CENTRE FOR DISTANCE AND ONLINE EDUCATION

BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI - 620 024.

B.Sc. (Chemistry) - CHOICE BASED CREDIT SYSTEM –

LEARNINIG OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS - LOCF)

(Applicable to the candidates admitted from the academic year 2026-27 onwards)

Sem.	Part	Course	Title of the Paper	Credit	Exam Hours	Marks		Total
						Int.	Ext.	
I	I	Language Course – I (Tamil*/Other Languages +#)		3	3	25	75	100
	II	English Course - I		3	3	25	75	100
	III	Core Course – I (CC)	General Chemistry I	5	3	25	75	100
		Core Practical – I (CP)	Volumetric Analysis	4	--	40	60	100
		First Allied Course – I (AC)		4	3	25	75	100
		First Allied Practical – I (AP)		--	--	--	--	--
	IV	Value Education		2	3	25	75	100
	TOTAL			**21**	**--**	**--**	**--**	**600**
II	I	Language Course - II (Tamil*/Other Languages +#)		3	3	25	75	100
	II	English Course - II		3	3	25	75	100
	III	Core Course – II (CC)	General Chemistry II	5	3	25	75	100
		Core Practical - II (CP I-III)	Applied Experiments in Volumetric Analysis	4	--	40	60	100
		First Allied Course – II (AC)		4	3	25	75	100
		First Allied Practical – I (AP)		2	--	40	60	100
	IV	Environmental Studies		2	3	25	75	100

	TOTAL		**23**	**--**	**--**	**--**	**700**

List of Allied Courses

First Allied Course (any one)	**Second Allied Course**
Botany	Physics
Computer Science	
Mathematics	
Zoology	

SUMMARY OF CURRICULUM STRUCTURE OF UG PROGRAMMES

Sl. No.	Part	Types of the Courses	No. of Courses	No. of Credits	Marks
1.	I	Language Courses	4	12	400
2.	II	English Courses	4	12	400
3.	III	Core Courses	9	45	900
4.		Core Practical	6	24	600
5.		Allied Courses I & II	4	16	400
6.		Allied Practical	2	4	200
7.		Major Based Elective Courses	2	8	200
8.		Project	1	7	100
9.	IV	Non-Major Elective Courses	2	4	200
10.		Soft Skills Development	1	2	100
11.		Value Education	1	2	100
12.		Environmental Studies	1	2	100
13.	V	Gender Studies	1	2	100
	Total		**38**	**140**	**3800**

PROGRAMME OBJECTIVES

The programme enable the students

1. To understand basic facts and concepts in chemistry while retaining the exciting aspects of chemistry to develop interest in the study of chemistry as a discipline.
2. To demonstrate, solve and understanding the major concept in organic, inorganic, physical, industrial, nuclear, polymer, food, pharmaceutical, cosmetics and environmental chemistry. (All disciplines of chemistry).
3. To develop the skill to solve the problems and think methodically, independently and draw the logical conclusion.
4. To understand the importance of the elements in the periodic table including their physical and chemical nature and role in the daily life.
5. To understand concepts of chemistry and apply scientific information to solve problems in all situation so that they get a strong foundation in chemistry.
6. To understand the concepts of chemistry to inter relate and interact to the other subject like mathematics, physics, biological science etc.
7. To develop skills in the proper handling of apparatus, chemicals and instruments.
8. To be exposed to the different processes used in industries and their applications.
9. To learn the laboratory skills and to transfer and interpret knowledge entirely in the working environment.
10. To achieve the skills required to succeed in graduate school, professional school and the chemical industry like cement industries, agro product, paint industries, rubber industries, petrochemical industries, food processing industries, fertilizer industries.
11. To expand the knowledge in available opportunities related to chemistry in the government services through public service commission particularly in the field of food safety, health inspector, pharmacist etc.
12. To discuss how science and its applications interact with social, economic, political, environmental, cultural and ethical factors.

