BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI -24

(For B.Sc. Biochemistry, Botany, Mathematics, Physics, Forensic Science, Geology, Environmental Science & Zoology - Allied Courses)

(For the candidates admitted from the academic year 2026 – 2027 onwards)

Allied Course- I

CHEMISTRY- I

Hours/Week: 4
Credits: 4

COURSE OBJECTIVES

1. To understand the various theories of coordination chemistry.

2. To study the various concepts of resonance and halogen compounds.

3. To study the properties of aromatic compounds and organic reactions.

4. To learn the concepts of solid state chemistry.

UNIT- I COORDINATION CHEMISTRY AND INDUSTRIAL CHEMISTRY

1.1 Coordination Chemistry: Nomenclature – Werner's, sidgwick and Pauling's theories. Chelation - industrial importance of EDTA, Biological role of heamoglobin and Chrophyll.
1.2 Industrial Chemistry: Fuel gases – Water gas, producer gas, LPG gas, Gobar gas and natural gas. Fertilizers – NPK and mixed Fertilizers- soaps and detergents.

UNIT- II ELECTRON DISPLACEMENT EFFECTS AND HALOGEN COMPOUNDS

2.1 Polar effects: Inductive effect – Relative Strength of Aliphatic monocarbocylic acid and aliphatic amines. Resonance – Condition for resonance. Consequences of resonance – resonance of energy. Basic property of aniline and acidic property of phenol. Hyperconjugation – Heat of hydrogenation - Bond length and dipole moment. Steric effect.
2.2 Halogen containing compounds: Important chlorohydrocarbons used as solvents. Pesticides – Dichloromethane, chloroform, carbon tetrachloride, DDT and BHC, Types of solvents - Polar, Non polar.

UNIT -III AROMATIC COMPOUNDS AND ORGANIC REACTIONS

3.1 Aromatic compounds: Structure, stability resonance and aromaticity of benzene. Substitution reaction: Nitration, Halogenations, Alkylation. Naphthalene – Isolation, properties and uses.

3.2 Organic reaction: Biuret, Decarboxylation, Benzoin, Perkin, Cannizaro, Claisen and Haloform reactions

3.3 Chemotherapy: Explanation with two examples each for analgesics, antibacterial, anti-inflammatory, antibiotics, antiseptic and disinfectant, anesthetics local and general (Structures not necessary)

UNIT- IV SOLID STATE, ENERGETICS AND PHASE RULE

4.1 Solid state: Typical crystal lattices - unit cell, elements of symmetry, Bragg's equation, Weiss Indices, Miller indices, simple body centered and face centered lattices

4.2 Energetics: First law of thermodynamics – state and path function – need for the second law – carnots cycle and thermo- dynamic scale of temperature, spontaneous and Non – spontaneous processes – entropy – Gibbs free energy.

4.3 Phase rule: Phase, component, degree of Freedom, phase rule definitions - one component system– water system.

UNIT -V CHEMICAL EQUILIBRIUM AND CHEMICAL KINETICS

5.1 Chemical equilibrium: Criteria of homogeneous and heterogeneous equilibria, decomposition of HI, N_2O_4, $CaCO_3$ + Pd5.

5.2 Chemical Kinetics: Order of reaction and their determinations - activation energy, effects of temperature on reaction rate.

REFERENCES

1. Gopalan R, Text Book of Inorganic Chemistry, 2nd Edition, Hyderabad, Universities Press, (India), 2012.
2. Morrison R.T. and Boyd R.N., Bhattacharjee S. K. Organic Chemistry (7th edition), Pearson India, (2011)
3. Puri B.R., Sharma L.R. and Pathania M.S. (2013), Principles of Physical Chemistry, (35th edition), New Delhi: Shoban Lal Nagin Chand and Co.

COURSE OUTCOMES

Upon completion of the course, students will be able to

CO1: Explain the principles of coordination chemistry, industrially important chemicals, fuel gases, fertilizers, soaps, and detergents and describe their applications in industry and daily life.

CO2: Illustrate the electron displacement effects such as inductive, resonance,

hyperconjugation, and steric effects and explain their influence on chemical reaction.

CO3: Describe the structure, aromaticity and reactions of aromatic compounds and classify commonly used chemotherapeutic agents based on their applications.

CO5: Interpret the concepts of crystal structure and phase rule to explain the behavior of solids, energy changes in chemical processes and phase equilibria in one-component systems.

