

Bachelor of Science



Chemistry

SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

[An Autonomous College Affiliated to Periyar University, Salem, Tamil Nadu]

[Accredited by NAAC with 'A' Grade with CGPA of 3.27]

[Recognized 2(f) & 12(B) Status under UGC Act of 1956]

Katteri – 636 902, Uthangarai (Tk), Krishnagiri (Dt)

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DEGREE OF BACHELOR OF SCIENCE IN CHEMISTRY
CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS AND SYLLABUS FOR

B.SC. CHEMISTRY PROGRAMME

(SEMESTER PATTERN)

**(For Students Admitted in the College from the
Academic Year 2020-2021 Onwards)**



Programme Outcomes (POs)

PO1	Graduates are prepared to be creators of new knowledge leading to innovation and entrepreneurship employable in various sectors such as private, government, and research organizations
PO2	Graduates are trained to evolve new technologies in their own discipline.
PO3	Graduates are groomed to engage in lifelong learning process by exploring their knowledge independently
PO4	Graduates are framed to design and conduct experiments /demos/create models to analyze and interpret data.
PO5	Graduates ought to have the ability of effectively communicating the findings of Physical sciences; incorporating with existing knowledge

Programme Specific Outcomes (PSOs)

PSO1	Human and Social Values and Responsibilities in the context of learning Chemistry
PSO2	Communicative Skills and the Creative scientific mind towards learning chemistry
PSO3	Positive approach towards Environment and Ecology from the Chemistry perspective
PSO4	Critical thinking and the Analytical mind, students develop for the in depth knowledge in advanced-level Chemistry
PSO5	The relevance of extension of Chemistry in the social context for solving social issues
PSO6	Employability Skills shall enable the students to find jobs in core- chemistry and other related fields
PSO7	Entrepreneurial Skills shall empower the students to start their own industries / business in core-chemistry fields
PSO8	Analytical or Experimental Skills make the students capable of doing higher-level research works in the emerging fields of chemistry



SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

Bachelor of Science (B.Sc.) in Chemistry

Programme Pattern and Syllabus (CBCS)

(For Students Admitted in the College from the Academic Year 2020-2021 Onwards)

Sl. No	Nature of the Course	Course Code	Name of the Course	Hours / Week	Credits	Marks		
						CIA	ESE	Total
SEMESTER I								
1	Language I	20UTA1F01	Tamil - I	5	3	25	75	100
2	English I	20UEN1F01	English - I	5	3	25	75	100
3	Value edu*	20UVE101	Value Education	2	2	25	75	100
4	Core-I	20UCH1C01	General Chemistry I	6	4	25	75	100
5	Core practical-I	20UCH1P01	Inorganic Qualitative Analysis-I and Complex Preparation	3	3	40	60	100
6	Allied I	20UMA1A01	Allied Mathematics-I	6	4	25	75	100
		20UZO1A01	Allied Zoology-I					
7	Allied-I Practical	20UMA1AP01	Allied Mathematics Practical -I	3	-	-	-	-
		20UZO1AP01	Allied Zoology Practical -I					
Total				30	19	165	435	600
SEMESTER II								
8	Language II	20UTA2F02	Tamil - II	5	3	25	75	100
9	English II	20UEN2F02	English - II	5	3	25	75	100
10	EVS	20UES201	Environmental Studies	2	2	25	75	100
11	Core-II	20UCH2C02	General Chemistry II	5	4	25	75	100
12	SBEC I	20UCH2S01	Food and Nutrition	2	2	25	75	100
13	Core practical-II	20UCH2P02	Practical II: Inorganic Qualitative Analysis-II	3	3	40	60	100
14	Allied II	20UMA2A02	Allied Mathematics-II	5	3	25	75	100
		20UZO2A02	Allied Zoology-II					
15	Allied-I Practical	20UMA2AP02	Allied Mathematics Practical -II	3	3	40	60	100
		20UZO2AP02	Allied Zoology practical -					



			II					
Total				30	23	230	570	800
SEMESTER-III								
16	Language III	20UTA3F03	Tamil - III	5	3	25	75	100
17	English III	20UEN3F03	English - III	5	3	25	75	100
18	NMEC - I	20UCH3N01	Non Major Elective Course - I	2	2	25	75	100
19	Core-III	20UCH3C03	General Chemistry III	6	4	25	75	100
20	Core Practical-III	20UCH3P03	Practical III: Volumetric Analysis- I	3	3	40	60	100
21	Allied-III	20UPH3A01	Allied Physics-I	6	4	25	75	100
22	Allied Practical-III	20UPH3AP01	Allied Physics Practical - I	3	-	-	-	-
Total				30	19	165	435	600
SEMESTER IV								
23	Language IV	20UTA4F04	Tamil - IV	5	3	25	75	100
24	English IV	20UEN4F04	English - IV	5	3	25	75	100
25	NMEC - I	20UCH4N02	Non Major Elective Course - I	2	2	25	75	100
26	SBEC II	20UCH4S02	Polymer Chemistry	2	2	25	75	100
27	Core - IV	20UCH4C04	General Chemistry IV	5	5	25	75	100
28	Core practical - IV	20UCH4P04	Practical IV: Volumetric Analysis- II	3	3	40	60	100
29	Allied - IV	20UPH4A02	Allied Physics-II	5	3	25	75	100
30	Allied Practical - IV	20UPH4AP02	Allied Physics Practical - II	3	3	40	60	100
Total				30	24	230	570	800
SEMESTER V								
31	Core -V	20UCH5C05	Inorganic Chemistry I	5	4	25	75	100
32	Core - VI	20UCH5C06	Organic Chemistry I	5	4	25	75	100
33	Core -VII	20UCH5C07	Physical Chemistry I	5	4	25	75	100
34	Elective I	20UCH5E01	Analytical Chemistry I	5	4	25	75	100
35	SBEC -III	20UCH5S03	Agricultural Chemistry	2	2	25	75	100
36	Core Practical - V	20UCH5P05	Practical V: Gravimetric Estimation I	3	3	40	60	100
37	Core Practical -	20UCH5P06	Practical VI: Organic	2	2	40	60	100



	VI		Chemistry Practical I					
38	Core Practical - VII	20UCH5P07	Practical VII: Physical Chemistry Practical I	3	3	40	60	100
Total				30	26	245	555	800
SEMESTER VI								
40	Core - VIII	20UCH6C08	Inorganic Chemistry II	5	4	25	75	100
41	Core -IX	20UCH6C09	Organic Chemistry II	5	4	25	75	100
42	Core - X	20UCH6C10	Physical Chemistry II	5	4	25	75	100
43	Elective II	20UCH6E02	Analytical Chemistry II	5	4	25	75	100
44	SBEC -IV	20UCH6S04	Pharmaceutical Chemistry	2	2	25	75	100
45	Core Practical - VIII	20UCH6P08	Practical V:Gravimetric Estimation II	3	3	40	60	100
46	Core Practical - IX	20UCH6P09	Practical V: Organic Chemistry Practical	2	3	40	60	100
47	Core Practical - X	20UCH6P10	Practical V: Physical Chemistry Practical II	3	3	40	60	100
48	Extension Activities	20UEX601	Extension Activities	-	1	-	-	-
Total				30	28	245	555	800
Cumulative Total				180	140	1280	3120	4400

Note

- CBCS – Choice Based Credit system
 CIA – Continuous Internal Assessment
 ESE – End of Semester Examinations
 SWAYAM –Study Webs of Active-Learning for Young Aspiring Minds
 NPTEL –National Programme on Technology Enhanced Learning

Major Elective Courses

- 1 Analytical chemistry-I
2. Analytical chemistry-II

Non-Major Elective Courses

1. Communication English / Hindi
2. Basic Computer Applications

**List of Extension Activities**

1. National Cade Corps (NCC)
2. National Service Scheme (NSS)
3. Youth Red Cross (YRC)
4. Physical Education (PYE)
5. Eco Club (ECC)
6. Red Ribbon Club (RRC)
7. Women Empowerment Cell (WEC)



PROGRAMME SYLLABUS



Program: B.Sc. Chemistry				
Core – I		Course Code: 20UCH1C01		Course Title: General Chemistry – I
Semester	Hours/Week	Total Hours	Credits	Total Marks
I	6	90	4	100

Course Objectives

1. Students shall explain the behavior and interactions between matter and energy at both the atomic and molecular levels.
2. Students shall use standardized names and symbols to represent atoms, molecules, ions and apply on chemical reactions.
3. Students shall predict the atomic structure, chemical bonding or molecular geometry based on accepted models.
4. Students shall apply quantitative reasoning skills to matter and energy and also study the physical or chemical changes that occur.
5. Students shall use accepted models to describe the reactions between gaseous systems and become aware of their physical properties.
6. Students shall demonstrate competence in collecting and interpreting data from their knowledge on analytical techniques.

UNIT- 1 Atomic Structure -I (18 Hours)

1.1. Dual nature of matter- Debroglie equation- derivation and limitation-Heisenberg's uncertainty principle- Schrodinger's wave equation(derivation not needed)-postulates of Bohr atom model-origin of Hydrogen spectrum

1.2. Quantum numbers-Pauli's Exclusion principle and its application-Hund's rule- its basis and applications - stability of half-filled and fully – filled orbitals- Aufbau principle and its limitations.Differences between an orbit and orbital-shapes of different orbitals

**UNIT-II Atomic Structure –II (18 Hours)**

2.1. Periodic properties: Atomic and ionic radii, Ionization Energy, Electron affinity and Electro negativity – Definition, Variation of the periodic properties along periods and groups-theoretical explanation for the variations.Measurement of electronegativity using Pauling’s scale and Mulliken scale.

2.2. Radioactivity-Isotopes, Isobar, Isotones- Radioactive series- Uranium series-Thorium series-Actinium series-Neptinium series.

UNIT-III Analytical chemistry (18 Hours)

3.1. Handling of chemicals – Safety and hygiene in chemical laboratory-storage and handling of chemicals, handling of acids, ethers, toxic and poisonous chemicals, antidotes. Threshold vapour concentration and first aid procedure.

3.2. Principles of Volumetric analysis- Definition of molarity, molality, normality and mole fraction-Definition and examples for Primary and Secondary standards. Theories of acid-base, redox, iodometric , iodimetric and complexometric titrations.

UNIT – IV Structure and Bonding of Alkanes and Alkenes (18 Hours)

4.1. IUPAC Nomenclature – aliphatic and aromatic compounds of simple functional groups – Hybridization and structure of Methane – ethylene – acetylene.

4.2 Alkane – Ethane preparation - properties and conformation analysis – octane number – cetane number

4.3 Alkenes-preparation, electrophilic and free radical mechanism of addition – Markownikoff’s Rule – Anti Markownikoff’s Rule -mechanism of hydroboration.

4.4 Electron displacement effects: Inductive and steric effects-their effect on properties of compounds, resonance, hyperconjugation - localised and delocalized chemical bond.

UNIT V The first law of thermodynamics (18 Hours)

5.1. Terminology of Thermodynamics-Thermodynamic equilibrium-Nature of work and heat-Law of conservation of energy- first law of thermodynamics-Internal energy-Enthalpy of a system- Heat capacity of a system-Expansion of an ideal gas-work done in reversible isothermal expansion-work done in reversible isothermal compression-work done in reversible adiabatic expansion – Joule-Thomson effect, Joule-Thomson coefficient-Inversion



temperature - zeroth law of thermodynamics-Absolute temperature scale - Kirchoff's equation.

Text Books

1. Puri B R, Sharma L R and Kalia K K, Principles of Inorganic Chemistry, 23rd Ed., (1993) Shoban Lal Nagin Chand & Co., New Delhi.
2. Bhal B S and Arun Bhal, Advanced Organic Chemistry, 12th Ed., (1997), Sultan Chand & Co., New Delhi.
3. Puri B R, Sharma L R and Kalia K K, Principles of Physical Chemistry, 23rd Ed., (1993) Shoban LalNagin Chand & Co., New Delhi.

Reference Books

1. Lee J D, Concise Inorganic Chemistry, 5th Ed., (2006), Black Well Science, UK.
2. Morrison R T, Boyd R N and Batcharjee S K, Organic Chemistry, 7th Ed., (2009), Pearson New York
3. Peter Atkins and Julio De Paula, Atkin's Physical Chemistry, 4th Ed., (2006), Oxford University Press, New Delhi.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Identify structure of atom	K1
CO2	Understand the concept of Dual nature of matter and atomic character in some molecules	K2
CO3	Illustrate the importance of storage and handling of chemicals	K3
CO4	Analyse the Safety and hygiene in chemical laboratory	K4
CO5	Evaluate the techniques of thermochemistry	K5&K6
CO6	Formulate the structure and bonding reactions shown by organic molecules	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create



Mapping of COs with POs

PO CO	PO1	PO2	PO3	PO4	PO5
C01	S	H	H	M	S
C02	S	H	M	H	H
C03	H	M	S	S	M
C04	H	H	H	M	S
C05	S	S	M	H	S
C06	H	S	S	S	S

S - Strong

H - High

M - Medium

L – Low



Program: B.Sc. Chemistry				
Core Practical – I		Course Code: 20UCH1CP01		Course Title: Inorganic Qualitative Analysis – I & Complex Preparation
Semester I	Hours/Week 3	Total Hours 45	Credits 3	Total Marks 100

Course Objectives

(a). To Analysis of Inorganic salt containing one anion and one cation. Semi-micro method using the conventional scheme to be adopted.

Anions to be Studied - I

Carbonate, Sulphide, Sulphate, Nitrate, Chloride, Bromide.

Cations to be Analyzed – II

Lead, Copper, Cadmium, Bismuth, Aluminium, Iron, Nickel, Zinc and Ammonium.

