unit - IV: Fuels **12 Hours**

4.1 Fuels-definition, Conventional and nonconventional fuels, types, calorific value, determination of calorific valume by Bomb colorimeter
4.2 Petroleum cracking, Refining of petroleum by fractional distillation, knocking
4.3 Manufacture of Gobar gas. Composition of bio-gas, LPG, CNG and water gas.
4.4 Lead storage battery, Zn-Cd cell, Li –ion battery.

Unit - V: Water Chemistry **12 Hours**

5.1 Chemistry of water, structure of water, properties of water, types of water (distilled, deionized, conductivity, double distilled water)
5.2 Water quality parameters- pH, COD, BOD, TDS, Hardness of water
5.3 Sources of water pollution, common water pollutants (dyes, fertilizers, pesticides), methods of removal.
5.4 Osmosis, Osmotic pressure, laws of osmosis, Reverse Osmosis and water purification.

References

1. R. D. Madan, *Modern Inorganic Chemistry,* Second edition, S. Chand publications, New Delhi, 2000.
2. A. Bahl and B. S. Bahl, *Advanced Organic Chemistry*, S.Chand publications, New Delhi, 2006.
3. B. R. Puri, L. R. Sharma and M. S. Pathania, *Principles of Physical Chemistry*, 47th Edition, Vishal Publishing Co, Jalandar, 2016.
4. Hari Jeevan Arnikar , *Essentials of nuclear chemistry*, New Age International (P) Ltd., 2005.
5. Robinson, J.W. *Undergraduate Instrumental Analysis,* 5th Ed., Marcel Dekker, Inc., New York, 1995.
6. K V Raman, *Chemical Applications of Group theory*, TataMc Graw Hill, New Delhi, 2006.

Learning Outcomes

- Explain different types of volumetric methods
- Mathematical background behind the development of group theory and its applications in chemistry
- Outline the principle behind chemical kinetics and electrochemistry
- Understanding of chemistry of fuels and chemistry of water

Semester – III ACH 307 B Allied Chemistry - I (Physics) 4 Hrs/week, 2 Credits

Objectives

- To make the students understand the physical applications of chemistry.
- To understand the chemistry of water

Unit - I: Solutions 12 Hours

1.1 Solutions, types, methods to express concentration of solutions, Normality, Molarity, mole and Mole fraction, ppm and percentage solutions. Raoult's law, deviations from Raoults law.

1.2 Primary standard, secondary standard, characteristic of primary standard, calculation of equivalent weights

1.3 Volumetric analysis, principle, types of titration, theory of indicators (acid base and redox),

1.4 Significant figures, types of errors in volumetric analysis and methods to avoid them

Unit - II: Photo chemistry 12 Hours

2.1 Deference between photochemical and dark reactions laws of photo chemistry, quantum yield

2.2 Jablonski diagram, types of excited states, fate of excited molecules (radiative and non-radiative processes)

2.3 Photo physical processes, photosensitization, chemilumnescence, laser-instumentation and application

2.4 Photochemical process photo reduction, photo dimerization, phot aoxdation, photo synthesis.

Unit - III: Spectroscopy **12 Hours**

3.1 Properties of electromagnetic radiation, calculation of energy of radiations, introduction to spectroscopy, types of spectroscopy(Absorption, emission, atomic, molecular), classification based on radiation,

3.2 Principle of UV-visible spectroscopy, chromophore, auxochrome, types of transition, instrumentation and applications (Estimation of iron and nickel)

3.3 IR spectroscopy, types of vibrations, hooks law - calculation of frequency of vibrations,

3.4 Applications of IR spectroscopy (Detection of functional group-COOH, Aldehyde, Ketone, amine and amide, detection of purity of compounds)

