ARULMIGU PALANIANDAVAR ARTS COLLEGE FOR WOMEN (AUTONOMOUS), PALANI

Nationally Reaccredited with B++ by NAAC in 3rd Cycle

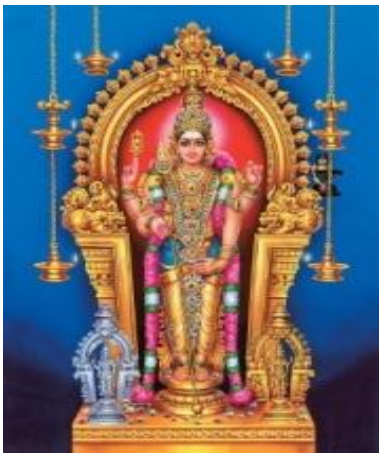
Run by Hindu Religious and Charitable Board under the Aegis of Arulmigu Dhandayuthapani Swami Thirukovil, Palani)

(Affiliated to Mother Teresa Women's University, Kodaikanal)

Chinnakalyamputhur, Palani -624 615.

DEPARTMENT OF CHEMISTRY

B.Sc., Chemistry - Syllabus



OUTCOME BASED EDUCATION

EFFECTIVE FROM THE ACADEMIC YEAR 2022-2023 ONWARDS

ARULMIGU PALANIANDAVAR ARTS COLLEGE FOR WOMEN (AUTONOMOUS), PALANI

OBE (Outcome Based Educational System)

Effect from the Academic Year 2022-2023 onwards

Common Academic Structure in Autonomy

For the Academic Year 2022-2023

Semester	Hours	Subject	Internal	External	Total	Credit
I	6	Part I Tamil	**25**	**75**	100	3
	6	Part II English	**25**	**75**	100	3
	4	**Part III** **Core Paper- I** General Chemistry – I	**25**	**75**	100	4
	4	**Core Paper – II** Organic Chemistry- I	**25**	**75**	100	4
	2	**Major Practical-1** – Semi Micro Qualitative Analysis	**--**	**--**	--	-
	5	**Allied – I** Mathematics Paper I / Zoology	**25**	**75**	100	5
	2	**Part – IV** **SBC** – Laboratory Techniques	**25**	**75**	100	2
	1	**VBE** – Yoga and Meditation Theory	**25**	**75**	100	2
	30	**TOTAL**			**700**	**23**
II	6	Part I Tamil	**25**	**75**	100	3
	6	Part II English	**25**	**75**	100	3
	8	**Part III** **Core Paper - III** General Chemistry – II	**25**	**75**	100	4
	3	**Core Paper – IV-** (Major Practical –I) – Semi Micro Qualitative Analysis	**40**	**60**	100	4
	5	**Allied – I** Mathematics Paper II / Zoology	**25**	**75**	100	5
	2	**Part IV -** SBC – Pulp and Paper Technology (Field Trip Compulsory)	**25**	**75**	100	2
	30	**TOTAL**			**600**	**21**

III	6	Part I Tamil	**25**	**75**	100	3
	6	Part II English	**25**	**75**	100	3
	4	**Core Paper –V** Physical Chemistry – I	**25**	**75**	100	4
	4	**Core Paper –VI** Organic, Inorganic and Analytical Chemistry	**25**	**75**	100	4
	2	**Core Paper – VIII-** Major Practical – II - Volumetric and Organic Compound Analysis	**-**	**-**	-	-
	4 (2T+2P)	**Allied II** Physics Theory Paper I	**25**	**75**	100	3
	2	**Part – IV SBC** Polymer Science	**25**	**75**	100	2
	2	**NME -** Chemistry in Everyday Life	**25**	**75**	100	2
	30	**TOTAL**			**700**	**21**
IV	6	**Part I** Tamil	**25**	**75**	100	3
	6	**Part II** English	**25**	**75**	100	3
	8	**Core Paper – VII** Inorganic Chemistry - I	**25**	**75**	100	5
	3	**Core Paper VIII** **Major Practical –II** Volumetric and Organic Compound Analysis	**25**	**75**	100	5
	3	**Allied - II** Theory Paper II	**25**	**75**	100	3
	2	Allied - Practical	**25**	**75**	100	4
	2	**Part – IV** **SBC** – Dye Chemistry	**25**	**75**	100	2
	-	**Part - V** Extension Activities	**-**	**-**	100	1
	30	**TOTAL**			**800**	**26**

V	6	**Part III** **Core Paper – IX** Organic Chemistry – II	**25**	**75**	100	5
	6	**Core Paper –X** Inorganic Chemistry – II	**25**	**75**	100	4
	3	**Core Paper XI** **Major Practical III** – Gravimetric Analysis & Organic Compound Preparations	**-**	**-**	-	-
	3	**Core Paper XIV** **Major Practical IV** – Physical Chemistry Practicals	**-**	**-**	-	-
	5	**Elective – I** Nano Technology and Green Chemistry (or) Water Treatment and Analysis	**25**	**75**	100	4
	5	**Elective II** – Analytical Chemistry and Elements of Organic Spectroscopy (or) Pharmaceutical Chemistry	**25**	**75**	100	4
	2	**Part – IV – SBC** Public Health Services	**25**	**75**	100	2
	30	**TOTAL**			**500**	**19**
VI	6	**Part – III** Core Paper **- XII** Organic Chemistry – III	**25**	**75**	100	5
	6	**Core Paper – XIII** Physical Chemistry – II	**25**	**75**	100	5
	3	**Core Paper XI** **Major Practical III** – Gravimetric Analysis & Organic Compound Preparations	**40**	**60**	100	5
	3	**Core Paper XIV** Major Practical – IV (Physical Chemistry Practical)	**40**	**60**	100	5
	6	**Elective – III** Petro Chemistry (or)Applied Chemistry	**25**	**75**	100	4
	2	**Part IV** – EVS	**25**	**75**	100	2
	2	**SBC** – Group Project	**75**	**25**	100	2
	2	**NME –II** – Agricultural Chemistry	**25**	**75**	100	2
	30	**TOTAL**			**800**	**30**

EXTRA CREDIT PAPERS

Semester	Name of the Course	Credit	Marks
I	Food Chemistry	2	100
III	Chemistry in day today life.	2	100
V	Forensic science and crime investigation.	2	100

Total Marks = 4100

Total Credits = 140

PROGRAMME OUTCOMES

The Students will be able to

PO1. Explain the scientific principles in various fields.

PO2. Display practical skills in their career, intellectual analysis of problems and lead a team, apply entrepreneurial skills and develop a leadership quality.

PO3. Enrich the academic career by doing higher education and have a successful attitude to do research.

PROGRAMME SPECIFIC OUTCOMES

On Successful Completion of the Programme, Our Students will be able to

PSO-1 Have appropriate knowledge in the main areas of chemical sciences.

PSO-2 Analyse and understand the experimental problems, design a problem solving method, carrying out the suitable experimental solutions.

PSO-3 Effective communication skill, develop critical thinking, be confident in carrying out all challenges.

PSO-4 Get exposure and involve in modern trends in chemical research.

PSO-5 Achieve employment in chemical related industries, public administration, academic fields and empower new avenues.

QUESTION PAPER PATTERN

FOR PART - III & PART – IV PAPERS

Summative Examination : Part III

Duration – 3 Hrs

Section A

Answer All Questions --------- **10X1=10** (Objective type)

Section B ----------**5X7 = 35** (Either or type)

Section C ----------**3 Out of 5**---- **3X10=30** (Open Choice)

Total = 75

Internal Marks:

Section A

Answer All Questions ---------- **6X 1= 6**

Section B ---------- **2X4 = 8** (Either or type)

Section C ---------- 2 Out of 4 ----- **2X8= 16** (Open Choice)

Total=30

Theory 30/2 =15

Assignment = **5**

Seminar = **5**

TOTAL = 25

QUESTION PAPER PATTERN PART – IV
FOR EXTERNAL EXAMINATION (SBC & NME)

Duration : 3 Hrs **Total Marks : 75**

Section A ---------- 5 out of 8 Questions **(5X3=15)**

Section B ---------- 5 out of 8 Questions **(5X6=30)**

Section C ---------- 3 out of 5 Questions **(3X10=30)**

QUESTION PAPER PATTERN PART – IV
FOR INTERNAL EXAMINATION (SBC & NME)

Duration: 1 Hr **Total Marks: 25**

Section A ---------- 2 out of 3 Questions **2X 2 = 4**

Section B ---------- 1 out of 2 Questions **1 X 4= 4**

Section C ---------- 1 out of 2 Questions **1 X 7 = 7**

Total (Theory) = 15

Assignment = 5

Seminar = 5

TOTAL = 25

SEMESTER - I

B.Sc., Chemistry

SEMESTER – I

CORE PAPER -I - GENERAL CHEMISTRY-1

Hours: 4 **Credits: 4** **Max Marks: 75(Ext); 25 (Int)**

UNIT – I : ATOMIC STRUCTURE AND PERIODICITY

Atomic orbital-Quantum numbers –Principal, azimuthal, magnetic and spin quantum numbers and their significance-shapes of atomic orbital-g and u character of atomic orbital-nodal points and nodal planes-Principles governing the occupancy of electrons in various quantum levels-Pauli's exclusion principle-Hund's rule of maximum multiplicity-Aufbau principle,(n+1) rule-writing practice for electronic configuration of vital elements in s,p,d & f block elements-stability of half and fully filled orbital with suitable examples.

Long form of the periodic table-characteristics-classification of elements on the basis of electronic configuration-periodicity of properties-cause of periodicity-explanation of atomic radii, ionic radii, electron affinity, ionization energy, electro negativity-factors affecting their magnitudes.

UNIT – II : CHEMICAL BONDING

Types of Chemical bonds – ionic, covalent, co-ordinate covalent, hydrogen (inter and intra)and metallic bonds with few suitable examples - comparison between them.

Chemical Bonding – valence bond approach-VB theory- types of overlapping and orbital diagrams- sigma and pi bonds-concept of hybridisation and geometry of molecules-sp,sp^2,sp^3,sp^3d and sp^3d^2 with suitable examples- $BeCl_2$,$SiCl_4$,PCl_5,SF_6,IF_7 - VSEPR theory-shapes of some simple inorganic molecules NH_3, and H_2O.

Molecular Orbital Theory-bonding and antibonding molecular orbital-relative order of energies of molecular orbital-MO theory applied to Homolonuclear molecules-Hydrogen, Helium, Nitrogen, Oxygen-Hetero nuclear molecules-HF and CO.

UNIT III : SURFACE CHEMISTRY

Adsorption- classification of adsorption of gases on solids- types of adsorption – differences between them – factors affecting adsorption.