Preparation of Inorganic Compounds - II

1. Tetrammine copper II sulphate
2. Tris (thiourea) copper I chloride
3. Potassium trioxalato ferrate (II)
4. Chloropentammine cobalt (III) chloride
5. Ferrous ammonium sulphate
6. Microcosmic salt

Acid Radical 15 Marks

Basic Radical 10 Marks

Preparation 10 Marks

Record 10 Marks

Viva Voce 10 Marks

Procedure 05 Marks

TOTAL 60 MARKS

Reference:

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

Course Outcomes



* Students shall learn the techniques of semi micro qualitative analysis of inorganic salt mixtures.

* Students become familiar with elimination of interfering acid radicals.

Program: B.Sc. Chemistry				
Core –II	Course Code: 20UCH2C02		Course Title: General Chemistry – II	
Semester	Hours/Week	Total Hours	Credits	Total Marks
II	6	90	5	100

Course Objectives

1. Students shall understand the concepts of chemical bonding
2. Students shall become aware of the fundamental aspects of reaction intermediate and its influence on chemical properties
3. Students will learn the chemical aspects of cycloalkanes
4. Students shall become aware of the chemistry of aromatic hydrocarbons
5. Students shall learn the Second law of Thermodynamic principles
6. Students shall learn to apply the concept of thermodynamics in real life context.

UNIT – I Chemical Bonding-I (18 Hours)

1.1. Ionic bond-condition for the formation of ionic bond -inert pair effect-Born Haber cycle-polarization of ions- Fajan's rules and applications. Covalent Bond-mode of formation-properties of covalent compounds-Octet theory- Explanation of the failure of Octet rule-Comparison of the properties of Ionic and Covalent compounds –

1.2 Co-ordinate bond – mode of formation –properties of co-ordinate bond –Nature of Metallic bond by Electron – gas theory –Hydrogen bond –mode of formation – properties of Hydrogen bonds-Types of Hydrogen bonds . Vander waals force-definition –Types-applications.

UNIT – II Chemical Bonding - II (18 Hours)

2.1 Valency bond theory – postulates – different types of overlapping - Comparative study of VB and MO theory. Hydrides – types of hydrides – preparation, properties , uses and structure of NaBH₄ and LiAlH₄.



2.2. Molecular orbital theory – postulates – Bonding , anti –bonding molecular orbitals – Energy level diagram for molecular orbitals-bond order – magnetic property – C_2 , N_2 , O_2 - Energy level diagram for molecular orbitals-bond order – magnetic property of Hetero nuclear diatomic molecules – CO , NO .

UNIT – III Reaction intermediates (18 Hours)

- 3.1. Reaction intermediates: carbocation, carbanion, free radicals-formation and stability.
- 3.2. Aliphatic nucleophilic substitution- SN_1 , SN_2 and SN_i reactions – mechanism and stereochemistry. Competition between substitution and elimination.
- 3.3. Elimination reactions-mechanisms of E_1 and E_2 reactions- Hofmann and Saytzeff rule.
- 3.4. Dienes-isolated and conjugated dienes - 1, 3 butadiene preparation and properties - 1, 2 and 1, 4-addition.

UNIT – IV Cycloalkanes and Aromatic Hydrocarbons (18 Hours)

- 4.1. Cycloalkanes- methods of formation-Wurtz reaction, Dieckmann ring closure and Baeyer's strain theory and its limitations.
- 4.2. Electrophilic substitution reactions in aromatic compounds- general mechanism – Nitration, Halogenation, Sulphonation, Friedel- Crafts acylation and alkylation. Nuclear and side chain halogenation.
- 4.3. Polynuclear aromatic hydrocarbons- naphthalene, anthracene -isolation, synthesis and properties

UNIT – V Second law of thermodynamics-I(18 Hours)

- 4.1. Limitations of the first law-need for second law- spontaneous processes-cyclic process-Carnot cycle – efficiency - Carnot theorem-Thermodynamic scale of temperature.
- 4.2. Concept of entropy-Entropy-a state function-Entropy change in isothermal expansion of an ideal gas-entropy change in reversible and irreversible processes-Clausius inequality-Entropy change accompanying change of phase--Entropy of mixture of ideal gases-entropy of mixing physical significance of entropy.

Text Books:

1. Puri B R, Sharma L R and Kalia K K, Principles of Inorganic Chemistry, 23rd Ed., (1993) Shoban Lal Nagin Chand & Co., New Delhi.



- Bhal B S and Arun Bhal, Advanced Organic Chemistry, 12th Ed., (1997) Sultan Chand & Co., New Delhi.

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- Morrison R T, Boyd R N and Batcharjee S K, Organic Chemistry, 7th Ed., (2009), Pearson New York
- Peter Atkins and Julio De Paula, Atkin's Physical Chemistry, 4th Ed., (2006), Oxford University Press, New Delhi.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define chemical bonding	K1
CO2	Understand the concept of different types of overlapping	K2
CO3	Illustrate the importance of Second law of thermodynamics and concept of entropy	K3
CO4	Analyse the Electrophilic substitution reactions in aromatic compounds	K4
CO5	Evaluate the Reaction intermediates	K5&K6
CO6	Formulate the Molecular orbital theory	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO \ CO	PO1	PO2	PO3	PO4	PO5
CO1	S	H	H	H	M
CO2	S	M	M	H	H
CO3	M	H	H	H	H
CO4	H	M	M	M	S
CO5	S	S	M	M	S



CO6	H	H	S	S	M
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S - Strong

H - High

M - Medium

L – Low

Program: B.Sc. Chemistry				
Core Practical – II		Course Code: 20UCH2CP02	Course Title : Qualitative Analysis of Inorganic Salt Mixture-II	
Semester II	Hours/Week 3	Total Hours 45	Credits 3	Total Marks 100

Course Objective

Analysis of mixture containing two cations and two anions of which one will be an Interfering ion. Semi-micro methods using the conventional scheme to be adopted.

Cations to be studied

Lead, Copper, Bismuth, Cadmium, Iron, Aluminium Zinc, Manganese, Cobalt, Nickel, Barium, Calcium, Strontium, Magnesium and Ammonium.

Anions to be studied

Carbonate, Sulphide, Sulphate, Nitrate, Chloride, Bromide, Fluoride, Borate, Oxalate and Phosphate.

RECORD 10 Marks

VIVA VOCE 10 Marks

ACID RADICALS 20 Marks

BASIC RADICALS 20 Marks

Total 60 Marks

REFERENCE BOOKS:

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

Course Outcomes

- * Students shall learn the techniques of titrimetric analyses.
- * Students will become familiar with safe-handling of chemical balance



Program: B.Sc. Chemistry				
SBEC – I	Course Code: 20UCH2S01		Course Title : Food and Nutrition	
Semester II	Hours/Week 2	Total Hours 30	Credits 1	Total Marks 100

Course Objectives

1. To study the Sources of foods, its types and constituents.
2. To know about Mal nutrition, poor nutritional status and guidelines for good health.
3. To study about Food poisoning and Food adulteration.
4. To study about Food spoilage and Food preservation.
5. To know about Sources, requirement and deficiency diseases of vitamins and minerals.

UNIT – I FOOD SOURCES

1.1. Sources of foods, types, constituents of foods-carbohydrate, protein, fats.Oils, colours, flavours and natural toxicants.

UNIT – II NUTRITION

2.1. Definition of nutrition, nutrients, functions. Nutritional status – Definition, signs of good and poor nutritional status.

2.2. Mal nutrition- Definition, forms, causes and remedy.

2.3. Health –Definition, guidelines for good health.

UNIT – III FOOD POISONING AND ADULTERATION

3.1. Food poisoning- Sources, causes and remedy.

3.2 Causes and remedies for acidity, gastritis, indigestion and constipation

3.3. Food adulteration- Types of adulterants- intentional and incidental, effects and detection.

UNIT – IV FOOD PRESERVATION AND PROCESSING

4.1. Food spoilage, causes of food spoilage, types of Food spoilage

4.2. Food preservation-preservation and processing by heating - sterilization, pasteurization.

UNIT – V VITAMINS AND MINERALS

5.1. Sources, requirement and deficiency diseases of A, C, K, E1 and B1, B2.

5.2. Mineral elements in food-source, function, deficiency diseases and daily requirements of Na, K, Mg, Fe, S and P



Reference Books

1. Seema Yadav, **Food Chemistry**, Anmol publishing (P) Ltd, New Delhi
2. Car H. Synder, **The Extraordinary Chemistry for ordinary thing**, John Wiley & sons inc., New York, 1992.
3. B.Sivasankar, **Food Processing and Preservation** – PHI Learning (P) Ltd, New Delhi-11001.
4. B.Srilakshmi, **Nutrition science**. Third edition, New age International (P) Ltd. New Delhi, Chennai.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define Sources of foods	K1
CO2	Understand the concept of Mal nutrition	K2
CO3	Illustrate the importance of Food poisoning and Food adulteration	K3
CO4	Analyze the Food spoilage and Food preservation	K4
CO5	Evaluate the Sources, requirement and deficiency diseases of vitamins and minerals	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO \ CO	PO1	PO2	PO3	PO4	PO5
CO1	S	H	H	H	M
CO2	S	M	M	H	H
CO3	M	H	H	H	H
CO4	H	M	M	M	S
CO5	S	S	M	M	S
CO6	H	H	S	S	M

S - Strong

H - High

M - Medium

L – Low



Program: B.Sc. Chemistry				
Core – III		Course Code: 20UCH3C03		Course Title: General Chemistry – III
Semester III	Hours/Week 5	Total Hours 75	Credits 4	Total Marks 100

Course Objectives

1. The students will be able to understand general trends in the chemistry behind d-block elements.
2. The students will be able to know the important compounds and important applications of compounds of boron and carbon.
3. To explain the typical physical and chemical properties of the transition metals
4. To identify simple compound classes for transition metals and describe their chemical properties
5. Students to understand organic reaction mechanism of name reactions
6. To understand the concepts of thermodynamics and its laws
7. To understand the entropy change in reversible and irreversible reaction
8. To understand the physical significance of third law of thermodynamics

UNIT- 1 Transition Elements and Qualitative Analysis

1.1 Principles of Qualitative analysis- Basic principles of inorganic semi micro analysis. Principles involved in Na_2CO_3 extract preparation, Common ion effect, Solubility product and their applications in Qualitative analysis. Separation of cations into Groups.

1.2. Transition Elements – position in the Periodic Table-General characteristics of d-block elements .Occurrence, extraction, properties and uses of Titanium, Zirconium, Molybdenum, Tungstun.

1.3 Chemistry of Titanium dioxide, Vanadium Pentoxide, Zirconium dioxide, Ammonium molybdate and Molybdenum blue.

UNIT-II Reaction Mechanism II

2.1. Mechanism of - Kolbe's reaction, Reimer-Tiemann reaction, Gattermann, Lederer-Manasse and Houben-Hoesch reactions.



2.2 Define – Example -Mechanism of claisen condensation reaction, Hofmann rearrangement, cannizzaro reaction, perkins reaction.

2.3. Mechanisms of Mannich, Stobbe, Darzen, Wittig and Reformatsky reactions.

UNIT-III Carboxylic acids Hydroxy Acids

3.1 Mono carboxylic acids –preparation ,properties , & uses –Formic acid , Acetic acid - crotonic, and cinnamic acids.

3.2. Hydroxy acids-classification – preparation and reactions of Glycolic acid, Malic acid and Citric acid-Action of heat on α and δ acids.

3.3. Dicarboxylic acids-preparation and properties of oxalic, malonic, succinic, and adipic acids.

UNIT – IV Acid Derivatives & Esters

4.1 Preparation, properties& uses of Acetic anhydride, Acetyl chloride & Acetamide.

4.2. Synthetic uses of Ethylaceto acetate & Diethyl malonate.

4.3. Tautomerism-definition-keto-enol and amido-imido tautomerisms. .

UNIT V Second Law of Thermodynamics-II

5.1. Work and free energy functions-Maxwell's relationships criteria for reversible and irreversible processes -Gibbs-Helmholtz equation.

5.2. Partial molar free energy. Clapeyron equation-Clapeyron- Clausius equation- Applications of Clapeyron-Clausius equation.

5.3. Third law of thermodynamics Nernst heat theorem-statement of III law-Evaluation of absolute entropy from heat capacity measurements-Test for the validity of the law.

Text Books

4. Puri B R, Sharma L R and Kalia K K, Principles of Inorganic Chemistry, 23rd Ed., (1993) Shoban Lal Nagin Chand & Co., New Delhi.

5. Bhal B S and Arun Bhal, Advanced Organic Chemistry, 12th Ed., (1997), Sultan Chand & Co., New Delhi.

6. Puri B R, Sharma L R and Kalia K K, Principles of Physical Chemistry, 23rd Ed., (1993) Shoban LalNagin Chand & Co., New Delhi.