PROGRAMME OUTCOMES

On successful completion of B.Sc. Chemistry programme, students are expected to

- Gain complete knowledge about all fundamental aspects of chemistry
- Apply chemistry knowledge to solve problems in various fields of chemistry.
- Get a skill for effective and safe handling of apparatus, chemicals and instruments in a laboratory.
- Carry out experiments in the area of organic analysis, Volumetric analysis, inorganic semi-micro analysis, conductometric & potentiometric equipment
- Use technologies and instrumentation together to explore new areas of research.
- Get enormous job opportunities at chemical, pharmaceutical and food product industries.
- Appear in competitive exams conducted by service commissions such as UPSC and TNPSC
- Gain knowledge in the emerging field of nanochemistry and polymer chemistry.

First Year **CORE COURSE I** **Semester I**

GENERAL CHEMISTRY I

(Theory)

COURSE OBJECTIVES:

- To learn the arrangement of elements in the periodic table and to understand the periodic properties
- To learn the laboratory hygiene, safety measures, principles of qualitative and quantitative analysis
- To learn the various methods of preparation, structure and stability of reaction intermediates.
- To understand the chemistry of cycloalkanes, alkenes and alkynes.
- To learn the types, preparation and properties of sols, colloids and emulsions and the determination of molecular weight of macromolecules

UNIT – I PERIODIC TABLE AND PERIODIC PROPERTIES:

1.1. Quantum Numbers, Filling up of atomic orbitals: Pauli's exclusion principle, Aufbau Principle, Hunds rule of maximum multiplicity – electronic configuration. Stability associated with half-filled and completely filled orbitals.

1.2. Periodic properties of elements – variation of atomic volume, atomic and ionic radii, ionization potential, electron affinity, electro negativity along periods and groups. Pauling scale of electro negativity.

1.3 Classification of elements into s, p, d and f blocks.

UNIT- II LABORATORY HYGIENE, SAFETY MEASURES AND ANALYTICAL METHODS:

2.1 Storage and handling of chemicals – Corrosion, flammable, explosive, carcinogenic and toxic chemicals. Simple first aid procedures for accidents involving acids, alkalis, bromine, fire burns and cut by glass.

2.2 Solubility product, common ion effect, complexation, oxidation-reduction reactions involved in identification of anions and cations – separation of cations into groups – Semi micro analysis of simple salts.

2.3 Volumetric analysis – preparation of standard solutions – normality, molarity and molality - titrimetric reactions – acid-base, redox, precipitation and complexometric titrations – indicators – effect of change in

2.4 pH – selection of suitable indicators.

UNIT - III ALKANES, REACTIVE INTERMEDIATES AND METHODS FOR REACTION MECHANISMS:

3.1 Introduction: Inductive, mesomeric, electromeric effects and hyper conjugation – structure of organic molecules based on sp3, sp2 and sp hybridization. Alkanes – sources of alkanes – general preparation – general

properties – conformational analysis of ethane and n-butane.

3.2 Homolytic and Heterolytic cleavages of bonds, Characteristics of nucleophilic, electrophilic and free radical reactions.

3.3 Carbocations, Carbanions, Free radicals and Carbenes: Generation and stability of reactive intermediates – Correlation of reactivity with structure of reactive intermediates.

UNIT- IV CHEMISTRY OF CYCLOALKANES, ALKENES, DIENES AND ALKYNES:

4.1 Preparation of cycloalkanes – Chemical properties – Relative stability of cyclopropane to cyclooctane – Baeyer's Strain theory – Limitations – Mono and di-substituted cyclohexanes.

4.2 Alkenes: Nomenclature – Petroleum source of alkenes and aromatics – General methods of preparation of alkenes – Chemical properties – Markovnikov's rule and peroxide effect-Uses – Elimination reactions and its mechanisms (E_1, E_2).