Catalysis- general characteristics- types of catalytic reactions, enzyme catalysis(Michaelis – Menton equation with derivation), types of catalysts- promoters-catalytic poison – theories of catalysis-application of catalysis.

UNIT – IV: CHEMICAL KINETICS

Scope of Chemical kinetics- rate of chemical reaction – factors influencing reaction rates- rate law- rate constant – order and molecularity of the reaction – differences between them- classification of rates based on the order of the reaction- half life period ,simple and complex reactions-differences between them – types of complex reactions.

UNIT-V : ELECTRO CHEMISTRY - I:

Conductors, insulators and semi conductors-definition with examples-theory of electrolytic conductors- Ostwald's dilution law for weak electrolytes-Faraday's laws of electrolysis-conductance- specific resistance- specific conductance-equivalent conductance-molar conductance-variation of equivalent conductance with concentration- Kohlrauch's Law-statement and application(any one)- common ion effect-buffer solutions-Henderson equation-pH indicators-theories of pH indicators.

Text books:

1. **A Text book of Inorganic Chemistry by – Puri , Sharma, kalia and Kaushal.**
2. **A Text book of Inorganic Chemistry by- P.L.Soni.**
3. **A Text Book of Physical Chemistry – Puri ,Shama and Pathania**

References Books:

1. Modern Inorganic Chemistry by R.D. Madan,
   S. Chand & Company LTD, Ram Nagar, New Delhi, Edition 2007.
2. Essentials of Physical chemistry by Arun Bahl and B.S. Bahl, G.D.Tuli
   S. Chand & Company Ltd, Edition 2006.

Co Number	Co Statement	Knowledge Level
CO1	To understand the Periodic table and Periodic properties	K2
CO2	To gain insight into valence bond theory, molecular orbital theory and the concept of hybridization	K1
CO3	To describe different types of catalysis and their kinetic study focus with special Focus on enzyme catalysis	K1
CO4	To explain the rate of chemical reaction	K1
CO5	To Explain the theory of electrolytic conductors	K1

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Strong	Strong	Strong	High	Strong
CO2	High	Strong	Strong	Medium	Strong
CO3	Strong	Strong	High	Strong	Strong
CO4	Strong	High	High	Medium	Strong
CO5	Strong	Strong	Strong	High	High

B.Sc., Chemistry

Semester - I

CORE PAPER- II

ORGANIC CHEMISTRY- I

Hours: 4 **Credits: 4** **Max Marks: 75(Ext); 25(Int)**

Objectives:

i) To Know the Fundamental Concepts of Organic Chemistry and its Reactions.

ii) To study the reactions mechanisms and properties of Aliphatic hydrocarbons like alkanes, alkenes, and alkynes.

UNIT-I FUNDAMENTAL CONCEPTS-I

a) **Introduction to Organic Chemistry -** Sources and classification of Organic compounds.

b) **Nomenclature of Organic compounds -** Common and IUPAC system of naming Aliphatic and Aromatic hydrocarbons up to 10 carbon atom systems. Functional groups: Definition – various functional groups of organic compounds Aliphatic and Aromatic. Homologue – definition and examples.

c) **Detection and estimation of elements:** Lassaigne's test and Beilstein test- Estimation of nitrogen by Kjeldahl's method -Halogens and Sulphur by Carius method.

d) **Purification techniques:** Fractional distillation, sublimation and crystallization.

e) **Determination of Molecular weight of Organic acids and bases**-Silver salt method for acids, Platinic chloride method for bases. Problems in determining empirical and molecular formulae - differences between them.

UNIT- II FUNDAMENTAL CONCEPTS-II

a) Tetrahedral arrangement of valencies of carbon atoms.

b) Cleavage of bond: Homolytic and Heterolytic Cleavages of Carbon bond.

c) Electrophillic and Nucleophillic reagents-Definition and examples.

d) Electronic effects: Inductive, Electromeric, Resonance effects and hyper conjugation.

e) Reaction intermediates: Free radicals, Carbonium ion(carbocation), Carbanions and Carbenes-generation and their stability.

UNIT-III : ALIPHATIC HYDROCARBONS - I

a)Alkanes: Introduction- Sources- Preparation by wurtz synthesis, decarboxylation and using Grignard reagents- reactions of Alkanes – halogenations - free radical mechanism of halogenation of alkanes- Cracking and Pyrolysis – Octane number- flash point- synthetic petrol, natural gas.

b)**Alkenes:** Introduction- classification of alkenes, Preparation by dehydrohalogenation of Rx- dehydration of alcohols and by heating quaternary ammonium salts- Hoffmann's rule and Saytzeff rule with examples. Reactions of alkenes- Electrophillic addition of Br_2 and HBr- Markownikoff's rule with examples- Peroxide effect with examples.

UNIT-IV ALIPHATIC HYDROCARBONS - II

a)Dienes: Classification-isolated-cumulated and conjugated double bond systems-Diels- Alder reactions- 1,2 and 1,4- addition mechanism in butadiene- Geometrical isomerism of dienes.

b) Alkynes: Introduction-preparation of alkynes-acidity of alkynes – Chemical properties- substitution, Hydrogenation, Ozonolysis and combustion reactions of alkynes(Mechanismnot necessary)

d)Isomerism- Structural, chain, position, functional isomerism-Tautomerism and Metamerism- Explanation with examples.

UNIT - V

Types of Organic Reactions:

a) Detailed mechanism of aliphatic nucleophillic substitution reactions- SN^1 ,SN^2 , SN^i reactions.

b) Detailed mechanism of aliphatic elimination reactions: E^1,E^2,E_{ICB} reactions-substitution Vs elimination – polymerization reaction - types- explanation with suitable illustrations.

c) Rearrangement reactions involving alkanes, alkenes and alkynes.

References Book:

Text Books:

1. A text book of Organic Chemistry by B.S. Bahl and Arun Bahl.

   S. Chand & Company LTD, Ram Nagar, New Delhi.20th Revised Edition-2011

2. A Text Book of Organic Chemistry by P.L. Soni.

3. A Text Book of Organic Chemistry by M.K Jain & S.C. Sharma.

CO Number	CO Statement	Knowledge Level
CO1.	To discuss the IUPAC Nomenclature of organic Compounds, Detection, Estimation and Purification techniques of organic compounds.	K1, K2
CO2.	To identify electrophiles and Nucleophiles and the chemical reactions involving these reagents.	K3
CO3.	To Interpret the Preparations, Properties of alkanes and alkenes.	K4
CO4.	To Illustrate the types of isomerism and Preparation, properties of dienes and alkynes.	K2, K3
CO5.	To Explain the mechanism of different types of organic reactions.	K1, K3

Mapping with Programme Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Strong	Strong	Strong	High	Strong
CO2	High	Strong	Strong	Medium	Strong
CO3	Strong	Strong	High	Strong	Strong
CO4	Strong	High	High	Medium	Strong
CO5	Strong	Strong	Strong	High	High

B.Sc., Chemistry

Semester - I

SBC – Laboratory Techniques

Hours: 2 **Credits: 2** **Max Marks: 75(Ext); 25(Int)**

Objectives:

To know about the basic lab safety rules. Such as washing hands, not bringing food and keeping the lab clean, wearing appropriate lab coat etc.

To identify hazardous material and procedures in the laboratory.

Unit – I: Laboratory Safety

Handling of concentrated acid, bases and hazardous chemical, safety precautions, fire hazards, safety and first aid procedures for laboratory accidents- poisoning- universal antidote.

Unit – II – Concentration of Solutions

`Avogadro number – mole concept- atomic weight, molecular weight, equivalent weight- primary and secondary standards- normality, morality, molarity, weight percentage, Volume percentage, dilution from stock solutions- problems.

Unit – III Basic principles of Quantitative Analysis

Condition for precipitation based on solubility and ionic product – titrimetry- principles of different acid- base titrations- indicators used in acid – base titrations – redox titrations (M_n-O_4 only) - accuracy – error calculation in Volumetric analysis – percentage error.

Unit – IV – Inorganic qualitative analysis

Group separation of common cations- interfering and non- interfering anions- elimination of interfering anions – test for basic anions and cation – phosphate – nitrate , sulphate , carbonate fluoride, oxalate, chloride, borate, lead, cadmium, copper, aluminum, iron, nickel, calcium, barium, strontium, ammonium (any one test for each)

Unit – V Practical Organic and physical chemistry

1. Determination of purity of organic compounds – introduction – Criteria of purity – experimental determination of melting point and boiling point precautions to be observed in the experiment.

2. Determination of critical solution Temperature phenol- water system.

3. Determination of molecular weight - Rast's macro method.

References Books:

1. Textbook of Organic Chemistry - P.L.Soni.
2. Vogel's Text Book of Practical Organic Chemistry.
3. Inorganic Semi – Micro Qualitative Analysis – V.V.Ramanujam.
4. Elements of Analytical Chemistry- R.Gopalan, P.S.Subramanian.

CO Number	CO Statement	Knowledge Level
CO1	To impart knowledge on handling of concentrated acid, bases and hazardous Chemicals.	K2
CO2	To Explain the principles of Volumetric Analysis & Preparation of stock solutions	K1&K3
CO3	To discuss the types of titrations.	K2
CO4	To identify the group separation of common cations, interfering and non- interfering anions.	K3
CO5	To gain practical skills in physical chemistry experiments.	K4

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Strong	Strong	Medium	High	Strong
CO2	High	Strong	Strong	Medium	Strong
CO3	Medium	Strong	High	Strong	Strong
CO4	Strong	High	High	Strong	Medium
CO5	Strong	Medium	Strong	High	Strong

SEMESTER - II

B.Sc., Chemistry

SEMESTER – II

CORE PAPER – III – GENERAL CHEMISTRY – II

Hrs: 8/Hrs **Credits: 4** **Max Marks: 75(Ext); 25(Int)**

Objectives:

1. To know the structures and types of solids.
2. To know the isotropy, anisotropy, and calculations involving interplanar spacing in crystal systems.
3. To understand the principles of metallurgy.
4. To learn about kinetic theory, gas laws and molecular velocities.
5. To understand the concept of nuclear chemistry and its applications.

UNIT – I : Solid State – I

Lattice Energy- ionic crystals, Nacl and CsCl crystal structure – determination of lattice energy using Born-Haber cycle-factors affecting crystal lattice energy-properties of ionic crystals(higher melting point, hardness, electrical conductivity in molten condition and in solution)- Polarisation and Polarising ability- Fajans Rule-Vander Waals forces-ion-ion, ion-dipole interactions.

Types of Crystals – ionic, molecular, covalent and metallic crystals.

