

**Allied Chemistry**  
*Syllabus for*  
***B.Sc. [Physics & Mathematics]***  
*(With effect from the year 2018-2019)*



***Department of Chemistry***  
**Sri Chandrasekharendra Saraswathi Viswa Mahavidyalaya**  
(University established under sec 3 of UGC Act 1956)  
(Accredited with "A" by NAAC)  
Enathur, Kanchipuram – 631 561.Tamilnadu,

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
III	III	PH3C4	Fundamentals of Chemistry-I	3	0	1	3

**Aim:** To learn about the chemical bonding and fundamentals of chemistry

**Objective:**

- To learn the basic of bonding nature, mechanism of reactions and materials used in the industries.

**Outcome:**

- Understanding on various bonding types in chemical compounds.
- Understanding on nuclear reactions and reaction mechanism in chemistry.

**Unit-I Chemical Bonding – I**

**(12 hrs)**

Types of bonds – ionic bond- factors favoring ionic bond - covalent bond – orbital overlap – linear combination of orbitals -  $\sigma$  and  $\pi$  bond formation – polarity in covalent molecules - Fajan's rule – effects of polarization -coordinate bond - simple examples.Molecular Orbital Theory – linear combination of orbitals –types of molecular orbitals- energy level diagrams-  $e^-$  filling in MO – bond order – MO diagrams of  $H_2$ ,  $He_2$ ,  $Li_2$ ,  $Be_2$ ,  $N_2$  and  $O_2$  molecules – mixing of orbitals – MO diagrams of CO, HF and NO molecules. Metallic Bond – properties of metals – free electron theory – merits and demerits – valence theory - band theory of solids (Primitive treatment only) – H-bonding – effects H bonding.

**Unit-II Co-ordination Chemistry**

**(12 hrs)**

Co-ordination chemistry-definition of terms- classification of ligands-Nomenclature- Chelation- Examples. Chelate effect- explanation-Coordination chemistry -nomenclature of complexes - Werner, Sidgwick and Pauling theories–Chelation – examples of complexes- Prussian Blue, Haemoglobin , Chlorophyll -applications of coordination chemistry in qualitative and quantitative analysis.

**Unit-III Fundamentals of reaction mechanism**

**(12 hrs)**

Homolytic and heterolytic fissions – types of organic reactions – types of attacking reagents – inductive, electromeric, resonance and hyperconjugation effects. Types of substitution reactions –  $S_N^1$  and  $S_N^2$  reactions – aromatic electrophilic substitution mechanism – Mechanism of nitration, halogenation, alkylation, acylation, sulphonation – elimination reactions – mechanism, examples. Addition reactions – types – nucleophilic and electrophilic additions- nucleophilic additions to alkenes – Markovnikov rule – peroxide effect.

**UNIT-IV Photochemistry and Electrochemistry**

**(12 hrs)**

**Photo chemistry** – Grotthus-Draper's law and Stark-Einstein's law of photochemical equivalence. Quantum yield. Examples for photochemical reactions-Hydrogen- Chlorine reaction, photosynthesis. Phosphorescence, Fluorescence, Chemiluminescence and photosensitization - definitions with examples.

**Electrochemistry:** Ionic equilibria- strong and weak electrolytes, acid-base, common ion effect, pH, buffer solutions and buffer action in biological systems and salt hydrolysis. (Definitions, examples and equations only). (No derivations)

**Unit-V Industrial chemistry****(12 hrs)**

Dyes – theory of colour and constitution - chromophore, auxochrome- classification of dyes – natural dyes (Indigo) – azo dyes (Methyl Orange, Bismark brown) – triphenyl methane dyes (Malachite Green, Crystal violet). Polymers- types- addition polymerization – mechanisms- preparation, properties and uses of PE,PU, PMMA and SBR.Fertilizers - micro and macro nutrients - urea, ammonium sulphate, ammonium nitrate, potassium nitrate NPK fertilizer – eutrophication- organic manures – compost, vermiculate.

**Text Books:**

1. Puri & Sharma – Principles of Physical Chemistry- Vishal Publishing Co, 42<sup>nd</sup> Edition, (2007).
2. Bahl & Arun Bahl, Principles of Organic Chemistry - S. Chand & Company, 16<sup>th</sup> edition, (2004).
3. Gopalan, R., Ramalingam, V. Concise Coordination Chemistry, Vikas Publishing House Pvt. Ltd. (2007).

**Reference Books:**

1. Jain & Jain –Dhanpat, Engineering Chemistry –Rai Publishing, 15<sup>th</sup> edition, (2008).
2. Asim. K.Das, Fundamental concept of Inorganic Chemistry –CBS publishers and Distributors, 2<sup>nd</sup> edition, (2010).
3. B.K. Sharma – Industrial Chemistry –Krishna Prakashan media (p) Ltd., 8<sup>th</sup> edition, (1996).

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
IV	III	PH4C4	Fundamentals of Chemistry-II	3	0	1	3

**Aim:** To learn about kinetics of reaction, stereoisomerism and biomolecules

**Objective:**

- To learn the basic concept of kinetics, liquid state, solutions and medicinal compounds in chemistry.

**Outcome:**

- Understanding on rate of reaction and naming reaction in chemistry
- Understanding on various biomolecules in chemistry.

**Unit-I Liquid state and solutions**

**(12 hrs)**

General properties of liquids – vapour pressure- definition, measurement – Trouton's rule – surface tension – effect of T on surface tension – effects of surface tension – measurement – surfactants – viscosity- measurement of viscosity – effect of temperature, pressure on viscosity. Solutions - types - Liquid in Liquid - Raoult's law. Deviation from ideal behavior - Binary liquid mixtures- theory of fractional distillation – azeotropes. Mesomorphic state – compounds forming liquid crystals – types of liquid crystals – applications of liquid crystals.