Reference Books

- Lee J D, Concise Inorganic Chemistry, 5th Ed., (2006), Black Well Science, UK.
- Morrison R T, Boyd R N and Batcharjee S K, Organic Chemistry, 7th Ed., (2009), Pearson New York
- Peter Atkins and Julio De Paula, Atkin's Physical Chemistry, 4th Ed., (2006), Oxford University Press, New Delhi.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	The students will be able to explain the fundamental concepts in coordination chemistry of transition metals	K1
CO2	Understand the concept of organic reaction mechanism via cation or anion in some molecules	K2
CO3	The Students should be familiar with the basic knowledge of the Synthetic uses of acid derivatives and esters	K3
CO4	The students will develop the ability of effective solving practical problem of thermodynamics	K4
CO5	Evaluate the techniques of thermochemistry	K5&K6
CO6	Formulate the structure and bonding reactions shown by organic molecules	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO \ CO	PO1	PO2	PO3	PO4	PO5
CO1	S	H	H	M	S
CO2	S	H	M	H	H
CO3	H	M	S	S	M
CO4	H	H	H	M	S
CO5	S	S	M	H	S
CO6	H	S	S	S	S

S - Strong

H - High

M - Medium

L – Low



Program: B.Sc. Chemistry				
Core Practical – III		Course Code: 20UCH3P03		Course Title: Volumetric Estimations -I
Semester III	Hours/Week 3	Total Hours 45	Credits 3	Total Marks 100

Course Objectives

1. To learn the practical techniques of Acidimetry, Iodimetry & Iodometry.
2. Experimental practice of quantitative volumetric analysis.
3. The objective of the titration is the determination of the concentration or the mass of the minimum formula from the titrated chemical material composing a pure liquid or a solution.
4. The main objective of volumetric analysis is to determine the amount of a substance in a given sample. When dealing with volumetric analysis the concept of concentration cannot be avoided. Molarity i.e. moles per litre or decimeter is widely used unit of concentration.
 - Estimation of Borax – Standard Sodium Carbonate.
 - Estimation of Sodium Hydroxide – Standard Sodium Carbonate.
 - Estimation of Ferrous Sulphate – Standard Oxalic acid.
 - Estimation of Copper – Standard Copper Sulphate.
 - Estimation of Potassium dichromate – Standard Potassium dichromate.

Students must write short procedure for the given estimation in ten minutes during the examinations and submit the paper for evaluation.

Reference:

1. Vogel's Inorganic Quantitative Analysis by Vogel, pearson education(2004).
2. O.P.Pandey,D.N.Bajpai,S.Giri, Practical chemistry, S.Chand & company Ltd.,(2005).
3. V.Venkateswaran, veeraswamy.R, Kulandaivelu.A.R. Sultan chand & sons (1997).
4. Qualitative Inorganic Analysis by V.V. Ramanujam.

**Course Outcomes**

Upon successful completion students should be able to:

1. Facilitate the learner to make solutions of various molar concentrations. This may include: The concept of the mole; Converting moles to grams; Converting grams to moles; Defining concentration; Dilution of Solutions; Making different molar concentrations.

1. Short procedure	05 Marks
2. Titration 1	10 Marks
3. Titration 2	10 Marks
4. Result	20 Marks
5. Record	10 Marks
6. Viva-voce	05 Marks

Error Calculation:

< 2%	-	20 Marks
2 – 3%	-	15 Marks
3 – 4%	-	10 Marks
>4%	-	05 Marks



Program: B.Sc. Chemistry				
NMEC-I	Course Code: 20UCH3N01		Course Title : Dairy Chemistry	
Semester	Hours/Week	Total Hours	Credits	Total Marks
III	2	30	2	100

Course Objectives

1. To provide students with the knowledge of milk
2. To understand the constituents of milk and their physico-chemical properties.
3. The course will allow to critically understanding the main phenomena involved in manufacturing of dairy products

UNIT- 1

Milk: General composition of milk. Factors affecting the gross composition of milk, physico-Chemical change taking place in milk due to processing parameters-boiling, pasteurization-sterilization and homogenization.

UNIT-II

1. Milk lipids-terminology and definitions
2. Milk proteins: Physical properties of milk proteins-Electrical properties and hydration, solubility. Reaction of milk proteins with formaldehyde and ninhydrin.
3. Milk carbohydrate-Lactose-Estimation of lactose in milk.
4. Milk vitamins-water and fat soluble vitamins, effect of heat and light on vitamins.
5. Ash and mineral matters in milk.

UNIT-III

1. Creams: Definition-composition-chemistry of creaming process-gravitational and centrifugal methods of separation of cream-Factors influencing cream separation (Mention the factors only)-Cream neutralization. Estimation of fat in cream.
2. Butter: Definition-% composition-manufacture-Estimation of fat, acidity, salt and moisture content-Desi butter.

**UNIT – IV Acid Derivatives & Esters**

1. Milk powder : Definition-need for making powder-drying process-spraying, drum drying, jet drying and foam drying-principles involved in each. Manufacture of whole milk powder by spray drying process-keeping quality of milk powder.
2. Ice cream : Definition-percentage composition-types- ingredients needed - manufacture of ice-cream stabilizers-emulsifiers and their role..

UNIT V Second Law of Thermodynamics-II

Dairy Detergents: Definition-characteristics-classification-washing procedure (modern method) sterilization-chloramin-T and hypochlorite solution..

Reference Books

1. Outlines of Dairy Technology-Sukumar De
2. Principles of Dairy Chemistry-Robert Jenness & S.Patorm.
3. Indian Dairy products-K.S. Rangappa and K.T. Achaya.



Program: B.Sc. Chemistry				
Core –IV	Course Code: 20UCH4C04		Course Title: General Chemistry – IV	
Semester	Hours/Week	Total Hours	Credits	Total Marks
IV	5	75	5	100

Course Objectives

1. In order to study nuclear reactions to understand the trends in properties and reactivity of the nuclear chemistry.
2. To explain the typical physical and chemical properties of the elements.
3. To identify simple compound classes of phenol and describe their chemical properties.
4. To make the students understand the amines and their derivatives.
5. The students should know that that equivalent weight of an acid and base can be find out from their molecular weight and the acidity and basicity of that compound.
6. The student should understand that there are different methods of expressing concentration of a solution such as mass percent, ppm, normality, molarity, and molality.

UNIT – I Nuclear Chemistry

1.1. Nuclear stability-n/p ratio-nuclear forces-Exchange theory. Natural radioactivity-modes of decay-Geiger Nuttal rule. Mass defect and binding energy. Nuclear fission and nuclear fusion – Stellar energy.

1.2. Application of radioactive isotopes- C-14 dating, rock dating- isotopes as tracers-study of reaction mechanism (e.g. ester hydrolysis). Nuclear reactors - types-common features like fuels, moderators, coolant control materials, reactor shielding- uses-Nuclear reactors in India.

UNIT – II Phenols

2.1 Classification of phenols – Preparation of phenol from chlorobenzene, Cumene – Reactions with mechanism: Schotten – Bauman, Bucherrer reaction and Liebermann reaction.

2.2 Preparation of Nitro phenol, Picric acid, Catechol, Resorcinol, Quinol, Pyrogallol and Phloroglucinol.

UNIT – III Amines and their derivatives

3.1. Aliphatic amines-separation of amines by Hinsberg's & Hofmann methods- preparation and properties of dimethyl amine, trimethyl amine, (ethylene diamine and hexamethylenediamine).



3.2. Diazonium compounds - diazotisation mechanism-diazonium ion as a weak electrophile-preparation and synthetic uses of diazoacetic ester & diazomethane.

UNIT – IV Data Analysis and Purification Techniques

4. 1. Data analysis- Idea of significant figures- its importance- Accuracy- Methods of expressing accuracy- Error analysis- Types of Errors Determinate and indeterminate errors - Minimizing Errors, Precision-Methods of expressing precision- Mean, Median, Mean deviation, Standard deviation and Confidence limits.

4.2 Purification techniques- Purification of solids-Crystallization, Fractional Crystallization and Sublimation.

UNIT – V Chemical Equilibrium

5.1. Thermodynamic derivation of equilibrium constants- K_p , K_c and K_x -Relations between K_p , K_c and K_x - Standard free energy change-Derivation of van't Hoff reaction isotherm.

5.2 De- Donder's treatment of chemical equilibria - concept of chemical affinity (no derivation)- Temperature dependence of equilibrium constant-van't Hoff isochore-Pressure dependence of equilibrium constant.

Text Books:

1. Puri B R, Sharma L R and Kalia K K, Principles of Inorganic Chemistry, 23rd Ed, (1993) Shoban Lal Nagin Chand & Co., New Delhi.
2. Bhal B S and Arun Bhal, Advanced Organic Chemistry, 12th Ed., (1997), Sultan Chand & Co., New Delhi.
3. Puri B R, Sharma L R and Kalia K K, Principles of Physical Chemistry, 23rd Ed., (1993) Shoban Lal Nagin Chand & Co., New Delhi.

Reference Books

4. Lee J D, Concise Inorganic Chemistry, 5th Ed., (2006), Black Well Science, UK.
5. Morrison R T, Boyd R N and Batcharjee S K, Organic Chemistry, 7th Ed., (2009), Pearson New York
6. Peter Atkins and Julio De Paula, Atkin's Physical Chemistry, 4th Ed., (2006), Oxford University Press, New Delhi.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	The students will be able to explain the fundamentals of the chemistry of the main group elements, and important real world applications of many of these species.	K1
CO2	Understand the concept of organic reaction mechanism in some organic molecules	K2
CO3	The Students should be familiar with the basic knowledge of the	K3
CO4	Synthetic uses of acid derivatives and esters	K4
CO5	The students will develop the ability of Basic knowledge of nuclear structure, stable and unstable atomic nuclei, nuclear reactions and different modes of radioactive decay.	K5&K6
CO6	Evaluate the methods for measurements of radioactivity.	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO \ CO	PO1	PO2	PO3	PO4	PO5
CO1	S	H	H	M	S
CO2	S	H	M	H	H
CO3	H	M	S	S	M
CO4	H	H	H	M	S
CO5	S	S	M	H	S
CO6	H	S	S	S	S

S - Strong

H - High

M - Medium

L – Low



Program: B.Sc. Chemistry				
Core Practical – IV		Course Code: 20UCH4CP04		Course Title : Volumetric Estimations -II
Semester IV	Hours/Week 3	Total Hours 45	Credits 3	Total Marks 100

Course Objective

1. To learn the practical techniques of Acidimetry, Iodimetry & Iodometry.
2. Experimental practice of quantitative volumetric analysis.
3. The objective of the titration is the determination of the concentration or the mass of the minimum formula from the titrated chemical material composing a pure liquid or a solution.
4. The main objective of volumetric analysis is to determine the amount of a substance in a given sample. When dealing with volumetric analysis the concept of concentration cannot be avoided. Molarity i.e. moles per litre or decimeter is widely used unit of concentration.
 1. Estimation of Oxalic acid – Standard Oxalic acid.
 2. Estimation of Ferrous ion using Diphenyl amine /N-Phenylanthranilic acid as indicator.
 3. Estimation of Nickel using EDTA.
 4. Estimation of Calcium using EDTA.
 5. Estimation of Chloride in neutral medium. [Demonstration – Experiment]

Students must write short procedure for the given estimation in ten minutes during the examinations and submit the paper for evaluation.

REFERENCE BOOKS:

1. Vogel's Inorganic Quantitative Analysis by Vogel, pearson education(2004).
2. O.P.Pandey,D.N.Bajpai,S.Giri, Practical chemistry, S.Chand & company Ltd.,(2005).
3. V.Venkateswaran, veeraswamy.R, Kulandaivelu.A.R. Sultan chand & sons (1997).

**Course Outcome (COs)**

Upon successful completion students should be able to:

1. Facilitate the learner to make solutions of various molar concentrations. This may include:

The concept of the mole; Converting moles to grams; Converting grams to moles; Defining concentration; Dilution of Solutions; Making different molar concentrations.

1. Short procedure	05 Marks
2. Titration 1	10 Marks
3. Titration 2	10 Marks
4. Result	20 Marks
5. Record	10 Marks
6. Viva-voce	05 Marks

Error Calculation:

< 2%	-	20 Marks
2 – 3%	-	15 Marks
3 – 4%	-	10 Marks
>4%	-	05 Marks



Program: B.Sc. Chemistry				
SBEC – II		Course Code: 20UCH4S02		Course Title : Polymer Chemistry
Semester IV	Hours/Week 2	Total Hours 30	Credits 2	Total Marks 100

Course Objectives

1. The subject provides an introduction to polymer science with respect to synthesis, polymerization kinetics and network formation/gelation of macromolecules formed by step-growth and chain-growth polymerization.
2. Polymer structure/conformation and transitions from liquid (melt, solutions) to solid states are discussed using equilibrium thermodynamics, kinetics and free volume considerations.
3. Polymer solubility/miscibility and phase diagrams are determined using thermodynamic parameters. Molecular weight determination of polymers is shown using osmotic pressure, viscosimetry
4. An overview of mechanical and rheological properties of polymers is also given.

UNIT – I

1.1. Basic concepts: Monomer, polymerization, degree of polymerization, repeat units. Classification of Polymers-addition and condensation polymers, natural and synthetic, based on structure, inorganic and organic, thermoplastic and thermosetting resin.

1.2. General methods of preparation of polymers. Polymerization through functional groups, multiple bonds and ring opening and Coordination polymerization

UNIT – II

2.1. Structure of polymers- linear, branched and cross linked. Homo & hetero copolymers. Block copolymers & graft copolymers. Stereochemistry of polymers-Isotactic, Syndiotactic and Atactic

2.2. Properties of polymers: The crystalline melting point. The glassy state and glass transition temperature

UNIT – III

3.1. Molecular weight of polymers

Number average molecular weight and weight average molecular weight. Determination of molecular weight by Viscosity and Osmometry methods.

3.2. Polymer processing- calendaring, Die casting, blow moulding, and Wet spinning.

**UNIT – IV**

4.1. Preparation, properties and uses of Poly olefins-polythene, PTFE, Freons, PVC, polypropylene and polystyrene.

4.2. Natural and synthetic rubbers-Constitution of natural rubber. Butyl, Buna-N, Neoprene, Thiocol, Polyurethane and silicone rubbers.

