

## Minor Courses offered by the Department of Chemistry

- Physics and Mathematics subjects are mandatory at +2 level who are opting for Mathematics and Physics Minor.
- Physics and Biology subjects are mandatory at +2 level who are opting for Zoology / Botany and Physics Minor.

### MINOR STREAM - I

a) With Minor Stream I (Within the Department)

Year / Sem	Type of Course	Course Code	Title of the Course	Credits	Teaching Hours
1 <sup>st</sup> Year (Semester-I & II)	MID-1		Mathematics-I / Zoology-I / Botany-I (anyone of the three)	4	5
	MID-2		Mathematics-II / Zoology-II / Botany-II (anyone of the three)	4	5
2 <sup>nd</sup> Year (Semester-III & IV)	MID-3		Physics-I	4	5
	MID-4		Physics-II	4	5
3 <sup>rd</sup> Year (Semester-V & VI)	MID-5		Course from any other Science Department	4	5
	MID-6		Course from any other Science Department	4	5
4 <sup>th</sup> Year (Semester-VII)	MID-7		Course from any other Science Department	4	5
	MID-8		Course from any other Science Department	4	5

\***Note:** For other Department Courses, Syllabus and Course Codes are given by the respective Departments.

### MINOR STREAM - II

b) With Minor Stream II (Course for other Departments)

Year / Sem	Type of Course	Course Code	Title of the Course	Credits	Teaching Hours
1 <sup>st</sup> Year (Semester-I & II)	MID-1	UCHMI 1101	Basic Chemistry-I	4	5
	MID-2	UCHMI 1200	Basic Chemistry Practical-I	4	5
2 <sup>nd</sup> Year (Semester-III & IV)	MID-3	UCHMI 2101	Basic Chemistry-II	4	5
	MID-4	UCHMI 2200	Basic Chemistry Practical-II	4	5
*3 <sup>rd</sup> Year (Semester-V & VI)	MID-5(A)	UCHMI 3101	Business Skills for Chemists	4	5
	MID-5(B)	UCHMI 3102	Analytical and Clinical Biochemistry		

	MID-6(A)	<b>UCHMI 3201</b>	<b>Applied Chemistry</b>	4	5
	MID-6(B)	<b>UCHMI 3202</b>	<b>Applications of Computer in Chemistry</b>		
<b>*4<sup>th</sup> Year (Semester-VII)</b>	MID-7(A)	<b>UCHMI 4101</b>	<b>Introduction to Green Chemistry</b>	4	5
	MID-7(B)	<b>UCHMI 4102</b>	<b>Pharmaceutical Chemistry</b>		
	MID-8(A)	<b>UCHMI 4103</b>	<b>Chemistry in Agriculture</b>	4	5
	MID-8(B)	<b>UCHMI 4104</b>	<b>Food and Medicinal Chemistry</b>		

**\*Note:** In 3<sup>rd</sup> Year and 4<sup>th</sup> Year, Student can choose one course from each stream for each semester.

**Pondicherry University**  
**CHEMISTRY SYLLABUS (NEP) FOR OTHER DEPARTMENT STUDENTS**  
**MINOR & MULTI DISCIPLINARY COURSES IN CHEMISTRY**

**Minor 1**

**Course Code: UCHMI 1101**

**Credits: 4**

**I Year – Semester-I**

**BASIC CHEMISTRY – I**

**Learning Objectives:**

- To Study classification, nomenclature and some fundamentals of organic chemistry.
- To Study isomerism in organic compounds and conformational analysis
- To Study the stoichiometry and some basic concepts of chemical equilibrium
- To Study radioactivity and its applications
- To study carbohydrates

**Learning Outcomes:**

- Learn the Classification and IUPAC nomenclature of organic compound
- Understand the hybridization in organic compounds, dipole moments and charged species
- Acquire knowledge about isomerism in organic compounds and learn how to name them
- Gain understanding about concepts of chemical equilibrium, acids and bases, pH and buffer
- Understand radioactivity and its applications

**Unit I: Fundamentals of Organic Chemistry**

**(12 Hrs)**

Classification and IUPAC nomenclature of organic compound, Hybridization ( $sp^3$ ,  $sp^2$  and  $sp$ ) in organic compounds, localized and delocalized chemical bonds, Hydrogen bonding. Dipole moments in organic molecules, homolytic and heterolytic bond cleavage, electrophiles, nucleophiles and free radicals, carbocations and carbanions.