4.3 Dienes: Structures and properties – conjugated dienes – stability and resonance– electrophilic addition – 1,2 addition and 1,4 addition. Alkynes: Nomenclature – General methods of preparation – Physical properties – Chemical properties – Uses.

UNIT – V COLLOIDS AND MACROMOLECULES:

5.1 Definition and types of Colloids- preparation, Purification (dialysis, electro dialysis and ultra-filtration) and stability of colloids, gold number.

5.2 Properties of colloids- kinetic, optical and electrical properties.

5.3 Emulsions – Types of emulsions, preparation, properties and applications, Donnan membrane equilibrium.

5.4 Osmosis – reverse osmosis and desalination. Macromolecules- Molecular weight of macromolecules- determination of molecular weight by osmotic pressure and light scattering methods.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Chart preparation on laboratory hygiene with safety measures and s, p, d and f block elements separately with their common properties and applications. Best chart can be placed in the laboratory for students perusal.

REFERENCES:

1. R.D. Madan, "Modern Inorganic Chemistry", 2nd edition, S. Chand & Company Ltd., 2000.
2. P.L. Soni, "Text book of Inorganic Chemistry", 20th revised edition, Sultan Chand & Sons, 2000.
3. B.R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry, 23rd edition, New Delhi, ShobanLalNagin Chand & Co., (1993).
4. J.D. Lee, 'Concise Inorganic Chemistry', 20th revised edition, Sultan

Chand & Sons, 2000.
5. R. Gopalan, P.S. Subramanian & K. Rengarajan, "Elements of Analytical Chemistry", 2nd edition, Sultan Chand & Sons, 1000.
6. Morrison, R.T. and Boyd, R.N., Bhattacharjee, S. K. Organic Chemistry (7th edition), Pearson, India, (2011).
7. Bahl, B.S. and Bahl, A., Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (2010).
8. Jerry March, "Advanced Organic Chemistry, Reaction, Mechanism and Structure", 7th Edition, Wiley Inter Science (2013).
9. Puri B.R., Sharma L.R. and Pathania M.S. Principles of Physical chemistry, (35th edition), New Delhi: ShobanLalNaginchand and Co. (2013)
10. Glasstone S. and Lewis D., Elements of Physical Chemistry, London, Mac Millan& Co Ltd.
11. https://oms.bdu.ac.in/ec/admin/contents-/316_20211123075240176.pdf
12. https://kanchiuniv.ac.in/coursematerials/Dr.%20RP%20%20Carbocationspdf

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- To predict periodic properties and position of elements in the periodic table.
- To apply theoretical aspects in qualitative and quantitative analysis and work safe and hygienically in laboratories.
- To prepare and predict the stability and reactivities of reaction intermediates.
- To prepare & explain the properties of colloids and emulsions.
- To determine the Molecular Weight of macromolecules.

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First Year **CORE PRACTICAL I** **Semester I**

VOLUMETRIC ANALYSIS

(Practical)

COURSE OBJECTIVES:

- To learn the techniques of titrimetric analyses.
- To know the estimation of several cations and anions.
- To know the estimation using neutralization and redox principle.

TITRIMETRIC QUANTITATIVE ANALYSIS:

1. Estimation of HClVsNaOH using a standard oxalic acid solution.
2. Estimation of Na_2CO_3VsHCl using a standard Na_2CO_3 solution.
3. Estimation of Iron (II) sulphateVs $KMnO_4$ using a standard Mohr's salt solution.
4. Estimation of oxalic acid Vs $KMnO_4$ using a standard oxalic acid solution.
5. Estimation of copper (II) sulphate by $K_2Cr_2O_7$ solution.

REFERENCES:

Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons (1997).

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- To understand the use of volumetric pipette, burette and analytical balance.
- To Explain the principles of volumetric analysis,
- Toprepare standard solution to find out the concentrations of unknown analyte,
- To understand the selection of indicators and can apply the knowledge in chemical experiments.