1. Ionic Crystals : Analysis of KCl.
2. Molecular crystals – Water and Ammonia.
3. Covalent crystals – Diamond and Graphite.
4. Metallic crystals : Metallic bond in metals
5. Defects in Crystals - Frankel and Schotty defects.

UNIT -II - Solid State – II

Isotropy and anisotropy- point groups space lattice unit cell-Bravais lattice-seven crystal systems-laws of crystallography-law of constancy of interfacial angle- law of rational indices-miller indices-symmetry elements in crystal systems-X-Ray diffraction-Bragg's equation-experimental method of determination of interplanar spacing (Single crystal method and powder method) -calculations involving interplanar spacing in crystal systems.

UNIT – III : Metallurgy

Occurrence of metals –minerals and ores-mineral wealth in India-steps involved in metallurgical process-concentration – calcinations – roasting - reduction to free metal-electrometallurgy - hydrometallurgy- refining of metals - electrolytic refining-Van Arkel process. Metallurgy of Aluminium, Iron, Titanium, Tungsten and Uranium and their uses.

UNIT – IV – KINETIC THEORY OF GASES

Postulates of kinetic theory of gases- Derivation of ideal gas laws from the expressions on the basis of kinetic theory of gases - deviation - Vander waals equation - Equation of state - Clausius, Berthelot and Dieterici equations of state - Boyle and inversion temperatures of gases.

Maxwell - Boltzmann law of distribution of velocities (Derivation not necessary) graphical representation - effect of temperature on various velocities - comparison of RMS, average and most probable velocities. Mean free path-viscosity of gases - collision diameter, frequency and cross section - Loschmidt number-principle of equipartition of energy.

UNIT –V : NUCLEAR CHEMISTRY

Constitution of nuclei – stable and unstable nuclei - Their relationship to a n/p ratio-magic number-mass defect and binding energy-whole number rule-packing fraction-mass energy relationship. Nuclear fission and fusion - Theories of fission-Application of fission-principles of atom bomb-nuclear fusion - stellar energy and hydrogen bomb. Natural and Artificial Radioactivity - Definition - Detection and measurement of radioactivity - Soddy's group displacement law. Application of Radioactivity Application in medicine-in agriculture-industry-as trace elements in the elucidation of structure and in the investigation of reaction mechanism in analytical chemistry - carbon dating. Particle accelerator - Linear accelerator – cyclotron and synchrotron Nuclear Reactors : Nuclear reactor –nuclear fuel- FBR – moderators – Coolants.

TEXT BOOKS:

1. A Text Book of Physical Chemistry – P.L Soni.
2. A Text Book of Physical Chemistry – Puri & Sharma
3. A Text Book of Inorganic Chemistry – R.D. Madhan
4. A Text Book of Inorganic Chemistry – P.L Soni.

REFERENCE BOOKS:

1. Modern Inorganic Chemistry by R.D. Madhan,,S. Chand & Company LTD, Ram Nagar, New Delhi, Edition 2007.
2. Essentials of Physical Chemistry by B.S. Bahl and Arun Bahl G. D.Tuli S. Chand & Company Ltd, Edition 2006.

Co Number	CO Statement	Knowledge Level
CO1	To Know the Structure and Compound Identification in the Solid State.	K1
CO2	To Explain the experimental method of determination of interplanar spacing	K2
CO3	To Understand the concept of various steps involved in metallurgical Process	K3
CO4	To gain knowledge and develop an understand of the kinetic theory of gases	K4
CO5	To Compare the penetrating power of alpha, beta, neutron and gamma radiation	K5

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Strong	Strong	Strong	High	Strong
CO2	High	Strong	Strong	Medium	Strong
CO3	Strong	Strong	High	Strong	Strong
CO4	Strong	High	High	Medium	Strong
CO5	Strong	Strong	Strong	High	High

B.Sc., Chemistry

CORE PRACTICAL – I

SEMI MICRO QUALITATIVE ANALYSIS

Hrs: 3 **Credits: 4** **Max Marks: 60(Ext); 40(Int)**

Objectives:

To Analyse the given inorganic mixture containing two anions (one interfering and one simple anion) and two of the following cations Pb, Cu, Cd, Bi, Fe, Al, Zn, Mn, Co, Ni, Ba, Sr, Ca, Mg and NH_4^+

Cations

Lead, copper, cadmium, bismuth, iron, aluminium, zinc, manganese, cobalt, nickel, barium, strontium, calcium, magnesium and ammonium.

Anions

Carbonate, sulphate, nitrate, chloride, oxalate, borate, phosphate, chromate and fluoride.

Text Books:

1. Vogel - A Text Book of qualitative inorganic Analysis.

Reference Books:

1. Basic Principles of Practical Chemistry By
   V.Venkateswaran, R.Veeraswamy & A.R.Kulandaivelu

B.Sc., CHEMISTRY

SEMESTER - II

Part – IV- SBC

Pulp and Paper Technology

Hours : 2 Per week **Credits : 2** **Max Marks: 75(Ext); 25(Int)**

Objectives:

1. To make the students industry ready employees
2. To improve the entrepreneurship skill

Unit 1:

Introduction – Raw material – Manufacture of Pulp- Mechanical process – Chemical Process.

Unit II:

Types of Pulp - Sulphite Pulp , Soda Pulp and Rag Pulp.

Unit III.

Manufacture of Paper- Various steps in the manufacture of paper -Bleaching ,Beating , Refining , Filling, Sizing ,Calendaring and Colouring of Paper**.**

Unit IV:

Uses of Paper

Unit V:

Preparation of Heavy Paper – Paper industries in India.

Industrial Visit & submission of report is mandatory.(5 Marks- Internal)

Reference Books :

1. Industrial Chemistry by B.K .Sharma

CO Number	CO Statement	Knowledge Level
CO1	To Discuss the manufacture of pulp and the process involved	K2
CO2	To describe the types of pulp	K1
CO3	To Illustrate various steps involved in the manufacture of paper	K2
CO4	To Explain the uses of paper	K1
CO5	To identify paper Industries in India	K2

Mapping with Programme Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Strong	High	Strong	High	Strong
CO2	Strong	High	Strong	Medium	Strong
CO3	Strong	Strong	High	Strong	Medium
CO4	High	Strong	High	Medium	Strong
CO5	Strong	Strong	Strong	Medium	High

SEMESTER - III

B.Sc., Chemistry

SEMESTER - III

CORE PAPER – V PHYSICAL CHEMISTRY – I

Hour : 4 **Credits : 4** **Max Marks: 75(Ext); 25(Int)**

Objectives:

1. **To get knowledge about phase rule.**
2. **To understand about thermodynamics.**
3. **To acquire knowledge about thermochemistry, photo chemistry and colligative properties.**

UNIT – I : PHASE RULE

Definition of terms – Gibb's phase rule-one component system-water, carbon- di-oxide-polymorphism-two component system-reduced phase rule-simple eutectic system-Pb-Ag system, KI-Water system-system involving compound formation with congruent and incongruent melting point-Zn-Mg system-CuSO4.5H2O dehydration phase diagram.
Partially Miscible liquid system-CST-completely immiscible liquid system.

UNIT – II :THERMODYNAMICS – I :

Introduction : Types of systems-state of a system-thermodynamic or state variables – extensive and intensive properties-state and path functions-exact and inexact differentials-thermodynamic process-reversible and irreversible processes- work,heat and energy.Zeroth law of thermodynamics and its significance.

Statement-mathematical formulation-internal energy- enthalpy or heat content-heat changes at constant volume and at constant pressure-relationship between Cp and Cv –work done ,heat change and enthalpy change for reversible isothermal expansion and compression of an ideal gas –calculation of q,w,E,H for adiabatic expansion of an ideal gas-relation between T,V and P of an ideal gas undergoing adiabatic reversible expansion. Comparison of work done in isothermal and adiabatic reversible expansion of an ideal gas-application of I law to non ideal gas undergoing reversible isothermal and adiabatic expansion-Joule Thomson effect-Joule Thomson co-efficient in the case of ideal gas and real gases-inversion temperature.

Unit – III : Thermochemistry and Chemical Equilibrium

Thermochemistry : Significance of Hess's law of constant heat of summation-Kirchoff's equation-bond enthalpies and energies.

Chemical Equilibrium

Law of mass action-Relation between Kc and Kp-Lechatlier principle and its application to Haber's process-common-ion effect in ionic equilibria.

UNIT – IV : SOLUTIONS AND COLLIGATIVE PROPERTIES

` Definition – concentration terms involved – mole fraction, weight percentage, mole percentage ,parts per million- Dissolution of substances-Temperature and solubility-solubility of gases in liquids- Gaseous solutions- solutions of gases in liquids –Henry's law-ideal solutions-Raoult's law of ideal solutions-Solutions of liquids in liquids in liquids-relation between the mole fractions of the components in the liquid &vapour phases –non-idael solutions-Activity co-efficients-Definition of melting point,boiling point,elevation in boiling point,depression in freezing point-ebulioscopic and cryoscopic constant.

UNIT – V : PHOTOCHEMISTRY

Definition of various terms – Consequence of light absorption - The Jablonski Diagram –light absorption by solutions- Beer-Lambert law – limitations of Beer-Lambert law – laws of photochemistry—Quantum yield-Experimental determination of quantum yields-photochemical rate law-kinetics of photochemical reactions (only for Hydrogen-Chlorine reaction). –Energy transfer in photochemical reactions-photosensitisation and Quenching-Quenching of Fluorescence –Chemiluminescience.

TEXT BOOKS:

1. Text book of Physical Chemistry by P.L.Soni and O.P.Dharmarha ,published by Sultan Chand & Sons, New Delhi,2005

2. Principles of Physical Chemistry by Puri, Sharma and Pathania, Vishal Publishing Co.,Jalandar, 2013.

REFERENCE BOOKS:

1. Principles of Physical Chemistry by Abhijit Mallick,Viva Books Private Limited,01.01.2018.
2. Physical Chemistry by Peter Atkins,Julio de Paula and James Keeler,Oxford University Press,01.07.2018.