UNIT – V

Plastics and Resins Definitions. Thermoplastic and thermo setting resins. Constituents of plastic-fillers, dyes, pigments, plasticizers, Lubricants and catalysts. Uses of thermoplastic resins and thermo setting resins.

Reference Books

1. V. R. Gowrikar, N.V.Viswanathan: Polymer Science- Wiley Eastern Limited, New Delhi. 1986.
2. R.B.Seymour, Introduction to Polymer Chemistry, MC Craw Hill, New York 1971.
3. S.S.Dara, A Text Book in Engineering Chemistry, S.Chand & Company Ltd, New Delhi. Third Edition, 1992.
4. A Textbook of inorganic polymers, A.K.Bhagi, G.R. Chatwal, Himalaya Publishing House, 1st edition (2001)



Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Students will indicate how the properties of polymeric materials can be exploited by a product designer	K1
CO2	Describe the role of rubber-toughening in improving the mechanical properties of polymers	K2
CO3	Identify the repeat units of particular polymers and specify the isomeric structures which can exist for those repeat units	K3
CO4	Estimate the number- and weight-average molecular masses of polymer samples given the degree of polymerisation and mass fraction of chains present.	K4
CO5	Differentiate between natural and man-made polymers	K5&K6
CO6	Explain polymerization methods and understand polymerization kinetics	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO \ CO	PO1	PO2	PO3	PO4	PO5
CO1	S	H	H	M	S
CO2	S	H	M	H	H
CO3	H	M	S	S	M
CO4	H	H	H	M	S
CO5	S	S	M	H	S
CO6	H	S	S	S	S

S - Strong

H - High

M - Medium

L – Low



Program: B.Sc. Chemistry				
NMEC-II		Course Code: 20UCH4N02		Course Title : Biological Chemistry
Semester	Hours/Week	Total Hours	Credits	Total Marks
IV	2	30	2	100

Course Objectives

1. To provide the chemical nature of biological macromolecules and the principles of molecular recognition
2. To understand the metabolism of dietary and endogenous carbohydrate, lipid, and protein;
3. An understanding of Nucleic acids and its involvement in disease processes.

UNIT- 1 Amino acids and Nucleic acids

Amino acids - classification, essential and nonessential aminoacids and functions. Nucleic acids - DNA, RNA-constituents, structure and functions.

UNIT-II Carbohydrates and lipids

Carbohydrates-classification and functions. Lipids-classification, biological functions and difference between fats and oils.

UNIT-III Vitamins

Classification, sources, biological function and deficiency diseases of Vitamins A,C,K,E1 and B6.

UNIT – IV Minerals

Sources, biological functions and deficiency disease of macro minerals-Sodium, Potassium, Calcium, Phosphorous and Magnesium. Micro minerals: Selenium, copper, Iron, Zinc and Manganese.

UNIT V Enzymes and Hormones

Enzymes : Classification and functions. Hormones: Classification and biochemical functions of Adrenalin, Thyroxine, Oxytocin, Insulin and Sex hormones.

Reference Books

1. S.Jayashree Ghosh, Fundamental concepts of applied chemistry. S.Chand & company 1st Edition 2006.
2. U.Satyanarayana and U.Chakrapani Biochemistry Elsevier India Pvt.Ltd. 4th Edition.



3. P.Palanivelu, Laboratory manual for analytical biochemistry and separation techniques, School of Biotechnology, Madurai Kamaraj University Press, Madurai.
4. Gurdeep Chatwaal, Natural products, Goel Publishing House, New Delhi.



Program: B.Sc. Chemistry				
Allied – I (For Zoology / Mathematics / Physics / Botany)		Course Code: 20UCH1A01 / 20UCH3A01	Course Title: Allied Chemistry – I (Inorganic, Organic and Physical Chemistry I)	
Semester I / III	Hours/Week 6	Total Hours 90	Credits 4	Total Marks 100

Course Objectives

1. Students shall understand the chemistry of chemical bonding
2. Students shall become aware of the fundamental aspects of stereochemistry and its influence on chemical properties
3. Students will learn the chemical aspects of Nuclear chemistry
4. Students shall become aware of the chemistry of radioactive elements
5. Students shall learn the chromatography aspects

UNIT-I Chemical Bonding (18 Hours)

- 1.1 Types of Bonding- Ionic Bond, covalent Bond and coordinate bond Molecular Orbital Theory-bonding, antibonding and nonbonding orbitals. M.O. diagrams of Hydrogen, Helium, Nitrogen, Oxygen and Fluorine discussion of bond order and magnetic properties.
- 1.2. Hydrides-classification and characteristics - preparation, properties and uses of NaBH_4 and LiAlH_4 .

UNIT-II Nuclear Chemistry(18 Hours)

- 2.1. Natural radioactivity-radioactive series including Neptunium series-Group displacement law.
- 2.2. Nuclear Binding energy, mass defect-Calculations.
- 2.3. Nuclear Fission and Nuclear Fusion-differences – Stellar energy.
- 2.4. Nuclear reactors, Applications of radioisotopes-C-14 dating, rock dating.

UNIT-III Covalent bonding and stereochemistry (18 Hours)

- 3.1. Covalent Bond-Orbital Overlap-Hybridisation – Geometry of Organic molecules- Methane, Ethylene and Acetylene



- 3.2. Electron displacement Effects: Inductive & Hyper conjugative effects. Their effect on the properties of compounds.
- 3.3. Stereoisomerism: Symmetry-elements of symmetry- cause of optical activity, Lactic acid & Tartaric acid. Racemisation - Resolution. Geometrical isomerism of Maleic and Fumaric acids.

UNIT-IV Aromatic compounds (18 Hours)

- 4.1. Aromatic compounds-Aromaticity-Huckel's rule
- 4.2. Electrophilic substitution in Benzene-Mechanism of Nitration, Halogenation, Sulphonation, Alkylation, Acylation.
- 4.3. Isolation, preparation, Haworth's synthesis properties and structure of Naphthalene & Anthracene

UNIT-V Solutions & Chromatography (18 Hours)

- 5.1. Solutions: Liquid in liquid type-Raoult's law for ideal solutions. positive and negative deviation from Raoult's law-Reasons and examples, Fractional distillation and Azeotropic distillation.
- 5.2. Chromatography: principle and application of column, paper and thin layer chromatography.

Text Books:

1. Puri B R, Sharma L R and Kalia K K, Principles of Inorganic Chemistry, 23rd Ed., (1993) Shoban Lal Nagin Chand & Co., New Delhi.
2. Bhal B S and Arun Bhal, Advanced Organic Chemistry, 12th Ed., (1997) Sultan Chand & Co., New Delhi.
3. Puri B R, Sharma L R and Kalia K K, Principles of Physical Chemistry, 23rd Ed., (1993) Shoban Lal Nagin Chand & Co., New Delhi.

Reference Book

1. Lee J D, Concise Inorganic Chemistry, 5th Ed., (2006), Black Well Science, UK.
2. Morrison R T, Boyd R N and Batcharjee S K, Organic Chemistry, 7th Ed., (2009), Pearson New York
3. Peter Atkins and Julio De Paula, Atkin's Physical Chemistry, 4th Ed., (2006), Oxford University Press, New Delhi.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define Nuclear chemistry	K1
CO2	Understand the Types of chemical Bonding	K2
CO3	Illustrate the importance of Covalent bonding and stereochemistry	K3
CO4	Analyse the chemical aspects of Nuclear chemistry	K4
CO5	Evaluate the principle and application of column, paper and thin layer chromatography	K5&K6
CO6	Formulate the Stereoisomerism	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO \ CO	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	H	H
CO2	H	M	S	S	S
CO3	M	M	H	H	H
CO4	M	H	H	H	S
CO5	H	M	M	M	S
CO6	S	S	H	H	M

S - Strong

H - High

M - Medium

L – Low



Program: B.Sc. Chemistry				
Allied – II (For Zoology / Mathematics / Physics / Botany)	Course Code: 20UCH2A02 / 20UCH4A02	Course Title: Allied Chemistry - II (Inorganic, Organic and Physical Chemistry – II)		
Semester II / IV	Hours/Week 6	Total Hours 90	Credits 4	Total Marks 100

Course Objectives

1. Students shall understand the chemistry of Co-ordination chemistry
2. Students shall become aware of the fundamental aspects of Carbohydrates & Aminoacids
3. Students will learn the chemical aspects of Pharmaceutical chemistry
4. Students shall become aware of the chemistry of Photochemistry
5. Students shall learn the Electro Chemistry principles and their aspects

UNIT – I

Co-ordination chemistry (18 Hours)

- 1.1. Co-ordination chemistry-definition of terms- classification of ligands- IUPAC Nomenclature of co-ordination compounds
- 1.2. Werner's theory-conductivity and precipitation studies. Sidgwick's theory-Effective Atomic Number concept.
- 1.3. Pauling's theory-postulates-Application to octahedral, square planar and tetrahedral complexes. Pauling's theory and magnetic properties of complexes. Merits and demerits of Pauling's theory.
- 1.4. Biological role of Haemoglobin and Chlorophyll (Elementary idea of structure and functions).

UNIT - II

Carbohydrates & Aminoacids(18 Hours)

- 2.1 Carbohydrates: Classification, preparation and properties of Glucose, Fructose and Sucrose. Inter conversion of Glucose to Fructose and vice versa.
- 2.2. Amino Acids-classification, preparation and properties of Glycine and Alanine.

UNIT – III

Pharmaceutical chemistry(18 Hours)

- 3.1. Chemotherapy: Preparation, uses and mode of action of sulpha drugs-prontosil



sulphadiazine and sulphafurazole. Uses of penicillin, chloramphenicol and streptomycin, Definition and one example each for-analgesics, antipyretics, tranquilizers, sedatives, hypnotics, local anaesthetics and general anaesthetics .

3.2. Cause and treatment of diabetes, cancer and AIDS.

UNIT - IV

Photochemistry (18 Hours)

4.1. **Photochemistry:** Grotthus-Draper law and Stark-Einstien's law of photochemical equivalence. Photosynthesis. Phosphorescence and Fluorescence.

4.2. Phase Rule: Phase rule and the definition of terms in it. Application of phase rule to water system & sulphur system. Reduced phase rule and its application to a simple eutetic system Lead - Silver (Pb-Ag) and Magnesium – Zinc system (Mg – Zn)

UNIT - V

Electro Chemistry(18 Hours)

5.1. **Electro Chemistry:** Kohlrausch law -measurement of conductance, pH determination – Hydrogen electrode – Quinhydrone electrode Conductometric titrations. Galvanic cells- EMF-standard electrode potentials, reference electrodes.

5.2. Corrosion: Definition -types and methods of prevention.

Text Books

1. Puri B R, Sharma L R and Kalia K K, Principles of Inorganic Chemistry, 23rd Ed., (1993) Shoban Lal Nagin Chand & Co., New Delhi.
2. Bhal B S and Arun Bhal, Advanced Organic Chemistry, 12th Ed., (1997) Sultan Chand & Co., New Delhi.
3. Puri B R, Sharma L R and Kalia K K, Principles of Physical Chemistry, 23rd Ed., (1993) Shoban LalNagin Chand & Co., New Delhi.

Reference Books

1. Lee J D, Concise Inorganic Chemistry, 5th Ed., (2006), Black Well Science, UK.
2. Morrison R T, Boyd R N and Batcharjee S K, Organic Chemistry, 7th Ed.,(2009), Pearson New York
3. Peter Atkins and Julio De Paula, Atkin's Physical Chemistry, 4th Ed., (2006), Oxford University Press, New Delhi.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define Co-ordination chemistry	K1
CO2	Understand the chemical aspects of Pharmaceutical chemistry	K2
CO3	Illustrate the importance of Electrochemistry and Photochemistry	K3
CO4	Analyse the Application of phase rule	K4
CO5	Evaluate the Cause and treatment of diabetes, cancer	K5&K6
CO6	Formulate the action of sulpha drugs	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with PSOs

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	S	S	S
CO2	S	S	S	H	H
CO3	M	S	H	H	H
CO4	S	S	H	H	M
CO5	H	H	S	M	M
CO6	S	S	H	H	M

S - Strong

H - High

M - Medium

L – Low



Program: B.Sc. Chemistry				
Allied Practical – II (For Zoology / Mathematics / Physics / Botany)		Course Code: 20UCH2AP01 20UCH4AP01		Course Title: Allied Chemistry Practical - I
Semester II/ IV	Hours/Week 3	Total Hours 45	Credits 3	Total Marks 100

Allied chemistry for B.Sc., Physics / Mathematics / Botany

Course Objectives

1. To analyse the given organic compounds

Organic Analysis:

- a) Detection of elements- nitrogen, sulphur and halogens.
- b) Detection of aliphatic or aromatic.
- c) Detection of whether saturated or unsaturated compounds.
- d) Preliminary tests and detection of functional groups, phenols, aromatic amines, aromatic acids, Urea, benzamide & carbohydrate.

Reference Book:

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

Marks: 60

1. Salt procedure: 20 marks
2. Detection of elements: 05 marks
3. Detection of aliphatic or aromatic: 05 marks
4. Detection of whether saturated or unsaturated: 05 marks
5. Result: 10 marks
5. Record: 10 marks
6. Viva - voce: 05 marks

Error Calculations

1. < 2%: 20 marks
2. 2 -3 %: 15 marks
3. 3-4: 10 marks
4. > 4 %: 5 marks



Program: B.Sc. Chemistry				
Core – V		Course Code: 20UCH5C05		Course Title: Inorganic Chemistry – I
Semester V	Hours/Week 5	Total Hours 75	Credits 4	Total Marks 100

Course Objectives

1. To understand types of acids and bases.
2. To classify acids and bases as hard and soft.
3. To study the Postulates of VSEPR theory.
4. To explain Isomerism in Complexes.
5. To understand the chelate effect.
6. To correlate the d-orbital splitting in octahedral, tetrahedral and square planar complexes.