**Unit II: Isomerism in organic compounds**

**(12 Hrs)**

Structural and Stereo isomerism, Geometrical isomerism, Cis, trans isomers, E and Z nomenclature of simple compounds; Optical isomerism, optical activity, specific rotation, enantiomers, diastereomers, and meso compounds. R, S configuration in organic molecules with single asymmetric centre. Conformers, Newman and sawhorse projection formulae, conformational analysis of ethane, n-butane and cyclohexane.

**Unit III: Stoichiometry**

**(12 Hrs)**

Mole and equivalent concepts, concentration units, molarity, molality, percentage, ppm, and ppb. Types of solutions, stoichiometric calculations.

Basic concepts of chemical equilibrium, equilibrium constants. Concepts of acids and bases. Ionisation of weak acids and weak bases. Hydrogen ion concentration, pH of acids and bases. Buffer solutions, Henderson's equation of buffer. Physiological buffers.

**Unit-IV: Radioactivity****(12 Hrs)**

Properties of  $\alpha$ ,  $\beta$  and  $\gamma$ -radiations, rate of disintegration, half life period, nuclear fission and fusion, fertile and fissile nuclei, radioactive isotopes, nuclear reactions and group displacement law, Application in medicine, agriculture, geology and industry. nuclear reactors- working principle. Neutron activation analysis.

**Unit V: Carbohydrate****(12 Hrs)**

Classification, preparation, properties and structures of glucose, fructose, and sucrose (structural elucidation not required), mutarotation, epimers and anomers. Polysaccharides, uses of starch and cellulose (structural elucidation not required) test for sugars.

**References Books:**

1. Text Book of Organic Chemistry by P.S. Soni, 29<sup>th</sup> Ed., 2012.
2. Principles of Physical Chemistry by Puri and Sharma, 2020.
3. Allied Chemistry – I by K.M.Tajun Meera Begum and N.M.I.Alhaji, 2016.
4. Advanced Organic Chemistry by Bahl and Arun Bahl, 2012.
5. Modern Inorganic Chemistry by R.D. Madan, 1987.
6. Principles of Inorganic Chemistry by Puri and Sharma, 2020.
7. Physical Chemistry by Bahl and Tuli, 28<sup>th</sup> Ed., 2020.
8. Analytical Chemistry by Gopalan et al, Sultan Chand & sons, 2003.

**I Year – Semester-II****BASIC CHEMISTRY PRACTICAL– I****Learning Objectives:**

- To learn to do titrimetric experiments
- To calculate the concentrations of unknown solutions
- To determine the melting and boiling points of organic compounds

**Learning Outcomes:**

- Understand basic principles involved in titrimetric analysis and compare the methodologies of different titrimetric analysis
- Develop the skill to estimate the amount of a substance present in a given solution
- Measure the melting point and boiling points of organic compounds and compare with the literature values

**(A) Volumetric Analysis**

1. Determination of sodium hydroxide and sodium carbonate in a mixture using selective indicator method (Acidimetry)
2. Determination of sodium carbonate and sodium bi-carbonate in a mixture using selective indicator method (Acidimetry)
3. Determination of oxalic acid (Permanganometry)
4. Determination of FAS (Permanganometry)
5. Determination of iron (Dichrometry)
6. Determination of potassium dichromate (Iodometry)
7. Determination of copper (Iodometry)
8. Determination of Magnesium or Zinc using EDTA
9. Determination of Hardness of water

**(B) Other Experiments**

1. Determination of melting point of organic compounds using water bath (m.pt. < 100 °C).
2. Determination of boiling point of organic substances like ethanol, cyclohexane, toluene, benzene etc.,
3. Determination of viscosity of the given liquid using Ostwald's Viscometer.
4. Purification of organic compounds by recrystallisation.
  - a) Aromatic substances from hot water; (b) Naphthalene from ethanol

**Reference Books:**

1. Basic Principles of Practical Chemistry, Venkateswaran, V., Veeraswamy, R., Kulandivelu, A.R., 2nd ed., Sultan Chand & Sons: New Delhi, 1997.
2. An advanced course in Practical Chemistry, Nad, A. K., Mahapatra, B., Ghoshal, A., 3rd ed., New Central Book Agency: Kolkata, 2007.
3. Vogel's Textbook of Quantitative Chemical Analysis, Mendham, J., Denney, R. C., Barnes, J. D., Thomas, M., Sivasankar, B., 6th ed.; Pearson Education Ltd: New Delhi, 2000.