Co Number	CO Statement	Knowledge Level
CO1	Understand the basic concepts of phase rule.	K2
CO2	Know the terms involve in thermodynamics and zeroth law of thermodynamics,	K2
CO3	Gain knowledge on thermochemistry and chemical equilibrium	K1, K2
CO4	Gain knowledge on laws of solution and on colligative properties of solutions	K1, K2
CO5	Know the laws of photochemistry and concepts of fluorescence, phosphorescence and chemiluminescence	K2,K4

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Strong	High	Strong	High	Strong
CO2	Strong	High	Strong	Medium	Strong
CO3	Strong	Strong	High	Strong	Medium
CO4	High	Strong	High	Medium	Strong
CO5	Strong	Strong	Strong	Medium	High

B.Sc., CHEMISTRY

SEMESTER-III

CORE PAPER –V

ORGANIC, INORGANIC AND ANALYTICAL CHEMISTRY

4 Hrs/Week **Credit : 4** **Max Marks: 75(Ext); 25(Int)**

Objectives:

1. To study about Alcohols, ethers, Thio alcohol and thioethers
2. To know the preparation and synthetic applications of poly halogen derivatives.
3. To study the chemistry of S,P,D block elements
4. To understand the basics of volumetric analysis and the importance of oxidation and reduction.

Unit I **Alcohols , Ethers, Thiols and Thio ethers**

Alcohol: Preparation by hydroboration, reduction of carbonyl compounds- oxymercuration and demercuration. Reaction with metals. Mechanism and reactivity towards HX, dehydration-Ascending and descending the alcohol series. Rectified spirit-absolute alcohol, methylated , spirit, power alcohol-estimation of number of hydroxyl groups.

Ethers: Mechanism of Williamson's synthesis mechanism of cleavage by HX-estimation of methoxy group by Zeisel's method.

Thio alcohols and Thio ethers: Definition with examples. Preparation and properties of Sulphonol and Mustard Gas.

Unit II **Polyhalogen Derivatives:**

Polyhalogen derivatives: Chlorofluoro carbons –westron and Freon-Preparation and applications. Preparation and properties of $CHCl_3$, CHI_3 and CCl_4.

Halogen derivatives of unsaturated hydrocarbons: vinyl chloride and Allyl chloride-Preparation & reactivity. Polymerisation reaction of vinyl chloride.

Organo Metallic Compounds: Grignard reagents-preparation, structure and synthetic applications, Organozinc - preparation & synthetic applications.

Unit III **Chemistry of s-block elements:**

Elements of group IA-General discussion of elements of group IA-Diagonal relationship of Li with Mg- Anomalous behaviour of lithium- extraction of lithium- properties and uses of Li.

Elements of group IB- general discussion –position in the periodic table, Resemblance among Cu, Ag, Au –Gradation in their properties – Resemblance between coinage metals and the VIII group elements. Elements of group IIA – Group discussion – diagonal relationship between Be and Al – Anomalous behaviour of Be – comparison of group IA and group IIA elements.

Unit IV **Chemistry of p-block elements:**

General discussion of group IV elements – Preparation properties and uses of carbonyl chloride – lead monoxide – red lead – white lead. General discussion of group V elements – active nitrogen – preparation and properties of hydrazine, hydrazoic acid and hydroxyl amine – Marsh test for arsenic. Peracids and their salts – definition – peracids of carbon – per mono and perdicarbonic acid – permono carbonates and perdicarbonates – peracids of sulphur – permono and perdisulphuric acid.

Unit V **Theory of volumetric Analysis** : Principles of volumetric Analysis – concentration units –standard solution-requirements of a primary standard solution-indicator-type of titrations & indicators-neutralization, redox, precipitation & complex formation reactions-choice of indicators in acid base titrations-complexometric titrations, EDTA Titrations-determination of hardness of water

REFERENCE BOOKS:

1. A Text book of Organic Chemistry by P.L. Soni.
2. A Text book of Organic Chemistry by M.K Jain & S.C. Sharma
3. A Text book of InOrganic Chemistry by R.D.Madhan

CO Number	CO Statement	Knowledge Level
CO1	To describe the preparation , Properties and uses of alcohols, thioalcohols, ethers, thioethers.	**K3**
CO2	To discuss the preparation, properties of polyhalogen derivatives	**K2**
CO3	To Illustrate the anomalous behaviour of Li, Be and the comparison of IA group elements with II A group elements.	**K4**
CO4	To Discuss the chemistry of p- block elements	**K2, K3**
CO5	To Explain the principles of volumetric analysis and types of Titrations.	**K1**

Mapping with Programme Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Strong	Strong	Medium	High	Strong
CO2	High	Strong	Strong	Medium	Strong
CO3	Medium	Strong	High	Strong	Strong
CO4	Strong	High	High	Strong	Medium
CO5	Strong	Strong	Strong	High	High

B.Sc., CHEMISTRY

SEMESTER-III

ANCILLARY CHEMISTRY

Inorganic, Organic and Physical Chemistry

Hours : 3 Per Week **Credit :3** **Max.Marks.75(Ext) ;25(Int)**

Objectives:

1. To know about the storage and handling of chemicals and apparatus.
2. To gain knowledge about various types of Chemical Bonding.
3. To understand various types of organic chemical reactions.
4. To study about the types of drugs and get knowledge about adsorption, catalysis and colloids.

UNIT I

Laboratory hygiene and safety :

Storage and handling of chemicals, handling of ethers. Toxic and poisonous chemicals. General precautions for avoiding accidents, first aid techniques- acid and alkali on eye , acid and alkali burn – Bromine burns – cut by glasses – Heat burns- Inhalation of toxic vapours- poisoning- Treatment for specific poisons- acids, alkalies, acetone, arsenic and copper compounds, cyanides.

UNIT –II

CHEMICAL BONDING

Introduction : Octet rule – Types of Chemical Bonds – Ionic, Covalent, co ordinate, hydrogen (inter and intra) and metallic bonds with few suitable Examples. Comparison between ionic and covalent bonded compounds.

Chemical bonding: Valency bond approach- types of overlapping and orbital diagrams – σ and π bonds. VSEPR theory as applied to $BeCl_2$, BF_3, CCl_4, PF_5 and SF_6. (Sp,Sp^2, Sp^3, Sp^3d and Sp^3d^2).

Molecular orbital theory: Bonding and anti-bonding molecular orbitals - MO theory applied to molecules- Hydrogen, Helium, nitrogen and oxygen.

Unit –III

Fundamental Concepts of Organic Chemistry:

Tetrahedral arrangement of valencies of carbon atoms- Electrophilles and Nucleophilles - Definition and examples- Cleavage of bond: Homolytic and Heterolytic Cleavages of Carbon bond- Electronic effects: Inductive, Electrometric, Resonance effects and hyper conjugation- Concept of hybridization - Geometry of Organic Molecules involving hybridizations sp, sp^2 & sp^3 (eg :methane, ethylene, acetylene only).

Unit –IV

Chemotherapy (Preparation and uses only)

Sulpha drugs- sulpha diazine- antimalarials –quinine. Antibiotics**:** definition –penicillin-tetracycline.

Carbohydrates:

Introduction and classification – preparation and uses of monosaccharides - glucose and fructose, Disaccharides –sucrose, polysaccharides – starch and cellulose. Conversion of Glucose to fructose only.

Aminoacids and Proteins

Aminoacids – Definition, classification.

Proteins –Definition, classifications, colour reactions and denaturation of proteins(an elementary idea only).

Unit –V

Adsorption - Definition of various terms-adsorption of gases on solids-characteristics of adsorption of gases on solids- physical and chemical adsorptions-factors influencing adsorption.

Catalysis : Definition –characteristics- theories of catalysis- types of catalysis – promoters – poisons – enzyme catalysis – applications of catalysis.

Colloidal State: Colloids definition – various types- classification – preparation by dispersion and condensation methods . Berdig's arc method- Lyophilic and Lyophobic Colloids – differences between them – purification of colloids (electro dialysis method only) – applications of colloids.

Text Books:

1. PL. Soni, Text books of Inorganic Chemistry, S. Chand& Co., New Delhi, (2006).

Reference Books:

1. Principles of physical Chemistry (23rd edition)Puri B.R., Sharma L.R., Pathania, M.S., ,New Delhi, ShobanLal, Nagin Chand &Co., (1993).
2. Text books of Inorganic Chemistry PL. Sony, S. Chand& Co., New Delhi,(2006).
3. Principles of Inorganic Chemistry B.R.Puri, Sharma,L.R. and Kalia, New Delhi (2002).
4. Text book of Organic Chemistry P.L.Soni and Mohan Kstyal , Sulthan Chand & Sons Educational Publishers, 20th edition 2007.

CO Number	CO Statement	Knowledge Level
CO1	To Explain how to respond to common emergencies that could occur in laboratories, such as fires , explosions, chemical exposures, injuries and chemical spilkls	**K2**
CO2	To gain insight in to valence bond theory molecular orbital theory and the concept of hybridization	**K1**
CO3	To Recognise many functional groups and their reactivity	**K1**
CO4	To Explain common and long – term side effects of Chemotherapy Drugs	**K2**
CO5	To understand the different theories of Catalysis.	**K2**

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Strong	Strong	Medium	High	Strong
CO2	High	Strong	Strong	Medium	Strong
CO3	Medium	Strong	High	Strong	Strong
CO4	Strong	High	High	Strong	Medium
CO5	Strong	Strong	Strong	High	High

B.Sc., Chemistry

SEMESTER – III

SBC - POLYMER SCIENCE

Hours: 5 **Credits : 2** **Max.Marks:25 (Int);75(Ext)** .

Objectives:

1. To highlight the commercially important polymers and their various forms.
2. To understand various industrial polymerization processes.
3. To highlight on average molecular weights.
4. To know preparation and properties of commercially important polymers.

Unit – I:

Basic Concept : Monomers, Polymers, Polymerization, Degree of Polymerization, Classification of polymers.

Plastics :Definition – Thermoplastic , Thermosetting plastics , Reinforced Plastic.

Elastomer **:** Definition – Natural & synthetic rubber –smoked rubber Reclaimed rubber – Foam rubbers – Spongy rubber – Laminate rubber.

Unit –II

Adhesives **:** Definition – thermosetting – Thermo resins.

Fibres **:** Definition – Natural and synthetic, Classification comfort safety - Industrial Fibers.

Unit III:

Ionic Polymerization **:** Anionic and Cationic Polymerizations . Step growth polymerisation (Condensation polymerisation).

Co-Polymerisation : Random – Alternating Block and Graft copolymers.

Stereo Regular Polymers: Isotactic, syndiotactic & Atactic Geometrical isomers- Ziegler Natta catalysis.

Unit IV:

Molecular weight of Polymers : Number –Average , Weight – Average – Average molecular weights. Average molecular weights and degree of Polymerisation. Molecular weight distribution GPC method –Average molecular weight and Degree of polymerisation. Determination of Average molecular weight, Light Scattering method, Viscosity method.

Unit V:

Polymer Processing Techniques: Preparation and uses of the following polymers. Polyethylene , PVC, polystyrene, Nylon-6, Nylon -6,6, Polyester, Phenol formaldehyde resins.