UNIT-I Concept of acids and bases

1.1. Acids and Bases: Definition-Example-applications and limitations Arrhenius (water system) concept, Bronsted-Lowry(protonic) concept, Lewis (Electron pair acceptor- donor) concept The solvent-system(Autoionization) concept Lux-Flood concept and Usanovich concept of acids and bases.

1.2. Hard and Soft Acids and Bases-classification of acids and bases as hard and soft– examples Pearson ‘s HSAB concept, acid-base strength and hardness and softness, Applications of HSAB principle.

UNIT-II Non-aqueous solvents and shape of molecules

2.1 Non-aqueous solvents- physical properties of a solvent, types of solvents and their general characteristics. Reactions in non- aqueous solvents with reference to liquid NH₃ and liquid SO₂- Comparison.

2.2 Postulates of VSEPR theory- determine the shape of molecules for boron tri chloride- phosphorous penta fluoride- Iodine hexafluoride- sulphur dioxide- phosphorous trichloride- water molecule and Iodine penta fluoride

UNIT III Coordination Chemistry-I

3.1. Definition of the Terms-Classification of ligands- Nomenclature of mononuclear and polynuclear complexes-chelating ligands and Chelates-Examples-chelate effect-explanation. Co-ordination number.



3.2. Isomerism in Complexes-Structural Isomerism—types. Stereoisomerism-Geometrical isomerism in 4 and 6 coordinated complexes. Optical isomerism in 4-and 6-coordinated complexes

UNIT IV Coordination Chemistry-II

4.1. Werner 's theory and its applications conductivity and precipitation studies - Sidgwick's theory-Effective Atomic Number concept.

4.2. Theories of bonding in Complexes-Valence Bond Theory- Postulates – Hybridisation and geometries of Complexes-Outer orbital and inner orbital octahedral complexes. Square planar and tetrahedral complexes-V.B. Theory and magnetic properties of complexes-limitations of V.B. Theory.

UNIT V Coordination Chemistry-III

5.1. Crystal Field Theory-postulates-d-orbital splitting in octahedral, tetrahedral and square planar complexes-strong and weak ligands- Spectrochemical Series-High spin and low spin complexes-C.F. Theory and magnetic properties of Complexes-Crystal Field Stabilisation Energy (CFSE) and its Uses-Calculation of CFSE values of d1 to d10 Octahedral and Tetrahedral complexes- C.F theory and colour of complexes-limitations of C.F. theory-comparison between VBT and CFT.

5.2. Application of coordination compounds in Qualitative and Quantitative analysis-separation of Copper and Cadmium ions, Cobalt and Nickel ions- Identification of Cu, Fe, and Ni.

Text Books

1.Puri B R, Sharma L R and Kalia K K, Principles of Inorganic Chemistry, 23rd Ed., (1993)Shoban Lal Nagin Chand & Co., New Delhi.

2.Bhal B S and Arun Bhal, Advanced Organic Chemistry, 12th Ed., (1997), Sultan Chand& Co., New Delhi.

3.Puri B R, Sharma L R and Kalia K K, Principles of Physical Chemistry, 23rd Ed., (1993)Shoban LalNagin Chand & Co., New Delhi.

Reference Books

1. Lee J D, Concise Inorganic Chemistry, 5th Ed., (2006), Black Well Science, UK.

2.Morrison R T, Boyd R N and Batcharjee S K, Organic Chemistry, 7th Ed., (2009),Pearson New York

3.Peter Atkins and Julio De Paula, Atkin's Physical Chemistry, 4th Ed., (2006), Oxford University Press, New Delhi.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Identify the soft and hard acids and bases	K1
CO2	Understand the concept of VSEPR theory	K2
CO3	Illustrate the importance of crystal field splitting of d-orbitals	K3
CO4	Analyse the Hybridisation and geometries of Complexes	K4
CO5	Evaluate the techniques of Qualitative and Quantitative analysis	K5&K6
CO6	Formulate the CFSE for low spin and high spin complexes	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO CO	PO1	PO2	PO3	PO4	PO5
CO1	S	H	H	M	S
CO2	S	H	M	H	H
CO3	H	M	S	S	M
CO4	H	H	H	M	S
CO5	S	S	M	H	S
CO6	H	S	S	S	S

S - Strong

H - High

M - Medium

L – Low



Program: B.Sc. Chemistry				
Core-VI	Course Code: 20UCH5C06		Course Title: Organic Chemistry – I	
Semester V	Hours/Week 5	Total Hours 75	Credits 4	Total Marks 100

Course Objectives

1. To effectively impart knowledge about, Stereochemistry and Heterocyclic chemistry
2. To understand the optical activity of various molecules and their naming patterns.
3. To understand the conformation and stability of various organic molecules.
4. To make the students more inquisitive in learning the mechanistic details in Organic Chemistry through the teaching of the named reactions
5. To learn the synthetic applications of certain organic compounds.
6. To know about the structure of Peptide & Proteins
7. Predict the structure of natural products, alkaloids and terpenoids

UNIT I: STEREOCHEMISTRY-I (15 Hours)

Optical isomerism, optical activity, optical and specific rotations, conditions for optical activity, asymmetric center, chirality, achiral molecules, meaning of (+) and (-) and D and L notations, elements of symmetry, racemization, methods of racemization (by substitution and tautomerism), methods of resolution (mechanical, seeding, biochemical and conversion to diastereomers), asymmetric synthesis (partial and absolute synthesis), Walden inversion. Projection Formula, Fischer, flying wedge, sawhorse and Newmann projection formulae – notation of optical isomers - Cahn-Ingold-Prelog rules, R and S notations for optical isomers with one and two asymmetric carbon atoms, erythro and threo representations. Optical activity in compounds not containing asymmetric carbon atoms namely biphenyls, allenes and spiranes.

UNIT II: STEREOCHEMISTRY-II (15 Hours)

Conformational isomerism: Conformers, dihedral angle, torsional strain. Conformational analysis of ethane and n-butane, conformers of cyclohexane (Chair, boat and skew boat forms), axial-equatorial positions and their interconversions, conformers of mono and disubstituted cyclohexanes, 1,2 and 1,3 interactions. Geometrical isomerism: Cis-trans, syn-anti and E-Z notations, methods of distinguishing geometrical isomers using melting point,



dipole moment, dehydration, cyclisation and heat of hydrogenation. Stereochemistry of cis and trans decalins.

UNIT III - AMINO ACIDS AND PROTEINS (15 Hours)

Amino acids-classification-essential and non essential amino acids-preparation of alpha amino acids-glycine, alanine and tryptophan-General properties of amino acids-Zwitter ions, isoelectric point Peptides-synthesis - Bergmann method-structure determination of polypeptides-end group analysis. Proteins-classification based on physical and chemical properties and on physiological functions-primary and secondary structure of proteins-helical and sheet structures (elementary treatment only) – Denaturation of proteins.

UNIT VI - HETEROCYCLIC CHEMISTRY-I (15 Hours)

- 4.1 Molecular orbital picture of pyrrole, furan, thiophene and pyridine.
- 4.2. Preparation, properties and uses of Pyridine, furan, pyrrole & thiophene.
- 4.3. Comparative study of basicity of pyrrole, pyridine with amines.

UNIT V- CHEMISTRY OF NATURAL PRODUCTS (15 Hours)

Alkaloids -classification- isolation– general methods of determination of structure of alkaloids-synthesis and structural elucidation of piperine, atropine and nicotine.

Terpenes-classification-isolation- isoprene rule-synthesis and structural elucidation of citral, geraniol, alpha pinene.

Text book

1. B.S. Bahl and Arun Bahl, Advanced Organic Chemistry –S. Chand & Co., 2012.
2. R.T. Morrison and R.N. Boyd, Organic Chemistry, Pearson Education, Sixth Ed., 2002.
3. P.L. Soni, S.M. Chawla, Text book Organic Chemistry, Sultan Chand & Sons, 2007.
4. Singh, Mukarji and Kapoor, Organic Chemistry, New Age Publishers, 2017.
5. Raj K. Bansal, A Text Book of Organic Chemistry, New Age International Private Limited, 2016.
6. O.P Agarwal Vol 1 & 2, Krishna Prakashan Media (P) Ltd, 2015
7. M.K. Jain and S.C. Sharma, Vishal Publishing House, 2019

Reference Books

- 1 Organic Chemistry – Vol. 1 and Vol. 2, I.L Finar, Pearson Education, Sixth Edn., 2006.
- 2 Stereochemistry of Organic compounds, D. Nasipuri, New Age International (P) Ltd, Second Edn., 2005.
- 3 Stereochemistry: Conformation And Mechanism - P. S. Kalsi, New Age International Private Ltd., 2015.



4. Nasipuri.D, Stereo Chemistry of Organic Compounds, New Age International Private Ltd., 2020
5. Francis A Carey, Advanced Organic Chemistry Springer; 5th edition 2008.
6. Gurdeep R. Chatwal, Organic Chemistry of Natural Product, Himalaya Publishing House, 2010

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	The students will be able to explain the fundamental concepts in coordination chemistry of transition metals	K1
CO2	Understand the concept of organic reaction mechanism via cation or anion in some molecules	K2
CO3	The Students should be familiar with the basic knowledge of the Synthetic uses of acid derivatives and esters	K3
CO4	The students will develop the ability of effective solving practical problem of thermodynamics	K4
CO5	Evaluate the techniques of thermochemistry	K5&K6
CO6	Formulate the structure and bonding reactions shown by organic molecules	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO CO	PO1	PO2	PO3	PO4	PO5
CO1	S	H	H	M	S
CO2	S	H	M	H	H
CO3	H	M	S	S	M
CO4	H	H	H	M	S
CO5	S	S	M	H	S
CO6	H	S	S	S	S

S - Strong

H - High

M - Medium

L – Low



Program: B.Sc. Chemistry				
Core-VII	Course Code: 20UCH5C07		Course Title: Physical Chemistry – I	
Semester V	Hours/Week 5	Total Hours 75	Credits 4	Total Marks 100

Course Objectives

1. To study about the solutions and colligative properties
2. To know about Chemical Equilibrium.
3. To study phase rule.
4. To promote interest in surface chemistry, catalysis & chemical kinetics.

UNIT-I- SOLUTIONS

16 HOURS

Solutions of gases in liquids - Henry's law - solution of liquids in liquids - Raoult's law – vapour pressure of ideal solutions - activity of a component in an ideal solution - chemical potential of ideal and non- ideal solution –Gibbs Duhem- Margulus Equation- Thermodynamics of ideal solutions – Gibbs - Free energy change of mixing for an ideal solution - volume change and enthalpy changes of an ideal solution - entropy change of mixing for an ideal solution -vapour pressures of real or non-ideal solutions .

UNIT-II - COLLIGATIVE PROPERTIES OF DILUTE SOLUTIONS 16 HOURS

Lowering of vapour pressure by a non-volatile solute - osmosis and osmotic pressure - relation between osmotic pressure and vapour pressure lowering of an ideal solution - reverse osmosis - elevation of boiling point - depression of freezing point - derivations and determination – vant Hoff factor.

UNIT-III - PHASE EQUILIBRIA

16HOURS

Gibb's phase rule – Derivation of Gibbs phase rule - one component systems - Water and sulphur system - Reduced phase rule - Two component systems - simple eutectic system - lead - silver system – potassium iodide – water system - compound formation with congruent melting point - Zn-Mg system, Ferric chloride - water system.

UNIT- IV - SURFACE CHEMISTRY

16 HOURS

Adsorption - Physisorption and Chemisorptions - Applications of adsorption - Adsorption of gases by solids - Freundlich adsorption isotherm - Langmuir's theory of adsorption - BET



theory of multilayer adsorption -Equation and postulates only - adsorption isotherms- types and applications. Adsorption from solutions – Gibb’s adsorption isotherm..

UNIT-V - CHEMICAL KINETICS - I

16 HOURS

The terminology of chemical kinetics- integration of rate expression for first order reactions, second order reactions, third order reactions and zero order reactions – Half life time of a reaction - methods for determining order of a reaction- experimental methods in the study of kinetics of reaction - volumetry, manometry, polarimetry, and colorimetry - effect of temperature on reaction rates – Arrhenius equation and its significance.

Text Book:

1. Puri B.R., Sharma L.R., Pathania M.S., Principles of Physical Chemistry, (23rd edition), New Delhi, ShobanLal, Nagin Chand & Co., (1993)
2. Keith J. Laidler., Chemical Kinetics, Third Edition(2009), Pearson Education.

Reference Books

1. Atkins P.W., Physical Chemistry, (7th edition) Oxford University Press, London (2009).
2. Castellan G.W., Physical Chemistry, Third Edition, New Delhi, Orient Longmann (1987).
3. J Rajaram, J C Kuriacose., Kinetics and mechanisms of chemical transformations, Macmillan India Ltd.,(2006).