**II Year – Semester-III**

**BASIC CHEMISTRY – II**

**Learning Objectives:**

- To Study thermodynamics and chemical kinetics
- To Study chromatography and solid state
- To Study amino acids, proteins and enzymes
- To Study polymers and dyes
- To study nucleic acids and drugs

**Learning Outcomes:**

- Understand the concept of heat, work, Internal energy and enthalpy
- Learn about separation techniques of organic compounds, bonding in metals, semiconductors and conductors
- Gain knowledge on building blocks of proteins and DNA and dyes
- Get an idea about the pharmaceutical drugs analgesics and antipyretics like paracetamol and aspirin and also about pigments and dyes and its applications.

**Unit I: Thermodynamics and Chemical Kinetics**

**(12 Hours)**

First Law of Thermodynamics, Statement, concepts of heat, work and internal energy, Enthalpy and heat capacity, exothermic and endothermic reactions, Second Law of Thermodynamics, spontaneous and non spontaneous processes, entropy concept. Chemical Kinetics: Rate of reaction, Factors affecting the rate of reaction, order and molecularity, examples for zero, first and second order reaction.

**Unit II: Chromatography and Solid State**

**(12 Hours)**

Separation techniques, Paper, thin layer and column chromatography, Adsorption, physisorption and chemisorptions, factors affecting them. Langmuir Adsorption Isotherm. Bonding in metals and crystal defects, Metallic bond, Band theory of solids, Applications to conductor, semiconductor and insulators, crystal defects - Schottky and Frenkel defect, metal excess and metal deficiency defects.

**Unit III: Amino acids, proteins and enzymes**

**(12 Hours)**

Amino acids: Classification, stereochemistry of amino acids, preparation and properties of amino acids, isoelectric point. Tests for amino acids, Proteins, Classification and structure of proteins, Enzymes, Characteristics of enzyme, mechanism of enzyme action, Michaelis Menten equation.

**Unit IV: Polymers and Dyes****(12 Hours)**

Polymers, Preparation and uses of nylon (6,6), Terylene, polythene, polyvinyl chloride, natural rubber and synthetic rubber (Buna-S rubber and neoprene) Vulcanization; Dyes, Modern classification and examples (Indigo, congo red, malachite green, Alizarin and Phenolphthalein)

**Unit V: Nucleic acid and Drugs****(12 Hours)**

Nucleic acid – Structure of DNA and RNA, brief account of m-RNA, t-RNA and r-RNA – differences between DNA and RNA.

Drugs, Antiseptic (Dettol), Antipyretic (Paracetamol), Analgesic (Aspirin), Antimalarial (Quinine), Antibiotic (Penicillin), Sulfa Drug (Sulfadiazine) - Structural elucidation not required.

**Reference Books:**

1. Physical Chemistry by Bahl and Tuli, 28<sup>th</sup> Ed., 2020.
2. Text Book of Organic Chemistry by P.S. Soni, 29<sup>th</sup> Ed., 2012.
3. Allied Chemistry – II by K.M.Tajun Meera Begum and N.M.I.Alhaji, 2016.
4. Advanced Organic Chemistry by Bahl and Arun Bahl, 2012.
5. Modern Inorganic Chemistry by R.D. Madan, 1987.
6. Principles of Inorganic Chemistry by Puri and Sharma, 2020.
7. Principles of Physical Chemistry by Puri and Sharma, 2020.
8. Analytical Chemistry by Gopalan et al., Sultan Chand & sons, 2003.

## II Year – Semester-IV

### BASIC CHEMISTRY PRACTICAL– II

#### Learning Objectives:

- To perform analysis to identify the functional group in an unknown organic compound performing a systematic analysis
- To learn to separate organic compounds using simple methods and chromatographic techniques

#### Learning Outcomes:

- Observe the physical state, odour, colour and solubility of the given organic compound.
- Identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis
- Compare between mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing and non-reducing sugars and explain the reactions behind them
- Prepare a solid derivative with respect to the identified functional group
- Learn to separate the organic compounds by simple methods and chromatography

#### Organic Qualitative Analysis

Systematic analysis of organic compounds containing single functional group:

- (i) Phenols
- (ii) Carboxylic acids (mono and di)
- (iii) Aldehydes
- (iv) Ketones
- (v) Aromatic Primary Amine
- (vi) Aliphatic Diamide
- (vii) Reducing sugars

#### Other Experiments:

1. Separation of the following mixtures:
  - a) Naphthalene and Benzoic acid
  - b) Benzoic acid and Glucose
  - c) Naphthalene and Glucose
2. Separation of mixture by paper chromatography and identification of R<sub>f</sub> value
  - a) Separation and identification of mixture of two amino acids
  - b) Separation and identification of mixture of sugars
  - c) Separation of components in a dye