Unit - IV: Thermodynamics **12 Hours**

4.1 Terminologies in thermodynamics, types of system, surroundings, types of processes,

4.2 First law of thermodynamics enthalpy of processes, limitations of first law. Zeroth law of thermodynamics

4.3 Second law of thermodynamics, Carnot engine calculation of efficiency,

4.4 Concept of entropy, entropy as criteria for spontaneity, statement of Third law of thermodynamics.

Unit - V: Water chemistry **12 Hours**

5.1 Chemistry of water, structure of water, properties of water, types of water (distilled, deionized, conductivity, double distilled water)

5.2 Water quality parameters- pH, COD, BOD, TDS, Hardness of water

5.3 Sources of water pollution, common water pollutants (dyes, fertilizers, pesticides), methods to remove

5.4 Osmosis, Osmotic pressure, laws of osmosis, Reverse Osmosis and water purification.

References

1. R. D. Madan, *Modern Inorganic Chemistry,* Second edition, S. Chand publications, New Delhi, 2000.
2. A. Bahl and B. S. Bahl, *Advanced Organic Chemistry*, S.Chand publications, New Delhi, 2006.
3. B. R. Puri, L. R. Sharma and M. S. Pathania, *Principles of Physical Chemistry*, 47th Edition, Vishal Publishing Co, Jalandar, 2016.
4. Hari Jeevan Arnikar , *Essentials of nuclear chemistry*, New Age International (P) Ltd., 2005.
5. Robinson, J.W. *Undergraduate Instrumental Analysis,* 5th Ed., Marcel Dekker, Inc., New York, 1995.

Learning Outcomes

- Evaluate the properties of solutions and explain the different laws governing them
- Outline the principle behind photochemistry and spectroscopy
- Explain the importance of thermodynamics and its applications

Semester - IV CH 414 Inorganic Chemistry - I 4 Hrs/week (4 Credits)

Objectives

- To study the chemistry of main groups elements
- To understand the variation in the periodic behaviour

Unit - I: p – block elements, Chemistry of Group 13 **12 Hours**

1.1 Main group elements- introduction, general and special characteristics.

1.2 *Group 13*: general properties, electronic configuration, oxidation states, inert pair effect, size of atoms and ions, electropositive nature and ionization energy.

1.3 Compounds of group 13: Structure and bonding in diborane. Preparation, properties and structure: Borazine, trihalides- Boron and Aluminium.

1.4 Compounds of Boron and Oxygen (structure and properties): Sesquioxides-Borates and Borax.

Unit - II: Chemistry of Group 14 **12 Hours**

2.1 *Group 14*: general properties, electronic configuration, metallic character, and oxidation states.

2.2 Uniqueness of Carbon and Silicon in comparison to remaining elements. Carbides- Preparation, classification and applications. Allotropes of Carbon- structure, properties and uses.

2.3 Oxides of carbon (structure and properties): CO, $CO_2$and carbon suboxides. Carbon cycle.

2.4 Silicates-classification, properties, structure and uses. Silicones- Polysiloxanes,

Unit - III: Chemistry of Group 15 **12 Hours**

3.1 *Group 15*: general properties, electronic configuration, oxidation states.

3.2 Compounds of group 15: Hydrides of Nitrogen and Phosphorus, Haber's process, Oxides of Nitrogen: NO, NO_2, N_2O, and N_2O_3 (structure, properties and uses).

3.3 Oxo-acids of Nitrogen and Phosphorous- preparation and structure.

3.4 Polyphosphates-preparation and structure.

Unit - IV: Chemistry of Group 16 **12 Hours**

4.1 Group 16- chalcogens: general properties, electronic configuration, oxidation states. Oxides- classification, structure and properties.

4.2 Oxo-acids and peroxo-acids of Sulphur.

4.3 Hydrogen peroxide and Hydrogen sulphide- preparation and properties.

4.4 Allotropes of Oxygen and Sulphur. Chemistry of Ozone.

Unit V: Chemistry of Halogens and Noble Gases **12 Hours**

5.1 Group 17: electronic configuration, oxidation states, ionization energies, and electron affinity. Hydrogen halides- preparation, properties and uses. Halides- ionic, molecular and bridging.