Reference Books:

1. **Modern Organic Chemistry By- M.K.Jain and S.C.Sharma**
2. **Principles of Physical Chemistry By- Puri , Sharma and Pathania**
3. **Principles of Polymer Science By- P.Bahadur and N.V.Sastry**

CO Number	CO Statement	Knowledge Level
CO1	To Explain the basic concepts of polymers.	**K1**
CO2	To Discuss the types of polymerizations.	**K3**
CO3	To Illustrate the properties of polymer.	**K2**
CO4	To Describe various methods used to determine the molecular weight of polymers.	**K3**
CO5	To Explain preparation and uses of various Polymers.	**K3**

Mapping with Programme Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**Strong**	**Medium**	**Medium**	**Strong**	**Strong**
CO2	**Strong**	**Medium**	**Strong**	**Strong**	**High**
CO3	**High**	**Strong**	**High**	**Strong**	**Strong**
CO4	**Strong**	**High**	**Medium**	**Strong**	**Strong**
CO5	**Strong**	**High**	**Strong**	**High**	**Strong**

B.Sc., Chemistry

Non – Major Elective

CHEMISTRY IN EVERYDAY LIFE

Hours: 2 **Credits : 2** **Max.Marks:25 (Int);75(Ext)**

Objectives:

1. **To Visualise the importance of chemistry in Everyday life.**
2. **To explain the terms soaps and detergents.**
3. **To know about health hazards of corrosive chemicals used in manual cleaning of household vessels.**

UNIT – I :

TEXTILE CHEMISTRY – Brief introduction to types of fabrics-natural and synthetic fabrics(cotton, fur, jute, silk, polymeric metallic)-durability and maintenance of cloth, fading and introduction to natural and synthetic dyes for colouring textiles, starching process.

UNIT – II: Soaps and detergents –types of soaps, surfactants-types,importance,fabric whiteners, stiffeners, flavouring agents, ultramarines ,brighteners, selection of cost effective washing powders-pleasant odours, flavouring liquids for fabrics-collar and surf dirty remover liquids.

UNIT –III : Dishwashers-soft and hard utensil cleaning liquid soaps-brighteners. Efficient way of using and maintenance-significance in health hazards of corrosive chemicals used in manual cleaning of household vessels,awareness on healthy way of using cleaning chemicals in day today life.

UNIT –IV:

Floor cleaning agents used in vacuum cleaners(lizol, phenoyl-sanifresh)deodorants, room air freshners.LPG stove top made of SS ,glass, GI, chromium alloys-cleaning liquids not affecting metals and glass. Anti mosquito repellant machines –evaporators-liquid, solids and gases.

UNIT-V:

Chemicals used in water purifiers-germicidal effect of uv radiation exposure-nutrient elements-sedimentation alum-types of water purifiers-water borne diseases-health care awareness on purified drinking water.

REFERENCE BOOKS:

1. Industrial Chemistry by B.K.Sharma,Goel publishing House 1995,websites manual of home appliances-healthcare printouts from the hospitals related to the syllabus mentioned above.

CO Number	CO Statement	Knowledge Level
CO1.	To learn the types of fabrics, fading, starching process.	K2
CO2.	To acquire knowledge about types of soaps whiteners, stiffeners, flavouring agents	K2
CO3.	To understand soft and hard utensil cleaning liquid soaps	K2
CO4	To acquire a comprehensive knowledge about Floor cleaning agents and Anti mosquito repellant machines	K2
CO5.	To understand the Chemicals used in water purifiers and germicidal effect of uv radiation	K2

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**Strong**	**Strong**	**High**	**Strong**	**High**
CO2	**Strong**	**Medium**	**High**	**Strong**	**High**
CO3	**High**	**High**	**Medium**	**Strong**	**Medium**
CO4	**Strong**	**Medium**	**High**	**Strong**	**Medium**
CO5	**Strong**	**High**	**Strong**	**Strong**	**Medium**

SEMESTER - IV

B.Sc., Chemistry

SEMESTER – IV

CORE PAPER -VII - INORGANIC CHEMISTRY - I

Hours : 8 **Credits : 5** **Max.100 Marks:(Ext: 75 & Int: 25)**

Objectives:

1. **To understand the concept of acids and Bases.**
2. **To know the properties about co- ordination compounds.**
3. **To know the various theories of co- ordination compounds.**
4. **To learn about metallic carbonyls & metallic nitrosyls.**
5. **To learn the characteristics d and f block elements.**

UNIT-1 :Modern Concept of Acids and Bases: Arrhenius, Lewis, Bronsted-Lowry concepts-Dual behavior water – Relative strengths of Acids and Bases – Dissociation constant of Acids and Bases – Levelling effect of water. Hard and soft acids and bases (HSAB) – General theory of solvent systems-Usanovich Concept- Lux-flood concept- Lewis Concept.

Oxidation and Reduction Reactions: Classical and Modern concept of Oxidation and Reuduction-Oxidation Number- Difference between Oxidation number and valency-Calculation of oxidation number – Equivalent weight of oxidizing and reducing agents.

Unit II : Co-ordination Chemistry –I :

Double salts –complex compounds –complex ion and co-ordination number - Types of ligands - IUPAC nomenclature – Chelates and their uses. Isomerism – Ionization, hydrate, ligand linkage, co-ordination position, geometrical and optical isomerism.

UNIT-III : CO-ORDINATION CHEMISTRY -II

Theories of coordination compounds – Werner's theory- Sidgewick's electronic interpretation-EAN concept, Valence bond theory-outer and inner orbital complexes-limitations of VBT, Crystal field Theory-crystal field splitting in Tetra hedral complexes –high spin and low spin complexes

UNIT- IV: Metallic carbonyls and metallic nitrosyls

Metallic carbonyls and metallic nitrosyls-metallic carbonyls-General methods of preparation, general properties, structure and nature of metal-carbonyl bonding in carbonyls. Effective atomic number rule(EAN) as applied to metallic carbonyls. Eighteen electron rule as applied to metallic carbonyls. some examples of metallic carbonyls-nickel tetra carbonyl, iron penta carbonyl, chromium hexa carbonyl and cobalt carbonyl.

Metallic nitrosyls : Effective atomic number rule(EAN) as applied to metallic nitrosyls-some metallic nitrosyls.

UNIT – V: d and f-Block Elements :d- block elements - General characteristics- electronic configuration, atomic radii, ionic radii, atomic volume, metallic character ,ionization energy, reactivity, oxidation state, tendency to form complexes, reducing property, colour and magnetic properties. Lanthanides and actinides – electronic structure- oxidation states, colour and magnetic properties, Lanthanide contraction and its consequences. Separation of Lanthanide elements by ion exchange method. Comparison of Lanthanides and Actinides.

TEXT BOOKS:

1. **A Text Book of Inorganic Chemistry by – R.D.Madhan , P.L. Soni**
2. **A Text Book of Inorganic Chemistry by – P.L.Soni**
3. **A Text Book of Inorganic Chemistry by – Puri & Sharma**

Reference Books:

1. Modern Inorganic Chemistry by R.D. Madhan, S. Chand & Company LTD, Ram Nagar, New Delhi, Edition 2007.

CO Number	CO Statement	Knowledge Level
CO1	To Describe the difference between strong acids/ bases and weak acids/ bases	**K1**
CO2	To Recognise which types of Isomerism are possible for a given Complex.	**K2**
CO3	To understand the key Features of Co-ordination Compounds Including the variety of structure co-ordination Numerism regards and cholates etc.	**K2**
CO4	Apply to write electronic Configuration of given Atomic number.	**K4**
CO5	To Explain the structure of metallic carbonlys and metallic nytrosyls	**K1**

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**Strong**	**Strong**	**Strong**	**High**	**Strong**
CO2	**High**	**Strong**	**Strong**	**Medium**	**Strong**
CO3	**Strong**	**Strong**	**High**	**Strong**	**Strong**
CO4	**Strong**	**High**	**High**	**Medium**	**Strong**
CO5	**Strong**	**Strong**	**Strong**	**High**	**High**

B.Sc., CHEMISTRY

SEMESTER III and IV

CORE PRACTICAL -II

VOLUMETRIC AND ORGANIC COMPOUND ANALYSIS

Hours : 3+3 Per Week **Credit :5** **Max.Marks.60(Ext) ;40(Int)**

VOLUMETRIC ANALYSIS :

1. Preparation of standard solutions of various normality.
2. Acidimetry – Estimation of HCl / H_2SO4
3. Alkalimetry – Estimation of Na_2 Co_3/ NaOH.
4. Permanganometry – Estimation of Oxalic acid , Fe^{2+}
5. Estimation of ferrous ion by external indicator.

ORGANIC QUALITATIVE ANALYSIS

1. Carboxylic aicds (Monocarboxylic - Benzoic acid.
2. Ketones (benzophenone), Aldehydes - Benzaldehyde), Amines- Primary Aromatic amine – Aniline, Amides (Aliphatic – Urea, Aromatic mono amide- Benzamide), Monohydric phenols- phenol.
3. Carbohydrates – Glucose and Sucrose.
4. Preparation of solid derivatives

Reference Books:

1. Basic Principles of Practical Chemistry by – V.Venkateswaran, R.Veeraswamy , and A.R. Kulandaivelu

COURSE OBJECTIVES:

1. To gain practical skills on volumetric analysis and qualitative analysis.

B.Sc., CHEMISTRY

SEMESTER – IV

Ancillary Chemistry - IV

Hours : 3 per week **Credit :4** **Max.Marks.75(Ext);25(Int)**

Inorganic, Organic and Physical Chemistry

Objectives:

1. To know about Fuel gases, Fertilizers and Silicons.
2. To gain knowledge about Metallurgy of Ti,V and W.
3. To understand about polymer chemistry, Soaps and detergents and photochemistry.

Unit I:

Industrial Chemistry

Fuel Gases:- Preparation and uses of Natural Gas ,Water gas, Producer gas, Semi- water gas, Carbureted water gas & oil gas.

Fertilizers:- Manufacture and uses of Urea - Ammonium sulphate, Ammonium nitrate, Super phosphate of lime- Triple super phosphate and potassium nitrate.

Silicones :- Definition-Types-Preparation, properties and uses.

Unit II :

Metallurgy:

Occurrence of metals- minerals and ores- steps involved in metallurgical process- concentration – calcinations – roasting – reduction to free metal—refining of metals- electrolytic refining- Van Arkel process.

Titanium – Ores – Extraction of titanium from Rutile Ore and from ilmenite Ore. Uses of titanium.

Vanadium – Ores - Extraction of vanadium from carnotite Ore and from venodinite ore. Uses of vanadium- Tungsten – Ores- Extraction of Tungsten from wolframite Ore- uses of Tungsten.