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Know the meaning of phase, component and degree of freedom	K1
CO2	Write an expression for rate constant K for third order reaction	K2
CO3	Calculate molar and normal solution of various concentrations	K3
CO4	Find out the acidity, Basicity and PKa Value on pH meter	K4
CO5	Know the qualitative properties of solution, the depression in freezing point, elevation in boiling point and osmotic pressure	K5&K6
CO6	Formulate various adsorption isotherms.	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

**Mapping of COs with POs**

PO CO	PO1	PO2	PO3	PO4	PO5
CO1	S	H	H	M	S
CO2	S	H	M	H	H
CO3	H	M	S	S	M
CO4	H	H	H	M	S
CO5	S	S	M	H	S
CO6	H	S	S	S	S

S - Strong

H - High

M - Medium

L – Low



Program: B.Sc. Chemistry				
Elective– I	Course Code: 20UCH5E01		Course Title : Analytical Chemistry-I	
Semester	Hours/Week	Total Hours	Credits	Total Marks
V	4	60	4	100

Course Objectives

- 1.To provide a basic knowledge and understanding of essential chemical and physical principles for analytical chemistry.
- 2.To introduce basic analytical techniques and practical aspects of classical chemical analysis.
- 3.To solve problems related to chemical analysis and interpret analytical results.

UNIT – I GRAVIMETRIC ANALYSIS

1.1 Principle- Theories of precipitation- Solubility product and precipitation- Factors affecting solubility. Conditions of precipitation – Co- precipitation & Post precipitation, Reduction of errors. Precipitation from homogeneous solution- Washing and Drying of precipitate.

1.2 Choice of the precipitant- Specific and Selective precipitants- Anthranilic acid, Cupferon, Dimethyl glyoxime, Ethylene diamine, 8-hydroxyquinoline, Salicylaloxime-Use of Masking agent.

1.3 Crucibles- Types, Care and uses. Calculation in gravimetric analysis- Use of Gravimetric factor.

UNIT – II SEPARATION AND PURIFICATION TECHNIQUES

2.1 Separation techniques- Precipitation, Solvent extraction, Extraction by chemically active solvents, Continuous extraction- Soxhlet extraction.

2.2 Purification of liquids- Distillation, Fractional Distillation, Vacuum distillation and Steam - distillations.

2.3. SEM, TEM Studies - Instrumentation and applications.

UNIT – III CHROMATOGRAPHIC TECHNIQUES -I

1.1 Column Chromatography- principle, types of adsorbents, preparation of the column, elution, recovery of substances and applications.



1.2 TLC- principle, choice of adsorbent and solvent, preparation of chromatoplates, R_f - values, factors affecting the R_f -values. Significance of R_f -values.

1.3 Paper Chromatography- principle, solvents used, development of chromatogram, ascending, descending and radial paper chromatography.

1.4 Ion-exchange chromatography- principle- types of resins- requirements of a good resin- experimental techniques- separation of Na-K, Ca-Mg, Co-Ni, and Chloride-bromide.

UNIT IV NMR SPECTROSCOPY

4.1. NMR Spectroscopy- principle of nuclear magnetic resonance, instrumentation-number of signals-chemical shift- shielding and deshielding-spin-spin coupling and coupling constants-TMS as NMR standard.

4.2. Interpretation of NMR spectra of simple organic compounds such as Acetone, Anisole, Benzaldehyde, Ethyl acetate, Ethylamine, Ethyl Bromide, Toluene and Isopropyl phenyl ketone.

UNIT V MASS SPCTROSCOPY

5.1 Mass spectroscopy- Basic principles- instrumentation- molecular ion peak, base peak, metastable peak, isotopic peak- their uses. Nitrogen rule- ring rule-fragmentation.

5.2. Interpretation of mass spectra of simple organic compounds such as Acetone, Anisole, Benzaldehyde, Ethyl acetate, Ethylamine, Ethyl Bromide, Toluene and Isopropyl phenyl ketone.

Text Books

1. Elements of analytical chemistry - R. Gopalan, P.S. Subramanian, K. Rengarajan - S. Chand and sons (1997).
2. Fundamentals of analytical chemistry - D.A. Skoog and D.M. West - Holt Reinhard and Winston Publication - IV Edition (1982).
3. Instrumental methods of chemical analysis - Chatwal - Anand - Himalaya Publishing house - (2000).
4. Y.R.Sharma., Elementary Organic spectroscopy, S.Chand Publisher, Fourth edition (2009).

Reference Books

1. Principles of instrumental methods of analysis - D.A. Skoog and Saunders - College publications - III edition (1985).
2. S.M. Khopkar., Analytical chemistry, New Age International publication, Third edition (2004).



3. S.Usharani, Analytical Chemistry, Macmillan publication, fourth edition (2008)
4. W.Kemp., Organic spectroscopy, Palgrave publications, third edition(2008).
5. P.S.Kalsi., Spectroscopy of organic compounds, New Age International publisher, sixth edition (2005).
6. Alka L.Gupta., Analytical chemistry, A pragathi prakasan Educational publisher, Fourth edition (2012).

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	After examination the student should be able to: - Explain the theoretical principles and important applications of classical analytical methods within titration (acid/base titration, complexometric titration, redox titration), and various techniques within gravimetric and coulometric methods.	K1
CO2	Explain the theoretical principles of various separation techniques in chromatography, and typical applications of chromatographic techniques	K2
CO3	Performing risk assessment of chemical experiments and chemical analytical activity	K3
CO4	The students will develop the ability of effective solving practical problem of thermodynamics	K4
CO5	Be familiar with calculations in analytical chemistry, be able to calculate titration errors for method evaluation	K5&K6
CO6	Make scientific reports from chemical experiments and present the results in a transparent manner	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

**Mapping of COs with POs**

PO CO	PO1	PO2	PO3	PO4	PO5
CO1	S	H	H	M	S
CO2	S	H	M	H	H
CO3	H	M	S	S	M
CO4	H	H	H	M	S
CO5	S	S	M	H	S
CO6	H	S	S	S	S

7.

S - Strong

H - High

M - Medium

L - Low



Program: B.Sc. Chemistry				
SBEC– III	Course Code: 20UCH5S03	Course Title : Agricultural Chemistry		
Semester	Hours/Week	Total Hours	Credits	Total Marks
V	2	30	2	100

Course objective

1. Understand basic concepts (including history of, resources needed, and the future of) production agriculture.
2. Describe important historical developments in production agriculture.
3. Understand factors influencing soil security.
4. Describe the differences between macro and micro nutrients

UNIT – I FERTILIZERS

- 1.1. Effect of Nitrogen, potassium and phosphorous on plant growth – commercial method of preparation of urea, triple superphosphate. Complex fertilizers and mixed fertilizers – their manufacture and composition.
- 1.2. Secondary nutrients – micronutrients – their function in plants.

UNIT – II MANURES

- 2.1. Bulky organic manures – Farm yard manure – handling and storage-oil cakes- blood meal – fish manures.
- 2.2. Green Manures – Advantage and Disadvantages

UNIT – III PESTICIDES AND INSECTIDES

- 3.1. **Pesticides** – classification of Insecticides, fungicides, herbicides as organic and inorganic – general methods of application and toxicity. Safety measures when using pesticides.
- 3.2. **Insecticides** : Plant products – Nicotine, pyrethrin – Inorganic pesticides – borates. Organic pesticides – D.D.T. and BHC.

UNIT – IV FUNGICIDES AND HERBICIDES

- 4.1. **Fungicide** : Sulphur compounds, Copper compounds, Bordeaux mixture, Arsenic compounds, Mercury compounds.
- 4.2. **Herbicides** : Acaricides – Rodenticides. Attractants – Repellants. Preservation of seeds.

UNIT – V SOILS



Classification and properties of soils –soil water, soil temperature, soil minerals, soil acidity, soil fertility, soil texture and soil testing.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Student is able to understand the molecular mechanisms that regulate the activity of Agro ecosystem function	K1
CO2	Accumulate skills for scientific research work and agricultural works in the future.	K2
CO3	Demonstrate a comprehensive understanding of the fundamental principles and multidisciplinary concepts in the field of agriculture.	K3
CO4	Demonstrate skills in laboratory techniques and field work relevant to agriculture as well as the use of the instrumentation for analysis.	K4
CO5	Evaluate the techniques of soil testing	K5&K6
CO6	Understand the macro and micro nutrients	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO \ CO	PO1	PO2	PO3	PO4	PO5
CO1	S	H	H	M	S
CO2	S	H	M	H	H
CO3	H	M	S	S	M
CO4	H	H	H	M	S
CO5	S	S	M	H	S
CO6	H	S	S	S	S

S - Strong

H - High

M - Medium

L – Low



Program: B.Sc. Chemistry				
Core practical– V	Course Code: 20UCH5P05		Course Title : GRAVIMETRIC ESTIMATION – I	
Semester V	Hours/Week 3	Total Hours 45	Credits 3	Total Marks 100

Course Objectives:

- ❖ To learn gravimetric estimation techniques.
 - ❖ To give practical exposure to estimations gravimetrically
1. Estimation of barium as barium sulphate.
 2. Estimation of barium as barium chromate.
 3. Estimation of lead as lead chromate.
 4. Estimation of lead as lead sulphate

Marks Distribution: 60 marks

1 .Record	10marks
2. Experimental work	30marks
3. Accuracy/ Result	15marks
4. Viva Voce	05marks

Reference Books:

- 1.Vogel's Inorganic Quantitative Analysis by Vogel, pearson education(2004).
- 2.O.P.Pandey,D.N.Bajpai,S.Giri, Practical chemistry, S.Chand & company Ltd.,(2005).
- 3.V.Venkateswaran, veeraswamy.R, Kulandaivelu.A.R. Sultan chand & sons (1997).
- 4.Qualitative Inorganic Analysis by V.V. Ramanujam.

**Course Outcome (COs)**

Students will gain an understanding of:

1. How to calculate limiting reagent, theoretical yield, and percent yield
2. How to engage in safe laboratory practices by handling laboratory glassware, equipment, and chemical reagents appropriately
3. How to dispose of chemicals in a safe and responsible manner
4. How to work effectively as a member of a team. Communicate productively with lab mates, teaching assistant and instructor
5. How to maintain a detailed scientific notebook



Core practical– VI	Course Code: 20UCH5P06		Course Title : Physical Chemistry Practical -I	
Semester V	Hours/Week 3	Total Hours 45	Credits 3	Total Marks 100

Course Objectives:

1. The course provides training in advanced physical chemistry laboratory techniques.
 2. To study the kinetics of a reaction.
1. Study of Kinetics of first order reaction using hydrolysis of methyl acetate ester in the presence of acid used as a catalyst.
 2. Determination of the transition temperature of the given salt hydrates,
 $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$, $\text{CH}_3\text{COONa} \cdot 3\text{H}_2\text{O}$, $\text{SrCl}_2 \cdot 6\text{H}_2\text{O}$, $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$.
 3. Determination of molecular weight of a given unknown solute by Rast's method using Naphthalene or Diphenyl as solvent.
 4. a) Determination of cell constant using 0.1N and 0.01N KCl solution.
b) Determination of equivalent conductance of two different strong electrolytes.
 5. Determination of Concentration of a given unknown sodium chloride solution by using phenol sodium chloride system. (Effect of impurity).

Marks Distribution: 75 marks

- | | |
|---------------|--------------------------------------|
| 1. Record | 10marks |
| 2. Procedure | 10marks |
| 3. Viva Voce | 05marks |
| 4. Experiment | 30marks (Expt. 15 + Manipulation 15) |

Reference Books:

1. Vogel's Inorganic Quantitative Analysis by Vogel, pearson education(2004).
2. O.P.Pandey, D.N. Bajpai, S. Giri, Practical chemistry, S.Chand & company Ltd., (2005).
3. V. Venkateswaran, veeraswamy. R, Kulandaivelu. A.R. Sultan chand & sons (1997).
4. Qualitative Inorganic Analysis by V.V. Ramanujam.

Course Outcome (COs)

On successful completion of the course students will be able to:

1. Developed an understanding of the breadth and concepts of physical chemistry



2. An appreciation of the role of physical chemistry in the chemical sciences and engineering
3. An understanding of methods employed for problem solving in physical chemistry
4. Experience in some scientific methods employed in basic and applied physical chemistry
5. Developed skills in procedures and instrumental methods applied in analytical and practical tasks of physical chemistry
6. Developed skills in the scientific method of planning, developing, conducting, reviewing and reporting experiments

Program: B.Sc. Chemistry



Core practical– VII	Course Code: 20UCH5P07		Course Title : Organic Chemistry Practical -I	
Semester V	Hours/Week 2	Total Hours 30	Credits 2	Total Marks 100

Course Objective

1. To understand the reactivity of the functional groups.
2. To learn the recrystallization techniques.
3. To gain firsthand knowledge by visiting industry.

I. Analysis of organic compounds containing one functional group and Characterization with a derivative.

Reactions of the following functional groups:

- Carboxylic acid (mono and di),
- Phenol
- Ester
- Aldehyde
- Ketone
- Carbohydrate
- Primary Amine
- Amide
- Nitro compound
- Diamide
- Anilide

Marks Distribution: 60 marks

- | | |
|----------------------------|---------|
| 1. Record | 10marks |
| 2. Procedure | 10marks |
| 3. Aliphatic / Aromatic | 05marks |
| 4. Saturated/Unsaturated | 05marks |
| 5. Element present/ absent | 10marks |
| 6. Functional Group | 10marks |



7. Derivative 05marks

8. Viva Voce 05marks

Reference Books:

1. Vogel's Inorganic Quantitative Analysis by Vogel, Pearson Education (2004).
2. O.P. Pandey, D.N. Bajpai, S. Giri, Practical Chemistry, S. Chand & Company Ltd., (2005).
3. V. Venkateswaran, Veeraswamy. R., Kulandaivelu. A.R. Sultan Chand & Sons (1997).
4. Qualitative Inorganic Analysis by V.V. Ramanujam.
5. Practical Chemistry - A.O. Thomas - Scientific Book Center, Cannanore.
6. Practical Chemistry - S. Sundaram - 3 Volumes - S. Viswanathan.