5.2 Preparation and properties of Oxo-acids- Hypohalous acids, halous acids, Halic acids and perhalic acids. Pseudo halogens and halides.

5.3 Preparation, properties and structure of Interhalogen compounds – types; ICl, BrF_3, ClF_5 and IF_7.

5.4 Noble gases: Xenon clatharates. Preparation properties and structure of Xenon fluorides.

References

1. J. D. Lee, *Concise Inorganic Chemistry*, Chapman and Hall: London, 1961.
2. B. R. Puri, L. R. Sharma and K. C. Kalia, *Principles of Inorganic Chemistry*, 33rd Edition, Vishal Publishing Co, Jalandar, 2004.
3. R. D. Madan, *Modern Inorganic Chemistry,* Second edition, S. Chand publications, New Delhi, 2000.
4. A. G. Sharpe and C. E. Housecraft, *Inorganic Chemistry* Vol-I, 3rd edition, Pearson prentice Hall, New York, 2008.

Learning Outcomes

- Identify the chemistry of p-block elements (Group 13,14,15,16 and 17) and noble gases
- Explain the periodic trends, chemical reactivity and physical properties of p-block elements
- List out important inorganic compounds of p-block elements, their synthesis and applications

Semester - IV CH 415 Physical Chemistry - I 3 Hrs/week (3 credits)

Objectives

- To learn the importance of Chemical potential and its significance
- To understand the basic concepts of quantum chemistry and phase equilibria
- To learn the concepts regarding chemical kinetics and apply them for kinetics related problems in photochemistry

Unit - I: Chemical Potential **9 Hours**

1.1 Spontaneous reaction- Standard free energy change- Standard free energy change of formation of compounds (ΔG^0_f)

1.2 Law of Mass action- Thermodynamic equilibrium of Law of the Chemical equilibrium- Van't Hoff reaction isotherm- Relationship between Kp, Kc and Kx- DeDonder's Concept- Chemical affinity

1.3 Thermodynamic relations for chemical affinity-The van't Hoff equation-Lechatelier's principle- Effect of change of concentration, temperature and pressure.

Unit - II: Phase Equilibria - I **9 Hours**

2.1 Phase- component- degrees of freedom- condition for equilibrium between phases- Gibb's phase rule- derivation.

2.2 One component system: water, sulphur and helium- Polymorphism

2.3 Two component system: construction of phase diagram(cooling curve method)- Pb-Ag System and KI- Water system

Unit - III: Phase Equilibria - II **9 Hours**

3.1 Congruent melting point system (Mg and Zn)- $FeCl_3$- H_2O system

3.2 Incongruent melting point system (Na- K). Three component system: Acetic acid-water- butanol.

3.3 The Ehrenfest classifications of phase transition

Unit - IV: Solutions **9 Hours**

4.1 Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions.

4.2. Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes.

4.3 Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation. Nernst distribution law and its applications, solvent extraction.

Unit - V: Colloidal state **9 Hours**

5.1 Origin of charge on colloids- electrical double layer-Electrokinetic properties (Electrophoresis, electro osmosis)

5.2 Surfactants: Classification- Micelle and reverse micelle formation- shape and structure of micelles- critical micelle concentration, aggregation number

5.3 Factors affecting CMC in aqueous media- Thermodynamics of Micellization

References

1. B. R. Puri, L. R. Sharma and M. S. Pathania, *Principles of Physical Chemistry*, 47th Edition, Vishal Publishing Co, Jalandar, 2016.
2. D. N. Bajpai, *Advanced Physical Chemistry*, 2nd Edn., S. Chand& Company, New Delhi, 1998.
3. P. L. Soni, O. P Dharmarha and U. N. Dash, *Text Book of Physical Chemistry*, Sultan Chand & Company Ltd., New Delhi, 2001.
4. A.S. Negi and S.C. Anand, *A text book of Physical Chemistry*, Wiley Eastern Ltd, New Delhi, 1984.
5. S. Glasstone, *Text book of physical chemistry*, 2nd revised edition, Macmillan, United Kingdom, 1980.