CO6: Analyze the principles of chemical equilibrium and chemical kinetics, equilibrium criteria, reaction order, activation energy, and the effect of temperature on reaction rates.

Relationship Matrix											
Semester	**Course Code**			**Title of the Course**						**Hours**	**Credits**
III				**Allied Course- I Chemistry- I**						**4**	**4**
Course Outcomes	**Programme Specific Outcomes (PSOs)**										**Mean Score of COs**
	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**	
CO1	1	3	1	2	2	1	2	2	1	1	**1.60**
CO2	1	3	2	3	2	1	2	3	1	1	**1.90**
CO3	1	3	2	2	2	1	2	2	1	1	**1.70**
CO4	1	3	2	3	3	1	2	3	2	1	**2.10**
CO5	1	3	3	3	3	1	2	3	2	2	**2.30**
Mean Overall Score											**1.92 (Medium)**

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ALLIED COURSE -II

PRACTICAL

Hours/Week: 3
Credits: 3

VOLUMETRIC AND ORGANIC QUANTITATIVE ANALYSIS

COURSE OBJECTIVES

1. Develop laboratory skills in volumetric analysis using standard analytical techniques for quantitative estimation.
2. Train students in the preparation, standardization, and accurate handling of standard solutions and laboratory apparatus.
3. Enable students to perform redox and acid-base titrations for the estimation of inorganic compounds and water hardness.
4. Develop the ability to identify organic compounds through systematic qualitative analysis and functional group tests.
5. Promote scientific reasoning, observation, accuracy, safety and proper recording of experimental results.

I. Volumetric Analysis

1. Acidimetry and alkalimetry

(a) Strong acid VS strong base

(b) Weak acid VS strong base

c) Determination of hardness of water.

2. Permanganometry

(a) Estimation of ferrous sulphate

(b) Estimation of oxalic acid

3. Iodometry

(a) Estimation of potassium dichromate

(b) Estimation of potassium permanganate

II. Organic Analysis

Analyse the following organic Compounds.

1. Carbohydrate 2. Amide 3. Aldehyde 4. Ketone 5. Acid 6. Amine

The students may be trained to perform the specific reactions like tests for elements (nitrogen only), aliphatic or aromatic, saturated or unsaturated and functional group present and record their observations.

REFERENCES

1. R. Gopalan, Elements of analytical chemistry, S. Chand, New Delhi, 2000.
2. N. S. Gnanapragasam and G. Ramamurthy, Organic Chemistry lab manual, S. Viswanathan and Co. Pvt. Ltd. Chennai-1998

COURSE OUTCOMES

Upon successful completion of the course, students will be able to:

CO1: Perform acid-base titrations and determine the concentration of acids, bases, and hardness of water using appropriate volumetric techniques.

CO2: Carry out redox titrations involving permanganometry and iodometry for the quantitative estimation of inorganic compounds with accuracy.

CO3: Prepare and standardize chemical solutions, use laboratory glassware correctly, and apply good laboratory practices while performing quantitative analysis.

CO4: Identify unknown organic compounds by carrying out systematic qualitative analysis based on elemental tests, solubility, unsaturation, aromaticity, and functional group identification.

CO5: Interpret experimental observations, analyze results, calculate quantitative data accurately, and maintain laboratory records following scientific and safety protocols.

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**						**Hours**	**Credits**
			ALLIED COURSE -II PRACTICAL						**3**	**3**
Course Outcomes	**Programme Specific Outcomes (PSOs)**										**Mean Score of COs**
	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**	
CO1	1	3	2	2	3	1	2	3	2	1	**2.00**
CO2	1	3	2	3	3	1	2	3	2	1	**2.10**
CO3	1	3	2	2	3	2	3	2	3	2	**2.30**
CO4	1	3	3	3	3	2	3	3	3	2	**2.60**
CO5	2	3	3	3	3	2	3	3	3	2	**2.70**
Mean Overall Score											**2.34 (High)**

Note: Scheme for Practical Evaluation.

Organic Qualitative Analysis - 20

Volumetric Estimation -35

Record - 5

Internal Assessment - 40

Total: 100

Volumetric Analysis: 35

Procedure 5 marks

Results < 2 % - 30 marks

2-3 % -20 marks

3-4 % - 10 marks

> 4 % - 5 marks

Organic Qualitative Analysis: 20

Identification of Nitrogen - 4 marks

Saturated and unsaturated - 3 marks

Aliphatic or Aromatic - 3 marks

Preliminary reactions with

Procedure - 5 marks

Functional group identified

Correctly - 5 marks

Total: 20

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GENERAL CHEMISTRY –II

Hours/Week: 4
Credits: 4

COURSE OBJECTIVES

1. To learn the basics of nuclear chemistry and metallic bond.
2. To understand the properties and applications of carbohydrates, amino acids and proteins.
3. To study the basic concepts of polymers, heterocyclic compounds and stereoisomerism.