Course Outcome (COs)

- a. How to calculate a limiting reagent, yield, and percent yield
- b. How to maintain a detailed scientific notebook
- c. How to critically evaluate data collected to determine the identity, purity, and yield of products.
- d. How to summarize findings in writing in a clear and concise manner
- e. How to use the scientific method to create, test, and evaluate a hypothesis



Program: B.Sc. Chemistry				
Core – VIII	Course Code: 20UCH6C08		Course Title: Inorganic Chemistry – II	
Semester	Hours/Week	Total Hours	Credits	Total Marks
VI	5	75	4	100

Course Objectives

1. To study Essentials of Bioinorganic Chemistry.
2. To study about the concepts of Biochemistry and material chemistry
3. To study Symmetry Elements and Symmetry operations.
4. To understand Uses of organometallic compounds
5. To understand Bonding in Carbonyls.

UNIT-I Bioinorganic Chemistry

- 1.1. Bioinorganic Chemistry Essential and trace elements in Biological processes- Biological role of Haemoglobin and Chlorophyll (elementary idea of structure and function)
- 1.2. Metal Carbonyls-Bonding in Carbonyls-Mono and binuclear Carbonyls of Ni, Fe, Cr, Co and Mn-Hybridisation and structure. Preparation, properties and uses.

UNIT-II Silicates and reaction mechanisms

- 2.1. Silicates-classification and structure—examples. Composition, properties and uses of asbestos, talc, mica, and zeolite.
- 2.2. Substitution reactions in square planar Complexes-Trans Effect-Trans effect series-uses of Trans Effect-Theories of Trans effect- polarisation theory and π -bonding theory.

UNIT-III- organometallic compounds

- 3.1 Definition-classification-ionic, σ - bonded and Π -bonded organometallic compounds examples- General methods of preparation. General properties of organometallic compounds -physical and chemical characteristics. Organometallic compounds of Lithium & Boron- preparation, properties, structure and uses.
- 3.2 Olefin complexes –Zeise's salt –synthesis and structure Cyclopentadienyl complexes - Ferrocene- preparation, properties, structure and uses. Uses of organometallic compounds.

UNIT-IV- Solid state and Nano science

- 4.1. Solids-Band theory of conductors, semiconductors and insulators- nano materials- an elementary study



4.2. Imperfections in a crystal-outline of Schottky defects, Frenkel defects, metal excess and metal deficiency defects and line defects

UNIT-V Group theory and Interhalogen Compounds

5.1. Interhalogen Compounds-.Preparation,properties,structure and uses of ICl,BrF₃ IF₅,IF₇. Pseudohalogen-Definition,similarities and dissimilarities between halogen and pseudohalogen,cyanogens,thiocyanogen- Preparation,properties and uses.

5.2. Symmetry Elements and Symmetry operations – point groups-point groups of simple molecules like H₂, HCl, CO₂, H₂O, NH₃,SF₆,CH₄ and dichloro ethylene(cis and trans)

Text Books

- 1.Puri B R, Sharma L R and Kalia K K, Principles of Inorganic Chemistry, 23rd Ed., (1993)Shoban Lal Nagin Chand & Co., New Delhi.
- 2.Bhal B S and Arun Bhal, Advanced Organic Chemistry, 12th Ed., (1997), Sultan Chand& Co., New Delhi.
- 3.Puri B R, Sharma L R and Kalia K K, Principles of Physical Chemistry, 23rd Ed., (1993)Shoban LalNagin Chand & Co., New Delhi.

Reference Books

- 1.Lee J D, Concise Inorganic Chemistry, 5th Ed., (2006), Black Well Science, UK.
- 2.Morrison R T, Boyd R N and Batcharjee S K, Organic Chemistry, 7th Ed., (2009),Pearson New York
- 3.Peter Atkins and Julio De Paula, Atkin's Physical Chemistry, 4th Ed., (2006), Oxford University Press, New Delhi.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Identify Symmetry Elements and Symmetry operations	K1
CO2	Explain the concept of bonding in organometallic compounds	K2
CO3	Illustrate the importance of solid state and semiconductor materials	K3
CO4	Analyse the Theories of Trans effect	K4
CO5	Evaluate the techniques of nanochemistry	K5&K6
CO6	Apply the knowledge in biochemical reactions	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO CO	PO1	PO2	PO3	PO4	PO5
CO1	S	H	H	M	S
CO2	S	H	M	H	H
CO3	H	M	S	S	M
CO4	H	H	H	M	S
CO5	S	S	M	H	S
CO6	H	S	S	S	S

S - Strong

H - High

M - Medium

L – Low



Program: B.Sc. Chemistry				
Core-VIII		Course Code: 20UCH6C09		Course Title: Organic Chemistry – II
Semester	Hours/Week	Total Hours	Credits	Total Marks
VI	5	75	4	100

COURSE OBJECTIVES

1. To know the reactions, structure and uses of carbohydrates.
2. To know the various types of vitamins and its biological biological functions.
3. To learn the various types of rearrangement and their applications in organic chemistry.
4. To learn the important reagents and their applications in organic synthesis.
5. Acquire the knowledge on reactions and structures of heterocyclic compounds, and nucleic acid

UNIT I - CARBOHYDRATES-I (15 Hours)

Classification, Monosaccharides-Reactions of Glucose and Fructose-osazone formation. Constitution of glucose and fructose-open chain structure- Configuration and ring structure-mutarotation-determination of ring size. Haworth's projection formulae and conformation of monosaccharides.

UNIT II - CARBOHYDRATES II (15 Hours)

Interconversions of monosaccharides-epimerisation-conversion of pentose to hexose and vice versa-aldose to ketose and vice versa. Disaccharides-structural elucidation of sucrose and maltose. Polysaccharides-structure of starch and cellulose - derivatives of cellulose.

UNIT III - HETEROCYCLIC CHEMISTRY-II (15 Hours)

3.1 Condensed five and six membered heterocyclics-preparation of indole, quinoline and isoquinoline - Fischer indole synthesis, Skraup synthesis and Bischer-Napieralski synthesis-Electrophilic substitution reactions.

3.2 Ureides-classification-pyrimidines-thymine, uracil and cytosine-purines-adenine and guanine – synthesis (structural elucidation not necessary)

3.3 Nucleic acids-structures of ribose and 2-deoxyribose- DNA and RNA – their components – Biological functions of nucleic acids-Elementary ideas on replication and protein synthesis.

**UNIT IV - MOLECULAR REARRANGEMENTS (15 Hours)**

Classification as anionotropic, cationotropic, intermolecular and intramolecular. Mechanisms of pinacol-pinacolone, Beckmann, benzidine, Hofmann, Curtius, Lossen, Schmidt, benzylic acid, Fries and Cope rearrangements.

UNIT V – REAGENTS (15 Hours)

Important reagents and their applications in organic chemistry – AlCl_3 , BF_3 , LiAlH_4 , NaBH_4 , PCl_5 , P_2O_5 , Na/ethanol , alcoholic KOH , H_2/Ni , $\text{H}_2/\text{Pd-BaSO}_4$, Zn/Hg-HCl , $\text{H}_2\text{N-NH}_2/\text{C}_2\text{H}_5\text{ONa}$, Ag_2O , HIO_4 , Lead tetra acetate and Osmium tetroxide.

Text book

1. B.S. Bahl and Arun Bahl, Advanced Organic Chemistry –S. Chand & Co., 2012.
2. R.T. Morrison and R.N. Boyd, Organic Chemistry, Pearson Education, Sixth Ed., 2002.
3. P.L. Soni, S.M. Chawla, Text book Organic Chemistry, Sultan Chand & Sons, 2007.
4. Singh, Mukarji and Kapoor, Organic Chemistry, New Age Publishers, 2017.
5. Raj K. Bansal, A Text Book of Organic Chemistry, New Age International Private Limited, 2016.
6. O.P Agarwal Vol 1 & 2, Krishna Prakashan Media (P) Ltd, 2015
7. M.K. Jain and S.C. Sharma, Vishal Publishing House, 2019

Reference Books

- 1 Organic Chemistry – Vol. 1 and Vol. 2, I.L Finar, Pearson Education, Sixth Edn., 2006.
- 2 Stereochemistry of Organic compounds, D. Nasipuri, New Age International (P) Ltd, Second Edn., 2005.
- 3 Stereochemistry: Conformation And Mechanism - P. S. Kalsi, New Age International Private Ltd., 2015.
4. Nasipuri.D, Stereo Chemistry of Organic Compounds, New Age International Private Ltd., 2020
5. Francis A Carey, Advanced Organic Chemistry Springer; 5th edition 2008.
6. Gurdeep R. Chatwal, Organic Chemistry of Natural Product, Himalaya Publishing House, 2010.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	The students will be able to explain Haworth's projection formulae	K1
CO2	Understand the classification of carbohydrates	K2
CO3	The Students should be familiar with the basic knowledge of the Heterocyclic compounds	K3
CO4	The students will be able to explain the Important reagents and their applications in organic chemistry	K4
CO5	Evaluate the molecular rearrangements	K5&K6
CO6	Formulate the structure and bonding reactions shown by organic molecules	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO \ CO	PO1	PO2	PO3	PO4	PO5
CO1	S	H	H	M	S
CO2	S	H	M	H	H
CO3	H	M	S	S	M
CO4	H	H	H	M	S
CO5	S	S	M	H	S
CO6	H	S	S	S	S

S - Strong

H - High

M - Medium

L – Low



Program: B.Sc. Chemistry				
Core-IX		Course Code: 20UCH6C09		Course Title: Physical Chemistry – II
Semester	Hours/Week	Total Hours	Credits	Total Marks
VI	5	75	4	100

Course Objectives

1. To study photo chemistry and laser.
2. To learn about Electro chemistry and its applications.

UNIT- I-PHOTOCHEMISTRY 16 HOURS

Laws of photochemistry –Jablonski diagram - Non radiative transitions – IC – ISC – Radiative transitions - Fluorescence and phosphorescence -primary and secondary reactions - Kinetics of hydrogen - bromine reaction. Photosynthesis-photosensitisation - chemiluminescence - Lasers - uses of lasers.

UNIT-II - ELECTROCHEMISTR -I 16 HOURS

Introduction: Metallic and Electrolytic conductors – Specific – Equivalent - Molar Conductance – Variation of Specific and Equivalent conductance with dilution- Kohlrausch's law and its applications, - Transport number and its determination by Hittorff's and moving boundary method – salt hydrolysis – determination of pH of a salt solution. Applications of conductivity measurements - degree of dissociation of weak electrolyte, determination of ionic product of water , determination of solubility and solubility product .

UNIT-III ELECTROCHEMISTR -II 16 HOURS

Theory of strong electrolytes - Debye - Huckel - Onsager theory -verification of Onsager equation - Wein effect and Debye Falkenhagen effect -ionic strength - activity and activity coefficients of strong electrolytes.

Galvanic cells - reversible and irreversible electrodes and cells -standard cell - emf and its measurement - types of electrodes – Gas electrode – Metal - Metal ion electrode – Metal Metal insoluble salt electrode – Redox electrode – Glass electrode – electrodereactions - electrode potentials - reference electrodes - Standard electrodepotentials. Derivation of Nernst equation for electrode and cell potential.

**UNIT-IV ELECTROCHEMISTR -III****16 HOURS**

Electrochemical series and its applications -Applications of emf measurement - calculation of ΔG , ΔH , ΔS and equilibrium constant. concentration cells- types of electrolyte concentration cells- with and without transference - liquid junction potential and its significance. applications of emf measurements- determination of activity coefficient – determination of transport number- determination of valency of ions in doubtful cases- determination of solubility products-determination of pH using quinhydrone and glass electrodes - potentiometric titrations.

UNIT-V - CHEMICAL KINETICS - II**16 HOURS**

Collision theory and derivation of rate constant for bimolecular reactions - theory of absolute reaction rates - thermodynamic derivation for the rate constant for a bimolecular reaction from it - comparison of collision theory and ARRT - significance of entropy , enthalpy and free energy of activation. Influence of ionic strength on the rate of ionic reactions-salt effect

Text Book:

- 1.Puri B.R., Sharma L.R., Pathania M.S., Principles of Physical Chemistry, (23rd edition), New Delhi, ShobanLal, Nagin Chand & Co., (1993)
- 2.Keith J. Laidler., Chemical Kinetics, Third Edition(2009), Pearson Education.

Reference Books

- 1.Atkins P.W., Physical Chemistry, (7th edition) Oxford University Press, London (2009).
- 2.Castellan G.W., Physical Chemistry, Third Edition, New Delhi, Orient Longmann (1987).
- 3.J Rajaram, J C Kuriacose., Kinetics and mechanisms of chemical transformations, Macmillan India Ltd.,(2006).



Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	After examination the student should be able to Write an expression for rate constant K for third order reaction	K1
CO2	Solve the numerical problems based on Rate constant	K2
CO3	Understand the term specific volume, molar volume and molar refraction	K3
CO4	The students will develop the ability of effective solving practical problem of electrochemistry	K4
CO5	Be familiar with electrochemical cells	K5&K6
CO6	Solve the cell reaction and calculate EMF	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO \ CO	PO1	PO2	PO3	PO4	PO5
CO1	S	H	H	M	S
CO2	S	H	M	H	H
CO3	H	M	S	S	M
CO4	H	H	H	M	S
CO5	S	S	M	H	S
CO6	H	S	S	S	S

S - Strong

H - High

M - Medium

L – Low



Program: B.Sc. Chemistry				
Elective– II	Course Code: 20UCH6E02		Course Title : Analytical Chemistry-II	
Semester VI	Hours/Week 5	Total Hours 75	Credits 4	Total Marks 100

Course Objectives

- 1.To provide a basic knowledge and understanding of essential chemical and physical principles for analytical chemistry.
- 2.To introduce basic analytical techniques and practical aspects of classical chemical analysis.
- 3.To solve problems related to chemical analysis and interpret analytical results.