Unit –III :

Organo metallic compounds – Grignard reagents – preparation - properties- structure and synthetic uses of Grignard reagents- Limitations of Grignard Synthesis.

Polymer Chemistry

Introduction – Types of Polymerisation – Plastics- definition - types – difference between thermoplastics and thermosetting Plastics- preparation and uses of polyethylene, PVC, PVA and Nylon - 66.

Unit –IV

Soaps and Detergents:

Soap- Definition – Saponification - manufacture of soap – Hot and Cold process - Difference between toilet soap and laundry soap- Types of Soaps - Cleaning action of Soap- Synthetic Detergents – composition of a common Detergent and Types- Differences between soaps and detergents.

Unit V:

Physical Chemistry:

Thermodynamics:-System-types of system-Work and Heat-Spontaneous and Non-Spontaneous changes, Reversible and Irreversible changes, Isothermal and Adiabatic changes-Statement and Mathematical expression of first law of thermodynamics-Statement of second law of thermodynamics.

Photo Chemistry:-Definition – Grotthus -Draper's law –Law of photochemical equivalence- Quantum yield-Photo chemical reactions - Photo sensitisation – Chemilumine science- Fluorescence, Phosphorescence.

Reference Books:

1. A Text Book of Organic Chemistry by - M.K Jain & S.C.Sharma
2. A Text Book of Inorganic Chemistry by - R.D. Madhan
3. A Text Book of Physical Chemistry by - P.L. Soni

CO Number	CO Statement	Knowledge Level
CO1	To Identify the different unit operations used for the preparation of coal for its utilization in thermal power plants and cove overns	**K2**
CO2	To Understand the concept of various steps involved in metallungical process	**K2**
CO3	To describe the properties of polymer chemistry	**K2**
CO4	To understand the applications of soaps and detergents	**K2**
CO5	To derive an expression for thermodynamic work at the moving boundary of a simple compressible system	**K3**

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Strong	Strong	Medium	High	Strong
CO2	High	Strong	Strong	Medium	Strong
CO3	Medium	Strong	High	Strong	Strong
CO4	Strong	High	High	Strong	Medium
CO5	Strong	Strong	Strong	High	High

B.Sc., CHEMISTRY

SEMESTER - III and IV

Ancillary Chemistry Practicals

Volumetric Analysis and Qualitative Analysis of Organic Compound

Hours : 2+2 **Credits : 4** **Max.100 Marks (Ext: 60 & Int: 40)**

Volumetric Analysis:

1.Acidimetry – Estimation of HCl.

2.Alkalimetry- Estimation of NaOH.

3.Permanganometry- Estimation of Oxalic Acid, Fe^{2+}, FAS and $FeSO_4$.

Organic Qualitative Analysis :

1. Mono Carboxylic Acid – Benzoic Acid.
2. Urea.
3. Aromatic Mono Amide- Benzamide.
4. Carbohydrates - Glucose and Sucrose.
5. Aniline (Primary Amine).
6. Phenol (Monohydric phenol)

Reference Books:

1. Basic Principles of Practical Chemistry by- V.Venkateswaran, R.Veeraswamy, and A.R.Kulandaivelu.

Course Objectives:

To gain practical skills on volumetric analysis and qualitative analysis.

B.Sc., CHEMISTRY

SEMESTER-IV

Part – IV- SBC

Dye Chemistry

Hours : 2 Per week **Credits : 2** **Max Marks: 75(Ext); 25 (Int)**

Course Objectives:

1. To understand the principles of colour and constitution of Dyes.
2. To classify dyes based on their structure and mode of application.
3. To describe the synthesis of various types of dyes.
4. To outline the importance of pigments in various fields.

UNIT: 1 - CHEMISTRY AND THEORY OF COLOURS

Colour and constitution-Relationship of colour observed-to wave length of light absorbed- Terms used in colour chemistry-Chromophores, Auxochromes, Bathochromic shift, Hypsochromic shift. Colour of a substance-Quinonoid theory and molecular orbital approach.

UNIT: II - CLASSIFICATION OF DYES -I

Classification of Dyes-chemical classification, classification according to their applications. Acid dyes and basic dyes, Azoic dyes, mordant dyes, vat dyes, sulphur dyes, disperse dyes, nitro dyes-and nitroso dyes and process of dyeing (simple treatment).

UNIT – III -CLASSIFICATION OF DYES - II

Azo dyes-Principles governing azo coupling – Mechanism of diazotisation - Coupling with amines, coupling with phenols Classification according to the number of azo group & application-Tautomerism in azo dyes.

UNIT –IV - SYNTHESIS AND APPLICATIONS OF DYES

Synthesis and applications of di and triphenyl methane dyes, acridine dyes, sulphur dyes, phthalocyanines, cyanine dyes, crystal violet, anthraquinone dyes and azine dyes

UNIT:V - PIGMENTS AND THEIR APPLICATIONS

Requirements of a pigment: Typical Organic and Inorganic pigments-application and their uses in paints. Reaction of dyes with fibres and water-Fluorescent Brightening agents. Application of dyes in other areas-medicine, chemical analysis, cosmetics, colouring agents, food and beverages.

Text Book(s)

1. Dyes and their intermediates-E.N. Abraha, Bergamon Press, 1969.
2. The Chemistry of Synthetic dyes and pigments-H.A.Lubs, ACS Publication, Halner,1970.
3. The Chemistry of Synthetic dyes Vol, I, II, III & IV- K.Venkataraman, Academic Press N.Y., 1949.

Reference Books:

1. Physical and Chemistry applications of dyestuffs- F.P. Schafer, Springer-VeriagN.Y.1976.
2. Organic Chemistry Vol.I- I.L. Finar, ELBS.
3. Modern paint pigment and Varnish –S.K. Jain & S.K. Malik, Industries Smallbusiness Publication, New Delhi.

CO Number	CO Statement	Knowledge Level
CO1	To understand the principles of colour and its relation withcompound's structure.	**K1 – K5**
CO2	To analyze and classify dyes based on their chemical structure and applications.	**K1 – K3**
CO3	To analyze and classify dyes based on their number of azo groups.	**K2, K3,**
CO4	To understand the synthesis and applications of dyes.	**K2, K3**
CO5	To outline the importance of pigments in various fields.	**K1 – K4**

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	High	Strong	Medium	Strong	HIGH
CO2	Strong	High	Strong	Medium	STRONG
CO3	Strong	Medium	Strong	High	STRONG
CO4	Medium	STRONG	High	Strong	MEDIUM
CO5	High	Medium	Strong	Medium	STRONG

Semester - IV

PART – V Extension Activities

Maximum Marks : 100 **Credit : 1**

SEMESTER - V

B.Sc., Chemistry

SEMESTER – V

CORE PAPER - IX

ORGANIC CHEMISTRY - II

Hours: 6 **Credit: 5** **Max. Marks :25(Int) ;75(Ext)**

Objectives

1. To study the stereoisomerisms of organic compounds.
2. To study the properties of aromatic compounds and aromatic acids.
3. To know the synthetic applications of some organic reagents.
4. To understand the preparation, properties and importance of alicyclic compounds, polynuclear hydrocarbons.

Unit – I Sterioisomerism:

a) **Geometrical Isomerism:**

Definition – geometrical isomerism of maleic and fumaric acids- aldoximes and ketoximes- determination of configuration of geometrical isomerism – E, Z notations.

b) **Optical Isomerism** : Definition - Optical activity – Chirality – Enantiomers, diasterooisomers – elements of symmetry – Plane of symmetry , axis of symmetry and centre of symmetry – specific rotation and its polarimetric determination.

Optical isomerism of compounds containing asymmetric carbon atom. Recemisation and resolution of racemic mixtures – Walden inversion – asymmertric synthesis – specification of absolute configuration by R and S notations.

Optical activity of compounds without asymmetric carbon atoms- allenes, spiranes and biphenyl compounds. Optical activity of elements other than carbon atoms.

Quaternary ammonium compounds and tertiary amine oxides.

Unit – II: Conformational Isomerism

Differences between configuration and conformation . Fischer, Saw- horse and Newmann projection formulae – conformational analysis of ethane, n – butane, 1,2 – dichloroethane, Cyclohexane and monosubstituted cyclohexane.

Tautomerism : Definition – condition of tautomerism - prototropy and differences between Tautomerism and Resonance – type of tautomerism.

i) Keto – Enol Tautomerism

ii) Nitro – acinitro Tautomerism

iii) Lactum – Lactim Tautomerism

iv) Quinone monoxime – p – nitrazo phenol Tautomerism.

Unit – III Aromatic Compounds (Aldehydes and phenols)

a) Aromatic aldehydes: Benzaldehyde – mechanism of Cannizaro, Perkin, Claisen reaction and Benzoin condensation .
b) Preparation & properties of cinnamaldehyde and vannilin.
c) Phenols: Acidity of Phenols – effect of substitutents on the acidity of phenol , mechanism of Kolbe's reaction. Reimer –Tiemann reaction . Test for phenol – estimation of Phenol.

Unit – IV Aromatic Acids

a) Effective of substituents on acidic character.
b) Substituted acids : Preparation , properties of salicylic acid and anthranilic acid.
c) Dicarboxylic acids : Isomers of Phthalic acid, preparation , properties of phthalic acid – derivatives of phthalic acid- phthalic anhydride and phthalimide. Preparation, properties and uses.
d) Preparation & Properties of Phenylacetic acid, Mandelic acid, cinnamic acid and coumarin.
e) Aromatic sulphonic acids: Preparation , properties and uses of benzene suphonic acid, saccharin - chloramine -T and dichloramine–T.

Unit – V

a) Alicylic Compounds
General methods of preparation and properties of Cycloparaffines- Baeyer's strain theory and its modifications.

b) **Poly nuclear hydrocarbons and their Derivatives:**

i)Isolated Systems- Preparation and properties of Biphenyl , biphenyl methane and triphenyl methane.

ii)(Condensed systems : Preparation , properties, uses and structural elucidation of Naphthalene and Anthracene, preparation , properties and uses of Naphthylamines and Naphthols.

c) Uses of reagents in organic synthesis:SeO_2, OsO4 N – bromo succinimide, Lead tetra acetate and Raney Ni.