Learning Outcomes

- Explain the significance Gibbs free energy and its applications in thermochemical reactions
- Derive the phase rule and construct phase diagrams
- List out the laws and the various properties of solutions and colloidal state

Semester - IV ACH 408 A Allied Chemistry - II (Mathematics) 4 Hrs/week, 2 Credits

Objectives

- To make the students understand the mathematical applications of chemistry
- To be familiar with chemistry in our surrounding.

Unit - I: Chemistry of Organic analysis **12 Hours**

1.1 Organic compounds definition, Classification based on structure and functional group

1.2 Definition of aliphatic and aromatic compounds, conditions for aromaticity, tests to detect aromaticity

1.3 Tests to detect unsaturation in organic compounds, Lassaigne's test,

1.4 Reactions involved in detection of carboxylic acids, aldehydes, ketones, phenols, amides and carbohydrates,

Unit - II: Nuclear Chemistry **12 Hours**

2.1 Natural Radioactivity, types of radioactive rays, difference between chemical and nuclear rections.

2.2 Representation of nuclear reaction, types of nuclear reactions, calculation of nuclear Q value, N/P ratio, groupdisplacement law

2.3 Nuclear Fision, atom bomb and Nuclear reactor – components - Fusion, hydrogen bomb, stellar energy,

2.4 applications of radio isotopes in agriculture, medicine, and industry, carbon and rock dating

Unit - III: Bio molecules **12 Hours**

3.1 Carbohydrates, classification, chemical properties of glucose and fructose

3.2 Amino acids, classification, standard amino acids, physical and chemical properties of glycine. Proteins-classification based on function, primary and secondary structure.

3.3 Vitamins –types, functions, sources, deficiency disease, daily requirement, vitaminoses

3.4 Nucleic acid, classification, structure and functions

Unit - IV: Chemistry of Drugs **12 Hours**

4.1 Drugs – definition Types – antibiotics, antiseptic, anti-inflammatory, analgesics, antipyretics

4.2 Structure, therapeutic uses and side effects of penicillin, Chloramphenicol, tetracycline

4.3 Structure, therapeutic uses and side effects of, Paracetomol and aspirin

4.4 Preparation and uses of aluminum hydroxide gel, alum, milk of magnesia, Drug abuse – implications, evil effects of alcohol

Unit - V: Soil Chemistry **12 Hours**

5.1 Composition of soil, types of soil, need for cultivation, need for soil testing, nitrogen fixation, nitrogen cycle.

5.2 Classification of nutrients - Macro and micro nutrients for soil Biological role of micro and macro nutrients - Na, Ca, Mg, Fe, Zn.
5.3 Need for fertilizers, characteristics of good fertilizers, types of fertilizers
5.4 Nitrogenous fertilizers, Phosphorous fertilizers, potassium fertilizers, Manures and its advantages over chemical fertilizers.

References

1. R. D. Madan, *Modern Inorganic Chemistry,* Second edition, S. Chand publications, New Delhi, 2000.
2. A. Bahl and B. S. Bahl, *Advanced Organic Chemistry*, S.Chand publications, New Delhi, 2006.
3. B. R. Puri, L. R. Sharma and M. S. Pathania, *Principles of Physical Chemistry*, 47th Edition, Vishal Publishing Co, Jalandar, 2016.
4. Hari Jeevan Arnikar , *Essentials of nuclear chemistry*, New Age International (P) Ltd., 2005.
5. JayShree Ghosh, *Applied Chemistry*, New Age Publications, Meerut, 2010.
6. Jayashree Ghosh, *Textbook of Pharmaceutical chemistry*, Rajendra ravindra printers Pvt. Ltd., New Delhi, 2010.