UNIT – I - U.V-Visible Spectroscopy

1.1.Definition of spectrum – Types - absorption and emission spectra. Electromagnetic radiation, quantization of different types of energies in molecules (translational, rotational and electronic) Born Oppenheimer approximation.

1.2. U.V-VISIBLE Spectroscopy-Types of electronic transitions. Beer's- Lambert's law-O.D. chromophore, auxochrome, bathochromic and hypsochromic shifts-Instrumentation, Applications.

UNIT-II - I.R Spectroscopy

2.1 I.R.Spectroscopy-Principles-modes of vibration of diatomic, triatomic linear (CO_2) and nonlinear triatomic molecules (H_2O)-stretching and bending vibrations-selection rules. Finger prints Region – Group frequency. Instrumentation - Applications.

2.2 FT- IR principle and applications

UNIT-III - ESR AND RAMAN SPECTROSCOPY

3.1 Electron Spin Resonance spectroscopy – Principle – Hyperfine structure in spectra of Hydrogen atom, Methyl radical and Naphthalene negative ion.

3.2. Raman spectroscopy-condition-Rayleigh and Raman scattering, stokes and anti-stokes lines – Differences between Raman and I.R. Spectroscopy. Mutual exclusion principle (CO_2 and N_2O)



UNIT – IV - CHROMATOGRAPHIC TECHNIQUES –II

4.1 Gas Chromatography (GC)-principle- experimental techniques-instrumentation and Applications.

4.2 HPLC - principle- experimental techniques-Block diagram and Applications.

4.3 Gel-Permeation chromatography – principle – experimental techniques, applications and advantages.

UNIT- V- THERMOANALYTICAL METHODS

5.1. Principle - thermogravimetric analysis and differential thermal analysis-discussion of various components with block diagram- TGA & DTA curves of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, $\text{MgC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ and $\text{Ca}(\text{OOCCH}_3)_2 \cdot \text{H}_2\text{O}$ -Simultaneous DTA-TGA curves of SrCO_3 in air and $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ in air and in CO_2 - factors affecting TGA & DTA curves.

5.2 Thermometric titrations-principle- apparatus- applications.

Text Books:

- 1.Elements of analytical chemistry - R. Gopalan, P.S. Subramanian, K. Rengarajan - S. Chand and sons (1997).
- 2.Fundamentals of analytical chemistry - D.A. Skoog and D.M. West - Holt Reinhard and Winston Publication - IV Edition (1982).
- 3.Instrumental methods of chemical analysis - Chatwal - Anand - Himalaya Publishing house - (2000).
- 4.Y.R.Sharma., Elementary Organic spectroscopy, S.Chand Publisher, Fourth edition (2009).

Reference Books:

- 1.Principles of instrumental methods of analysis - D.A. Skoog and Saunders - College publications - III edition (1985).
- 2.S.M. Khopkar., Analytical chemistry, New Age International publication, Third edition (2004).
3. S.Usharani, Analytical Chemistry, Macmillan publication, fourth edition (2008)
- 4.W.Kemp., Organic spectroscopy, Palgrave publications, third edition(2008).
- 5.P.S.Kalsi., Spectroscopy of organic compounds, New Age International publisher, sixth edition (2005).
- 6.Alka L.Gupta., Analytical chemistry, A pragathi prakasan Educational publisher, Fourth edition (2012).



Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	After examination the student should be able to Explain the thermo analytical methods and various techniques	K1
CO2	Explain the theoretical principles of various separation techniques in chromatography, and typical applications of chromatographic techniques	K2
CO3	Performing risk assessment of spectroscopic techniques	K3
CO4	The students will develop the ability of effective solving practical problem of spectroscopy(IR,UV,ESR and Raman)	K4
CO5	Be familiar with calculations in analytical chemistry.	K5&K6
CO6	Formulate the Thermometric titrations	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO \ CO	PO1	PO2	PO3	PO4	PO5
CO1	S	H	H	M	S
CO2	S	H	M	H	H
CO3	H	M	S	S	M
CO4	H	H	H	M	S
CO5	S	S	M	H	S
CO6	H	S	S	S	S

S - Strong

H - High

M - Medium

L – Low



Program: B.Sc. Chemistry				
SBEC- V	Course Code: 20UCH6S05		Course Title : Pharmaceutical Chemistry	
Semester	Hours/Week	Total Hours	Credits	Total Marks
VI	2	30	2	100

Course Objectives:

1. To effectively impart knowledge about - various diseases and their treatment.
2. To know about the different types of drugs.
3. To impart knowledge about different spectroscopy techniques.

UNIT-I

1.1. Definition of the terms-drug, pharmacophore, pharmacodynamics, pharmacopoea, pharmacology, bacteria, virus, fungus, actinomycetes, metabolites, antimetabolites, LD50, ED50. Therapeutic index.

1.2 Nomenclature of Drugs - Classification of drugs—chemical classification – biological classification – some important heterocyclic system and their nomenclatures.

UNIT-II

2.1. Sulphonamides-mechanism and action of sulpha drugs- preparation and uses of sulphadiazine, sulphapyridine, sulphafurazole.

2.2. Antibiotics-Definition-classification as broad and narrow spectrum, Antibiotics-penicillin, ampicillin, streptomycin, tetracycline and chloramphenicol structure and mode of action only (no structural elucidation, preparation, assay)

UNIT-III

3.1. Analgesics-definition and actions-narcotic and non narcotic-morphine, Heroin, Pethidine and Methadone

3.2. Antipyretic analgesics-salicylic acid derivatives-methyl salicylate, aspirin, Sodium salicylate, Salicine and Diethylamine salicylate.

UNIT –IV

4.1. Anaesthetics-definition-classification-local and general- volatile, nitrous oxide, ether, Halothane, Trichloroethylene, ethylchloride, Chloroform, uses and disadvantages –



nonvolatile – intravenous - thiopental sodium, Methohexitone -local anaesthetics –cocaine, benzocaine and procaine.

4.2. Indian medicinal plants and uses-tulasi, kilanelli, mango, semparuthi, adadodai and thoothuvalai.

UNIT-V

5.1. Diabetics-Hypoglycemic agents-sulphonyl urea, biguanides.

5.2. AIDS-causes, prevention and control.

5.3 Cancer – causes and treatment.

5.4. Blood and Haematological agents- composition of blood – blood group and matching.

Text book

1. Jayashree Ghosh., A textbook of Pharmaceutical chemistry, S.Chand publication, Third edition (2008).
2. S. Laksmi., Pharmaceutical chemistry, Sultan Chand & sons, Third edition (2004).

References books

1. G.R.Chatwal., Pharmaceutical chemistry organic, Himalaya Publishing House, Second edition (1997).



Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	The students will be able to explain the various diseases and their treatment	K1
CO2	Understand the concept of sulpha drugs	K2
CO3	The Students should be familiar with the basic knowledge of the Indian medicinal plants and uses	K3
CO4	The students will develop the ability of application and Synthesis of drugs	K4
CO5	Evaluate the various pharmaceutical drugs	K5&K6
CO6	Students will be able to demonstrate methods of drugs analysis and pharmaceutical calculations	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO \ CO	PO1	PO2	PO3	PO4	PO5
CO1	S	H	H	M	S
CO2	S	H	M	H	H
CO3	H	M	S	S	M
CO4	H	H	H	M	S
CO5	S	S	M	H	S
CO6	H	S	S	S	S

S - Strong

H - High

M - Medium

L – Low



Program: B.Sc. Chemistry				
Core practical– VIII	Course Code: 20UCH6P08		Course Title : GRAVIMETRIC ESTIMATION – II	
Semester VI	Hours/Week 3	Total Hours 45	Credits 3	Total Marks 100

Course Objectives:

- ❖ To learn gravimetric estimation techniques.
- ❖ To give practical exposure to estimations gravimetrically
 - a. Estimation of calcium as calcium oxalate monohydrate.
 - b. Estimation of sulphate as barium sulphate.
 - c. Estimation of Nickel as Nickel dimethyl glyoxime.
 - d. Estimation of Magnesium as Magnesium oxinate.

Marks Distribution:60 marks

1 .Record	10marks
2. Execution of work	30 marks
3. Accuracy/ Result	15marks
4. Viva Voce	05marks

Reference Books:

- 1.Vogel's Inorganic Quantitative Analysis by Vogel, pearson education(2004).
- 2.O.P.Pandey,D.N.Bajpai,S.Giri, Practical chemistry, S.Chand & company Ltd.,(2005).
- 3.V.Venkateswaran, veeraswamy.R, Kulandaivelu.A.R. Sultan chand & sons (1997).
- 4.Qualitative Inorganic Analysis by V.V. Ramanujam.

**Course Outcome (COs):**

Students will gain an understanding of:

1. How to calculate limiting reagent, theoretical yield, and percent yield
2. How to engage in safe laboratory practices by handling laboratory glassware, equipment, and chemical reagents appropriately
3. How to dispose of chemicals in a safe and responsible manner
4. How to work effectively as a member of a team. Communicate productively with lab mates, teaching assistant and instructor
5. How to maintain a detailed scientific notebook



Program: B.Sc. Chemistry				
Core practical– IX	Course Code: 20UCH6P09		Course Title :	
			Physical Chemistry Practical -II	
Semester	Hours/Week	Total Hours	Credits	Total Marks
VI	3	45	3	100

Course Objectives:

- ❖ The course provides training in advanced physical chemistry laboratory techniques.
- ❖ *To study the kinetics of a reaction.*
To learn thermometric experiments and conductivities.
 - a) Determination of UCST and UCSC of phenol-water system.
 - b) Conductometric titration of a strong acid and a strong base.
 - c) Partition Co-efficient of Iodine between water and CCl₄.
 - d) Determination of Equilibrium constant between KI and Iodine.
 - e) Study of Zero order kinetics by using Iodination of Acetone.

Marks Distribution: 60 marks

1. Record	10marks
2. Procedure	10marks
3. Viva Voce	05marks
4. Experiment	35marks (Expt. 15 + Manipulation 15)

Reference Books:

1. Vogel's Inorganic Quantitative Analysis by Vogel, pearson education(2004).
2. O.P.Pandey, D.N.Bajpai, S.Giri, Practical chemistry, S.Chand & company Ltd.,(2005).
3. V.Venkateswaran, veeraswamy.R, Kulandaivelu.A.R. Sultan chand & sons (1997).
4. Qualitative Inorganic Analysis by V.V. Ramanujam.

**Course Outcome (COs)**

On successful completion of the course students will be able to:

1. Developed an understanding of the breadth and concepts of physical chemistry
2. An appreciation of the role of physical chemistry in the chemical sciences and engineering
3. An understanding of methods employed for problem solving in physical chemistry
4. Experience in some scientific methods employed in basic and applied physical chemistry
5. Developed skills in procedures and instrumental methods applied in analytical and practical tasks of physical chemistry
6. Developed skills in the scientific method of planning, developing, conducting, reviewing and reporting experiments



Program: B.Sc. Chemistry				
Core practical– X	Course Code: 20UCH5P07		Course Title : Organic Chemistry Practical -II	
Semester VI	Hours/Week 2	Total Hours 30	Credits 2	Total Marks 100

Course Objective:

1. To learn the skills of preparative methods.
2. To learn the determination of boiling points of liquids.
3. Set up glassware and apparatus to conduct experiments in Organic Chemistry
4. Understand and apply the concept of protecting groups
5. Understand the influence of bond polarization on a molecule's structure and reactivity

1. Organic Preparations

Acylation

- a. Acetylation of salicylic acid or aniline.
- b. Benzoylation of aniline or phenol.

Nitration

- a. Preparation of m-dinitrobenzene
- b. Preparation of p- nitroacetanilide

Halogenation

- a. Preparation of p-bromoacetanilide
- b. Preparation of 2,4,6-tribromophenol

Diazotization / coupling

- a. Preparation of methyl orange.
- b. Preparation of benzoic acid from toluene

Hydrolysis:

- a. Hydrolysis of ethyl benzoate (or) methyl salicylate

2. Determination of boiling point of Water, Ethanol, Benzene, Acetic Acid and Toluene.

Marks Distribution: 60 marks

1. Record

10 marks



2. Procedure	10 marks
3. Preparation	10 marks
4. Recrystallization	10marks
5. Boiling point	15marks
6. Viva Voce	05marsk

Reference Books:

- 1.Vogel's Inorganic Quantitative Analysis by Vogel, pearson education(2004).
- 2.O.P.Pandey,D.N.Bajpai,S.Giri, Practical chemistry, S.Chand & company Ltd.,(2005).
- 3.V.Venkateswaran, veeraswamy.R, Kulandaivelu.A.R. Sultan chand & sons (1997).
- 4.Vogel's text book of practical organic chemistry – Longman.
- 5.Practical Organic Chemistry by Gnanaprakasam.
- 6.Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)

Course Outcome (COs):

Students will gain an understanding of:

- a. How to calculate a limiting reagent, yield, and percent yield
- b. How to maintain a detailed scientific notebook
- c. How to critically evaluate data collected to determine the identity, purity, and yield of products.
- d. How to summarize findings in writing in a clear and concise manner
- e. How to use the scientific method to create, test, and evaluate a hypothesis
- f. How to engage in safe laboratory practices handling laboratory glassware, equipment, and chemical reagents
- g. How to predict the outcome and mechanism of some simple organic reactions, using a basic understanding of the relative reactivity of functional groups