**Unit-II Chemical kinetics and catalysis**

**(12 hrs)**

Kinetics – terminology of kinetics - rate, law of mass action, rate law, order, molecularity, pseudo first order, half-life period -Determination of order – graphical, isolation and half-life time methods. Kinetics of zero, first and second order reactions (both cases) – kinetics of hydrolysis of ester (both acid and alkaline)activation energy – importance of  $E_a$  – Arrhenius equation (derivation not expected) .

Catalysis – requirements of a catalyst – types of catalysis and catalysts –theories of catalysis – enzyme catalysis –Fischer mechanism.

**Unit-III Stereoisomerism and Name reactions**

**(12 hrs)**

Stereoisomerism – types – geometrical isomerism – optical activity- condition for optical activity – symmetry elements –chirality -optical isomerism –R,S notation - diastereomers – optical activity of lactic and tartaric acids- racemization.Name reactions - Mechanisms of aldol, Schmidt, Perkin, Knoevenagel, Cannizaro and benzoin condensation reactions.

**Unit-IV Biomolecules**

**(12 hrs)**

Amino Acids- Classification – preparation, properties - preparation of peptides. Classification of proteins - Primary and secondary structures of proteins – biosynthesis of proteins (basic idea only) Carbohydrates – classification, preparation and properties of glucose and fructose- open ring structuresof glucose and fructose. Antineoplastic agents – cancer – types of tumour – causes for cancer – treatment methods (concepts only)-antineoplastic agents- alkylating agents – cisplatin - mode of action.

**Unit-V Industrial materials****(12hrs)**

Lubricants – friction and wear – functions and types of lubricants –mechanism of lubrication – solid lubricants – selection of lubricants –cutting fluids. Adhesives – adhesive action- factors affecting the adhesion- classification of adhesives.Cement – manufacture of Portland cement – hardening of cement – Glass- manufacture – types (Soda –lime and Potash – lime glasses only) and their uses.

**Text Books:**

1. Puri & Sharma – Principles of Physical Chemistry- Vishal Publishing Co, 42<sup>nd</sup> Edition, (2007).
2. Bahl & Arun Bahl, Principles of Organic Chemistry - S. Chand & Company, 16<sup>th</sup> edition, (2004).
3. V.K.Ahluwalia, Drugs, Ane Books Pvt. Ltd. (2010).

**Reference Books:**

1. Jain & Jain –Dhanpat, Engineering Chemistry –Rai Publishing, 15<sup>th</sup> edition, (2008).
2. Asim. K.Das, Fundamental concept of Inorganic Chemistry –CBS publishers and Distributors, 2<sup>nd</sup> edition, (2010).
3. B.K. Sharma – Industrial Chemistry –Krishna Prakashan media (p) Ltd., 8<sup>th</sup> edition, (1996).

Semester	Part	Sub. Code	Title of the Paper	L	P	T	Credits
IV	III	PH4LC2	Fundamentals of Chemistry Laboratory	0	3	0	2

### ALLIED CHEMISTRY PRACTICALS

#### I. VOLUMETRIC ANALYSIS: (any 10)

1. Estimation of hydrochloric acid using standard Oxalic acid.
2. Estimation of Sodium hydroxide using standard Sodium carbonate
3. Estimation of  $\text{Na}_2\text{CO}_3$  in washing soda
4. Estimation of Carbonate and bicarbonate in a mixture
5. Estimation of Ferrous Sulphate- standard Mohr's salt solution.
6. Estimation of Oxalic acid- standard Mohr's salt solution
7. Estimation of  $\text{H}_2\text{O}_2$  – using standard oxalic acid
8. Estimation of  $\text{MnO}_2$  in Pyrolusite
9. Estimation of  $\text{Cu}^{2+}$  by using standard  $\text{K}_2\text{Cr}_2\text{O}_7$
10. Estimation of  $\text{Cu}^{2+}$  by using standard  $\text{CuSO}_4$
11. Estimation of Chloride ion in water
12. Estimation of hardness of water using EDTA.

#### II. ORGANIC ANALYSIS: systematic analysis

1. Detection of Elements (N, S, Halogens).
2. To distinguish between Aliphatic and Aromatic.
3. To distinguish between saturated and unsaturated.
4. (a) Functional group tests for phenols, acids (mono and di), aromatic primary amine, amide, diamide, carbohydrate, carbonyl compounds.  
(b) Functional group(s) to be characterized by confirmatory tests.

#### Reference Books:

1. Advanced Inorganic Practicals- Gurudeepraj , Krishnaprakasham , 2<sup>nd</sup> edition, 2002.
2. Systematic Organic Analysis, Gnanaprakasham, B.Viswanathan publishers, 1<sup>st</sup> edition, 1979.

Scheme of Valuation	
<b>Record</b>	<b>10 marks</b>
<b>Volumetry</b>	<b>40 marks</b>
Aim, Tables (05 marks)	
Procedure (10 marks)	
Calculation (15 marks)	
Result (10 marks)	
<b>Organic Analysis</b>	<b>40 marks</b>
Procedure (15 marks)	
Elements (05 marks)	
Aromatic/ Aliphatic (05 marks)	
Sat/Unsat (05 marks)	
Functional group (10 marks)	
<b>Viva</b>	<b>10 marks</b>
<b>Total</b>	<b>100 marks</b>