Learning Outcomes

- List out the theory governing organic analysis and outline the principles and applications of nuclear chemistry
- Identify different types of biomolecules (Carbohydrates, proteins, nucleic acids and vitamins)
- Formulate the chemistry behind drugs
- List out the chemistry behind soil analysis

Semester - IV ACH 408 B Allied Chemistry - II (Physics) 4 Hrs/week, 2 Credits

Objectives

- To make the students understand the physical applications of chemistry
- To understand the chemistry of soil.

Unit - I: Organic Compounds 12 Hours

1.1 Organic compounds definition, Classification based on structure and functional group

1.2 Definition of aliphatic and aromatic compounds, conditions for aromaticity, tests to detect aromaticity

1.3 Tests to detect unsaturation in organic compounds, lassaigne's test,

1.4 Reactions involved in detection of carboxylic acids, aldehydes, ketones, phenols, amides and carbohydrates,

Unit - II: Nuclear Chemistry 12 Hours

2.1 Natural Radioactivity, types of radioactive rays, difference between chemical and nuclear rections.

2.2 Representation of nuclear reaction, types of nuclear reactions, calculation of nuclear Q value, N/P ratio, group displacement law

2.3 Nuclear Fission, atom bomb and Nuclear reactor, Fusion, hydrogen bomb, stellar energy,

2.4 applications of radio isotopes in agriculture, medicine, and industry, carbon and rock dating

Unit - III: Kinetics and Catalysis 12 Hours

3.1 Rate-order-molecularity-derivation of rate equation for first order reaction-halflife period.

3.2 Determination of order of the reaction: half-life method and isolation method. Activation energy-arrehenius equation-Collision theory,

3.3 Catalysis – catalyst, characteristics of catalyst – auto catalyst – enzyme catalyst – promoters – catalytic poisoning – Active centers.

3.4 Distinction between homogeneous and heterogeneous catalysis – Industrial applications of catalysts.

Unit - IV: Electro Chemistry 12 Hours

4.1 Types of Electrolytes, Specific conductance, equivalent conductance, variation of equivalence conductance with dilution

4.2 Definition of Faradays law and Ostwald dilution law. Kohlraush's law and its application, conductometric titrations.

4.3 Cell constant, representation of cell, reduction potential, electrochemical series

4.4 Lead storage battery, Zn-Cd cell, Lithium-ion

Unit - V: Soil Chemistry **12 Hours**

5.1 Composition of soil, types of soil, need for cultivation, need for soil testing, nitrogen fixation, nitrogen cycle.

5.2 Classification of nutrients - Macro and micro nutrients for soil Biological role of micro and macro nutrients - Na, Ca, Mg, Fe, Zn.,

5.3 Need for fertilizers, characteristics of good fertilizers, types of fertilizers

5.4 Nitrogenous fertilizers, Phosphorous fertilizers, potassium fertilizers,Manures and its advantages over chemical fertilizers

References

1. R. D. Madan, *Modern Inorganic Chemistry,* Second edition, S. Chand publications, New Delhi, 2000.
2. A. Bahl and B. S. Bahl, *Advanced Organic Chemistry*, S.Chand publications, New Delhi, 2006.
3. B. R. Puri, L. R. Sharma and M. S. Pathania, *Principles of Physical Chemistry*, 47th Edition, Vishal Publishing Co, Jalandar, 2016.
4. Hari Jeevan Arnikar , *Essentials of nuclear chemistry*, New Age International (P) Ltd., 2005.
5. Jayashree Ghosh, *Fundamental concepts of Applied Chemistry*, S Chand Publications, New Delhi, 2006.

Learning Outcomes

- List out the theory governing organic analysis and outline the principles and applications of nuclear chemistry
- Outline the principle behind chemical kinetics and electrochemistry
- List out the chemistry behind soil analysis