Scheme of Valuation	**Max. Marks**
Record	**- 5 (marks)**
Procedure Writing	**-10 (marks)**
Results	
< 1 %	- 45 marks
1-2 %	- 35 marks
2-3 %	- 25 marks
3-4 %	- 15 marks
> 4 %	- 10 marks

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First Year **CORE COURSE II** **Semester II**

GENERAL CHEMISTRY II

(Theory)

COURSE OBJECTIVES:

- To understand the principles of bonding and theories of chemical bonding.
- To understand the chemistry of S-block and Zero group elements.
- To learn the concepts of inorganic semi micro qualitative analysis.
- To understand the aromatic character of benzene type molecules and to learn the reaction mechanisms involved in haloalkanes and halobenzenes.
- To understand the properties of atoms, characteristics, effect of radiations and the significance of wave functions.

UNIT - I CHEMICAL BONDING:

1.1. Ionic bond – formation, variable electro valency – Lattice energy, Born – Haber Cycle. Covalent bond - formation, variable covalency, maximum covalency, covalent character in ionic bond – Fajans' Rule. Polarization – partial ionic character of a covalent bond.

1.2 VB theory, MO theory – Basic principles of bonding and antibonding orbitals, applications of MOT to H_2, He_2, N_2 & O_2 – molecular orbital sequence, comparison of VB & MO Theories.

1.3 Hybridization – Formation of $BeCl_2$ & BCl_3. VSEPR theory of simple inorganic molecules – $BeCl_2$, $SiCl_4$, PCl_5, SF_6, BF_3 & H_2O.

1.4 Hydrogen bonding – Intermolecular & Intramolecular H_2 – bonding and consequences.

UNIT - II CHEMISTRY OF s-BLOCK AND ZERO GROUP ELEMENTS:

2.1 General characteristics of s-block elements – comparative study of elements – alkali metals and their hydroxides, oxides and halides, alkaline earth metals and their oxides, carbonates and sulphates.

2.2 Diagonal relationship of Li & Mg, Be & Al, chemistry of NaOH, KI & $Mg(NH_4)PO_4$.

2.3 Qualitative Inorganic Analysis – Dry Test, flame test, cobalt nitrate test wet confirmatory test for acid radicals, interfering acid radicals–elimination of interfering acid radicals.

2.4 Zero group elements – position in the periodic table, occurrence, isolation, applications, compounds of Xe - XeF_4 & XeF_6.

UNIT - III CHEMISTRY OF BENZENE AND BENZENOID COMPOUNDS:

3.1 Aromaticity – Huckle's rule - structure of benzene – Benzene-preparation, chemical properties and uses. Aromatic electrophilic substitution reactions and mechanism – Orientation and reactivity in substituted benzenes.

3.2 Polynuclear aromatic hydrocarbons – Nomenclature, Naphthalene from coal tar and petroleum – Laboratory preparation, Structure of Naphthalene, Aromatic character, Physical properties, Chemical properties, Uses.
3.3 Anthracene, Phenanthrene from coal tar and petroleum, Laboratory preparation, Molecular Orbital structures, Aromatic Characters, Physical Properties, Chemical properties and uses.

UNIT - IV ALKYL AND ARYL HALOGENS:

4.1 Nomenclature of haloalkanes – structure - general preparations of haloalkanes - physical and chemical properties and uses.
4.2 Nucleophilic aliphatic substitution reaction mechanisms (S_N1 and S_N2) – Stereo chemical aspects.
4.3 Halobenzenes: Theory of orientation and reactivity - general preparation – properties - uses. Electrophilic and nucleophilic aromatic substitution reaction mechanisms.