Reference Books:

1. **A Text Book of Organic Chemistry By- M.K.Jain and S.C Sharma**
2. **A Text Book of Organic Chemistry By – P.L.Soni**
3. **A Text Book of Organic Chemistry By – K.S.Tewari**
4. **A Text Book of Organic Chemistry By- B.S.Bahl and Arun Bahl**

CO Number	CO Statement	Knowledge Level
CO1.	To discuss Bayer's strain theory and the structure of naphthalene	K4, K5
CO2.	To Arrange the acidity of Substituted phenols with phenol	K1
CO3.	To Describe the preparation and properties of aromatic substituted acids.	K2, K3
CO4.	To Examine the configuration of geometrical isomers and optical isomers.	K4
CO5.	To compare the conformational isomerism with configurational isomerism.	K2

Mapping with Programme Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Strong	Strong	Strong	High	Strong
CO2	High	Strong	Strong	Medium	Strong
CO3	Strong	Strong	High	Strong	Strong
CO4	Strong	High	High	Medium	Strong
CO5	Strong	Strong	Strong	High	High

B.Sc., Chemistry

SEMESTER – V

CORE PAPER – X- INORGANIC CHEMISTRY – II

Hours : 6 Per Week **Credits : 4** **Max.100 Marks (Ext: 75 & Int: 25)**

Objectives:

1. **To explain the various behavior of non – aqueous solvents and compare them with aqueous medium.**
2. **To describe the physical and chemical properties of halogens.**
3. **To learn about boron family in the periodic table.**
4. **To know the chemistry of fluorocarbons and inert gases.**
5. **To illustrate the range of chemical variability expected in environmental and manufacturing conditions.**

UNIT – I: Non aqueous Solvents

Classification of solvents –liquid ammonia as solvent-chemical reaction that occur in liquid ammonia .

Liquid sulphur dioxide as solvent –solubility of inorganic materials in liquid sulphur dioxide –solubility of organic compounds in liquid sulphur dioxide –chemical reaction that can occur in liquid sulphur dioxide.

UNIT – II : Halogens

Position of halogen in the periodic table –anomalous behaviour of fluorine –difficulties in the isolation of fluorine –modern method of isolation of fluorine –estimation of available chlorine in bleaching powder –structure –properties and uses of perchloric acid –potassium perchlorates .

Oxides and oxyacids of bromine –brominating mixture –periodic acid –preparation –properties –uses –inter halogen compounds –polyhalides –pseudohalogens –basic iodine –comparative study of halogens.

UNIT – III : Chemistry of Boron Family

Group discussion –electron acceptor behavior and Electron deficiency of Boron hydrides bonding in diboranes. $NaBH_4$, $LiBH_4$ – Preparation - properties, structure and uses of Borozoles.

Comparison between Carbon & Silicon - hydrides of silicon and silicates structure. Classification of silicates and its applications (elementary study only)

Unit – IV : Fluorocarbons

Flurocarbons- Definition – Synthesis – Properties and uses of fluorocarbons. Inert gases – occurrence- isolation of rare gases from dry air and from liquid air – uses of inert gases. Clathrates: Types – preparation and uses.

Unit – V: Consumer Chemistry

Food adulteration – Types of adulteration – intentional adulteration – metallic contamination – incidental adulteration – food laws and standards.

Beverages and appetizers – Classification - carbonated non – alcoholic beverages – miscellaneous beverages – alcoholic beverages.

TEXT BOOKS:

1. **A Text Book of Inorganic Chemistry by – R.D.Madhan , P.L. Soni**
2. **A Text Book of Inorganic Chemistry by – P.L.Soni**
3. **A Text Book of Inorganic Chemistry by – Puri & Sharma**

Reference Books:

1. Modern Inorganic Chemistry by R.D. Madhan, S. Chand & Company LTD, Ram Nagar, New Delhi, Edition 2007.

Co Number	CO Statement	Knowledge Level
CO1	To Describe the Classification of Solvents and the Chemical reactions that Occur in Liquid Ammonia	**K1**
CO2	To Explain the oxides and oxyacids of bromine, interhalogen compounds & Pseudohalogens.	**K1**
CO3	To Discuss the structure of diborane, preparation , Properties , structure and uses of borazoles.	**K1**
CO4	To Illustrate Synthesis – Properties and uses of fluorocarbons.	**K3**
CO5	To interpret the food adulteration, classification of adulteration and food laws and standards	**K3**

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Strong	Strong	Medium	Strong	High
CO2	Strong	Strong	Strong	Strong	Strong
CO3	High	Strong	High	Strong	Strong
CO4	Strong	High	High	Strong	Strong
CO5	Strong	Strong	Strong	High	High

B.Sc., Chemistry

SEMESTER – V

ELECTIVE - I

NANOTECHNOLOGY AND GREEN CHEMISTRY

Hours : 5 **Credits : 4** **Max.Marks:25 (Int); 75(Ext)**

Objectives:

1. To know the preparation and properties of nanomaterials.
2. To learn basic experimental methods and tools used in nanotechnology.
3. To discuss the applications of nanotechnology.
4. To highlight on solvent free microwave assisted organic synthesis.
5. To know ionic liquids, super critical fluids and super critical carbon dioxide.

UNIT-I:NANOTECHNOLOGY:

Introduction-meaning of 'nano'-history of nano materials-Moore's law-nano science the multidisciplinary science. Nano materials: Top-down-and bottom-up approach-examples of the bottom-up approach-different types of nano materials: one dimensional materials-carbon nano tubes-types of carbon nano tubes SWNT & MWNT-two dimensional nano materials.

Properties of nano materials:Different types of nano materials & their sizes –M.pt-quantum effects-size dependent properties of cdse carbon nano tubes & graphene.

UNIT-II:

NANOTECHNOLOGY -II:

Preparations of nano materials:

Different methods of preparing nano materials- hydrothermal and solvothermal methods-solvothermal reaction- inorganic nano tubes- assembling nano materials- preparation of metals nano particles, graphene, gold nano particles, ZnO nano wires, carbon nano tubes and copper sulphide nano films. Analysis of nano particles: Study of nano materials under TEM, SEM, STM & AFM-working of TEM, STM & AFM.

UNIT-III:

NANOTECHNOLOGY - III

Definition of nanotechnology- nano biotechnology- definition and explanation

Applications: applications of nano technology in nano cosmetics, textile, nano sensors, cancer therapy, silver nano particles and water purification, nano computers, MRI with magnetic nano particles and nano materials for energy.

UNIT-IV: GREEN CHEMISTRY –I :

Introduction – definition- green chemistry- need of the day- twelve principles of green chemistry- atom economy.

Solvent free microwave- assisted organic synthesis: Introduction- solvent – free techniques- microwave activation- benefits and limitations of microwave assisted synthesis.

Non- traditional (greener alternatives to functional group transformation, condensation, oxidation and reduction reaction (one example each).

UNIT-V

GREEN CHEMISTRY –II :

Ionic liquids : definition- examples- synthesis- tuneable physical properties- application in organic synthesis- hydroformylation of olefins, carbonylation, aryl halides, dimerisation of butadiene, Diels Alder reaction and total synthesis of pravadoline.

General uses of liquids.

Super critical fluids: definition- basic principle of SFE (super critical fluid extraction)- choice of solvent for SFE- advantages of SFE technology- applications of SFE. (super critical fluid extraction)- choice of solvent for SFE- advantages of SFE technology- applications of SFE.

Super critical Carbondioxide.

CO_2 as super critical fluid- features of technique for using super critical CO_2. Advantages and applications of super critical CO_2.

REFERENCE BOOKS:

1. NANO: The Essentials – T. Pradeep
2. Nano world - "An introduction to nano science & technology" – CNR RAO third edn.2013.Nava Karnataka publication pvt.ltd.
3. NANOTECHNOLOGY- Technology Revolution of 21St Century- Er.Rakesh Rath.
4. An Introduction to Green Chemistry-V.Kumar
5. Green chemistry- environment friendly alternatives- editiors: Rashmisanghi. MM. Sri vasta fourth re-print 2009. Norosa publishing house pvt. Ltd.

CO Number	CO Statement	Knowledge Level
CO1	To illustrate the preparation of different types of nano particles	**K3**
CO2	To know the preparations of nano materials:	**K2**
CO3	To discuss the applications of nano technology in nano cosmetics, textile, nano sensors, cancer therapy	**K3**
CO4	To study Solvent free microwave- assisted organic synthesis	**K2,K3**
CO5	To study the synthesis of Ionic liquids, advantages and applications of Super critical Carbondioxide.	**K2, K3**

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Strong	Strong	Medium	High	Strong
CO2	High	Strong	Strong	Medium	Strong
CO3	Medium	Strong	High	Strong	Strong
CO4	Strong	High	High	Strong	Medium
CO5	Strong	Medium	Strong	High	Strong

B.Sc., Chemistry

V Semester

Elective - I

Water Treatment and Analysis (Optional)

Objectives:

The objectives of the course is to give an in depth understanding of water quality parameters, ground water and surface water pollution and its control measures. In Addition, the students will also learn the water treatment methods, sewage and industrial effluent treatment methods and water resources management.

Unit – I Water Quality Parameters and their determination

Physical, chemical and biological standards significance of these contaminates over the quality and their determinations- Electrical Conductivity – turbidity – pH, total solids, TDS- alkanlinity- hardness – chlorids- DO-BOD- COD.

Unit- II Ground water and surface water pollution and control measures

Surface water and ground water pollution- Harmful effects – Pollution of major rivers- protecting ground water from pollution – ground water pollution due to fluoride, Iron, Chromium and Arsenic – Sources, ill effects and treatment methods.

Unit- III Water treatment methods

Treatment for community supply- screening, Sedimentation , , coagulation, filtration- removal of micro organisms- Chlorination, adding bleaching Powder, UV irradiation and ozonation.

Unit- IV Sewage and industrial effluent treatment

Sewage- Characteristics – purpose of sewage treatment – methods of sewage treatment- primary – secondary and tertiary – Role of algae in Sewage treatment – Types of industrial Wastes- treatment of effluents with organic and inorganic impurities.

Unit- V Water Management

Water resources management – rain water harvesting methods – Percolation Ponds- Check dams – roof top collection methods – water management in industries.

References Book:

1. Chemical and biological methods for water pollution studies, R.K.Trivedy and P.K. Goel. Environmental Publications, 1986.
2. Engineering Chemistry, P.C. Jain and Monica Jain, Dhanpat Rai and Sons, 1993.
3. Environmental Chemistry, B. K.Sharma, Goel Publishing House.
4. Water Quality and Defluoridation Techniques, Rajiv Gandhi National Drinking water mission Publication 1994.