UNIT- I NUCLEAR CHEMISTRY AND METALLIC BOND

1.1 Nuclear Chemistry : Fundamental particles of nucleus- isotopes, isobars, isotones and isomers – differences between chemical reactions and nuclear reactions, nuclear fusion and fission- radioactive series.
1.2 Metallic bond : Electron gas, Pauling and band theories, semiconductiors – intrinsic, extrinsic n-type and p-type semi conductors.
1.3 Compounds of sulphur and sodium thiosulphate

UNIT- II CARBOHYDRATES, AMINOACIDS AND PROTEINS

2.1 Carbohydrates: classification – glucose and fructose – preparation and properties –structure of glucose – Fischer and Haworth cyclic structures.
2.2 Amino acids and proteins : Amino acids – Classification based on structure. Essential and non – essentials amino acids – preparation, properties and uses – peptides (elementary treatment only) – proteins – Classification based on physical properties and biological functions. Structure of proteins – primary and secondary (elementary treatment).

UNIT- III POLYMERS, HETEROCYCLIC COMPOUND AND STEREOISOMERISM

3.1. Synthetic polymers: preparation, properties and uses of teflon, epoxy resins, polyester resin.
3.2 Heterocyclic compounds: Furan, pyrrole and pyridine – preparation, properties and uses – basic properties of pyridine and pyrrole.
3.3 Stereoisomerism: Optical isomerism – Lactic and tartaric acid – racemic mixture and resolution. Geometrical isomerism – maleic and fumaric acids.

UNIT -IV SURFACE AND PHOTO CHEMISTRY

4.1 Surface Chemistry: Emulsions, gels – preparation, properties - Electrophoresis and applications, chromatography – Column, paper and thin layer Chromatography.
4.2 Photochemistry : Laws of photochemistry and applications.

UNIT- V ELECTROCHEMISTRY, pH AND BUFFER

5.1 Electrochemistry: Specific and equivalent conductivity – their determination – effect of dilution on conductivity. Ostwald's Dilution law, Kohlrausch law, conductivity measurements, and conductometric titrations.
5.2 pH and buffer: Importance of pH and buffers – pH determination by colorimetric and electrometric methods.

REFERENCES

1. B.R. Puri, L.R. Sharma, K.C. Kalia, 'Principles of Inorganic Chemistry', 21st edition, Vallabh Publications, 2004-2005.
2. Bahl, B.S. and Bahl, A., Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (2010)
3. Puri B.R., Sharma L.R. and Pathania M.S. (2013), Principles of Physical Chemistry, (35th edition),New Delhi: Shoban Lal Nagin Chand and Co.

COURSE OUTCOMES
Upon successful completion of the course, students will be able to

CO1: Explain the fundamental concepts of nuclear chemistry, metallic bonding, semiconductor materials, and the chemistry of sulphur compounds and describe their scientific and industrial applications.

CO2: Describe the classification, structure, preparation, properties, and biological significance of carbohydrates, amino acids, peptides and proteins.

CO3: Explain the preparation, properties, and applications of synthetic polymers and heterocyclic compounds, and distinguish different types of stereoisomerism in organic molecules.

CO4: Interpret the principles of surface chemistry and photochemistry, and explain the applications of emulsions, gels, chromatography, electrophoresis and photochemical reactions.

CO5: Analyze the principles of electrochemistry, conductivity, pH, and buffer solutions and apply these concepts in conductometric measurements and chemical analysis.

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**						**Hours**	**Credits**
IV			**Allied Course –III** **General Chemistry –II**						**4**	**4**
Course Outcomes	**Programme Specific Outcomes (PSOs)**										**Mean Score of COs**
	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**	
CO1	2	3	2	2	3	1	2	2	1	2	**2.0**
CO2	2	3	2	2	2	1	2	2	1	2	**1.9**
CO3	2	3	2	3	2	1	2	3	2	2	**2.2**
CO4	2	2	3	3	2	1	2	2	2	2	**2.1**
CO5	2	3	3	3	3	1	2	3	2	2	**2.4**
Mean Overall Score											**2.12 (Medium)**

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