UNIT – V ATOMIC STRUCTURE AND BASIC QUANTUM MECHANICS:

5.1 Rutherford's and Bohr's model an atom- Bohr's theory and origin of hydrogen spectrum. Somerfield's extension of Bohr's theory.
5.2 Electromagnetic radiation- definitions for λ, υ and velocity.
5.3 Dualism of light -Particle nature of radiation- black body radiation and Planck's quantum theory, photoelectric effect and Compton effect of matter.
5.4 De Broglie hypothesis and Davisson and Germer experiment. Heisenberg's uncertainty principle. Schrodinger wave equation (Derivation not needed). Physical significance of Ψ and Ψ^2.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

An assignment on applications of hydrogen bonding, various atomic models and evidences for dualism of light. Chart preparations for molecular orbital theory diagram. An exposure to virtual laboratory experiments.

REFERENCES:

1. R.D. Madan, "Modern Inorganic Chemistry", 2nd edition, S. Chand & Company Ltd., 2000.
2. P.L. Soni, "Text book of Inorganic Chemistry", 20th revised edition, Sultan Chand & Sons, 2000.
3. B.R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry, 23rd edition, New Delhi, ShobanLalNagin Chand & Co., (1993).
4. J.D. Lee, 'Concise Inorganic Chemistry', 20th revised edition, Sultan Chand & Sons, 2000.
5. R. Gopalan, P.S. Subramanian & K. Rengarajan,"Elements of Analytical Chemistry", 2nd edition, Sultan Chand & Sons, 1991.
6. Morrison R.T. and Boyd R.N., Bhattacharjee S. K. Organic Chemistry (7th edition), Pearson India, (2011).
7. Bahl B.S. and Bahl A., Advanced Organic Chemistry, (12th edition), New

Delhi, Sultan Chand & Co., (2010).
8. Jerry March, "Advanced Organic Chemistry, Reaction, Mechanism and Structure", 7th Edition, Wiley Inter Science (2013).
9. Puri B.R., Sharma L.R. and Pathania M.S. (2013) Principles of Physical Chemistry, (35th edition), New Delhi: ShobanLalNaginchand and Co.
10. Bahl B.S., ArunBahl and Tuli G.D. (2012). Essentials of Physical Chemistry, New Delhi: Sultan Chand and Sons.
11. https://oms.bdu.ac.in/ec/courses.php?subject=B.Sc.%20(CHEMISTRY)
12. http://www.chem.ualberta.ca/~vederas/Chem_164/handouts/pdf/sub_elim_rxn.pdf

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

- To explain the principles and theories of chemical bonding.
- To explain the chemistry of S-block elements and Zero group elements.
- To apply the concept of common ion effect, solubility product in inorganic Semi micro qualitative analysis
- To explain the reaction mechanism of haloalkanes and halobenzene.
- To explain atomic models. Atomic spectrum and dual nature of light black body radiation and significances of wavefunctions.

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First Year **CORE PRACTICAL II** **Semester II**

APPLIED EXPERIMENTS IN VOLUMETRIC ANALYSIS
(Practical)

COURSE OBJECTIVES:

- To learn the applications of volumetric analysis in consumer product.
- To learn the applications of complexometric titrations.
- To understand estimation of hardness, alkalinity and chlorine in water.

TITRIMETRIC QUANTITATIVE ANALYSIS:

1. Estimation of total hardness of water by EDTA method.
2. Estimation of chloride ion in water (in acidic and alkaline medium).
3. Estimation of calcium in commercial milk powder by EDTA method.
4. Estimation of Mg (II) in water by EDTA method.
5. Estimation of chlorine in bleaching powder.
6. Estimation of saponification value of an oil.
7. Preparation of distilled and deionized water.

REFERENCES:

Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons (1997).

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

1. To Apply the principles of complexometric titrations,
2. To understand the conditions of complex formation.
3. To prepare the buffer solutions at a required pH
4. To select the correct titrimetric procedure along with standard and nonstandard solutions.
5. To perform all sorts of volumetric calculations.

Scheme of Valuation	**Max. Marks**
Record	- 5 (marks)
Procedure Writing	-10 (marks)
Results	
< 1 %	- 45 marks
1-2 %	- 35 marks
2-3 %	- 25 marks
3-4 %	- 15 marks
> 4 %	- 10 marks

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