CO Number	CO statement	Knowledge Level
CO1	To Understand the quantitative information on the physical , chemical and biological charactertics of water via statistical sampling.	**K2**
CO2	To Explain the importance of ground water , surface water pollution & its harmful effects.	**K1**
CO3	Know the types of water treatment methods.	**K2**
CO4	To acquire knowledge about the different steps involved in primary, secondary and tertiary treatment of waste water.	**K2**
CO5	To Understand how water resources management are developed.	**K2**

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Strong	Strong	Strong	High	High
CO2	High	Medium	Strong	Medium	Strong
CO3	Strong	Strong	Medium	Strong	Strong
CO4	Strong	High	High	High	Medium
CO5	High	Strong	Strong	Medium	High

B.Sc., Chemistry

Semester - V

ELECTIVE: II

ANALYTICAL CHEMISTRY AND ELEMENTS OF ORGANIC SPECTROSCOPY

Hours : 5 **Credits : 4** **Max.100 Marks (Ext: 75 & Int: 25)**

Objectives:

1. **To impart the knowledge of qualitative, Quantitative, & error analysis.**
2. **To understand the basis of NMR Spectroscopy and Solving simple organic molecules.**
3. **To learn the basic principles, instrumentation and application of Spectrochemical, thermal and radio chemical techniques.**
4. **To Know the basic principle and applications of separation techniques.**

Unit –I : Introduction To Analytical Chemistry:

Types of analytical methods : Importance of analytical methods is Qualitative and Quantitative analysis - chemical and instrumental methods - advantages and limitations of chemical and instrumental methods

Simple First Aid procedure for accidents involving acids , alkalis , bromine, burns and cut by glass. Carcinogenic chemicals – toxic and poisonous chemicals-First Aid Technique for poisoning – methods of expressing precision waste disposal – fume disposal- methods only.

Evaluation of Analytical data : Idea of significant figures- its importance. Accuracy - methods of expressing accuracy. Error analysis – types of errors – minimizing errors. Precision – methods of expressing precision Mean, Median, Mean deviation, standard deviation and confidence limit.

UNIT – II:

Quantitative analysis:

Estimations of commercial samples- Determination of percentage purity of samples – pyrolusite –Iron ore – washing soda and Bleaching powder estimation of glucose and phenol. Gravimetric analysis – Principle – Theories precipitation – solubility product and precipitation – conditions of precipitations – Types of Precipitation – purity of precipitates – Co-precipitation – Post Precipitation – precipitation from homogeneous solution – use of sequestering agents.

Unit - III

Spectroscopy - I

UV spectra: Allowed electronic transitions – conditions for a molecule to be UV active – absorption maxima (max) – applications of Uv spectra.

IR spectra – spectral range – conditions for a molecule to be IR active – mode of vibrations – calculations of IR bands for water and carbon - di- oxide molecule. Finger print region – IR frequency range of functional groups like aldehydes, ketones , acids, acidamide and primary amines only.

NMR spectra – conditions for a molecule to be NMR active equivalent and non-equivalent protons – splitting of NMR signals – detailed study of NMR spectrum of ethanol – importance of reference compound TMS (Tetra methyl silane) – applications of NMR spectra.

UNIT – IV:

Spectroscopy - II

Mass Spectroscopy – Base peak, molecular ion peak and isotopic peak. Spectrum of neopentane , benzene and ethyl bromide Raman spectra – theory of Raman Spectra –stoke and anti-stoke lines – conditions for a molecule to be Raman active – comparison of Raman and IR spectra. Applications of Raman spectra only in structural equilibria and mechanism of tautomerism.

ESR spectra – conditions for a molecule to be ESR active – ESR spectrum of methyl radical and naphthalene ion – application of ESR

Unit – V:

Chromatography Techniques :

Column/chromatography- principle, types of absorbents, preparation of the column, elution, recovery of substances and applications. Thin layer chromatography – principle, choice of adsorbent and solvent, preparation of chromatoplates , Rf – values Paper chromatography- principle, solvents used ,Development of chromatogram, ascending and descending paper chromatography. Gas chromatography – principles ,experimental techniques. High pressure Liquid chromatography – (HPLC)- principles – experimental techniques.

REFERENCE BOOKS:

1. Douglas A. Skoog and Donald M.West, F.J. Holler, Fundamentals of Analytical Chemistry,7th edition , Harcourt College publishers.
2. Mendham J.Denney R.C.,Bames J.D.,Thomas M., Vogel's Text book of Quantitative Chemical analysis 6th edition, Pearson education.
3. Sharma B.K., Instrumental methods of chemical Analysis , Coel publishing House, Merrut.(1997)
4. Gopalan R.,Subramaniam , P.S and Rengaraj k., Elements of Analytical Chemistry, Sultan Chand and Sons.
5. Usharani S., Analytical Chemistry, Macmillon.

CO Number	Co Statement	Knowledge Level
CO1	Explain the importance of Analytical methods in qualitative and quantitative analysis	**K4**
CO2	To Analyze the purity of Samples and precipitates	**K4**
CO3	To Interpret uV, IR, Spectra and their applications	**K2, K3**
CO4	To Illustrate NMR, Mass and Raman spectra with their applications	**K3, K4**
CO5	To apply different types of chromatographic techniques in separation of mixtures	**K2, K3**

Mapping with Programme Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Strong	Strong	Medium	Strong	Medium
CO2	Strong	Medium	Strong	Strong	High
CO3	High	Strong	High	Strong	Strong
CO4	Strong	High	Strong	Strong	Strong
CO5	Strong	Strong	Strong	High	High

B.Sc. Chemistry

Semester - V

ELECTIVE – II

PHARMACEUTICAL CHEMISTRY (Optional)

Hours: 5 **Credits: 4** **Max.100 Marks (Ext: 75 & Int: 25)**

Objectives:

1. **To get knowledge about terminologies used in pharmaceutical chemistry.**
2. **To know about analgesics.**
3. **To acquire knowledge about transquilisers and Haematological agent.**

Unit I: Terminologies used in pharmaceutical chemistry-pharmacology-pharmacognosy-pharmacy-pharmocodynamics-therapeutics-toxicology-chemotherapy-pharmacopoeia-national-formulary(BNF,NF of india british pharmaceutical codes AMA drug evaluation),therapeutic index,$LD_{50,}$ $ED_{50,}$grams test, bacteria, virus, immunity, vaccines and toxoids . pharmacophore, antimetabolite.

Unit II: Traditional practice –sidda , ayurveda and unani. Medicinally important compounds of Al, P,As, Hg and Fe and its uses.

Blood-blood grouping –Rh factor-buffers in blood, maintenance of pH of blood-composition of blood-clotting mechanism-blood pressure(normal, high and low and control of B.P)

Unit III:Analgesics: Definition classification ,action of analgesics-narcotice analgesics (morphine and its derivatives with reference to SAR) synthetic analgesics- preparation, assay and uses of pethidines and methadones. Antipyretic analgesics-salicylic as it derivatives,indole derivatives &p-amino phenol derivatives.

Antiseptics and disinfectants-Definition and distinction, standartization of disinfectants. Use of phenols,dyes, chloramines, dequalinium chloride, formaldehyde and cationic surface active agent

Unit IV: Anaesthetics : Definition and classification.
Uses of volatile anaesthetics –ethers, halohytrocarbons – chloroform ,halothane ,try chloroethylene , ferguson principle.

Gaseous anaesthetics: Cyclopropane,N_2O- preparation ,advantages, adverse, effect and assay of N_2**O**.

Non volatile anaesthetics : Intravenous anesthetics-preparation of thiopental sodium and methohexitone.

local anesthetics: Classification, structure, preparation and uses of procaine, derivatives of procaine, benzocaine and cocaine.

Unit V:Transquilisers - classification in detail.

Sedatives and hypnotics-distinction, definition, classification of hypnotics-structure and uses of barbiturates and non barbiturates.

Haematological agent: Anticoagulants and coagulants drugs

Antianaemic Drugs: iron,vitamin-B_{12} and folic acid

Cardiovascular drugs-examples and uses.

Aids: causes, prevention and treatment.

Reference Books:

1. Pharmaceutical Chemistry By- Dr.A.V.Kasture and Dr.S.G.Wadoolkar
2. A Text Book of Pharmaceutical Chemistry By- Jayashree Ghosh.
3. Text Book of Medicinal Chemistry By- V.Alagarsamy.

CO Number	CO statement	Knowledge Level
CO1	To know the terminologies used in pharmaceutical chemistry	**K1,K2**
CO2	To understand various traditional practice	**K2**
CO3	To gain knowledge about analgesics, antiseptics &disinfectors	**K2**
CO4	To know the uses of various anesthetics	**K1,K2**
CO5	To gain knowledge about different types of medicines to cure various diseases.	**K1,K2**

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Strong	Strong	Medium	High	Strong
CO2	High	Strong	Strong	Medium	Strong
CO3	Medium	Strong	High	Strong	Strong
CO4	Strong	High	High	Strong	Medium
CO5	Strong	Medium	Strong	High	Strong

B.Sc., CHEMISTRY

SEMESTER-V

Part – IV- SBC

Public Health Services

Hours : 2 Per week **Credits : 2** **Max Marks: 75(Ext); 25(Int)**

Course Objectives:

1. To Acquire knowledge and skills related to the performance of health care activities.
2. To understand the concept of public health.
3. To acquire knowledge about health education.
4. To understand major communicable and non communicable diseases.

UNIT - I

1. Concept of public health, health problems and responsibilities of health workers. Ethics and behaviour of health workers, the health team.
2. **Public Health Services**

Principles of organizing care in the home, health agencies, clinics, schools, hospitals. Principles of organizing care according to needs of the patient-Seriously ill, chronically ill, moderately ill, terminally ill Principles of organizing care according to patient groups -age groups – children and adolescents -adults and the elderly - health or medical problems, e.g. patient with fever –unconsciousness -patients for surgery.

UNIT –II

The Public Health and Medical Departments – Relationship between the two – Relation to other departments, Revenue, Agriculture, Animal Husbandry, Engineering, Education etc. – Responsibility of the State and various local bodies in matter of Public Health – Local bodies – Corporations, Municipalities, Town Panchayats, Panchayat Unions, Village Panchayats – their responsibilities – Financial obligation – Public Health staff in these areas – their duties – Health education – different methods and values – Dominion responsibility in Public Health – Port Quarantine.

UNIT - III

HEALTH EDUCATION

1. Introduction:

(a)Aims of health education; scope of health education. Concept of health education. Role of Health Workers; identifying health education component of Health Workers; functions;

(b)Teaching-learning process

Concept of learning, change in behaviour Characteristics of learner Steps in the learning process; methods of learning. Evaluating learning. Principles of motivation. Establishment of a favorable teaching-learning situations; understanding factors which promote learning; learning connects with life; relevant learning; learning by doing, participation of learner in the teaching-learning situation.

UNIT - IV

A.CONTROLE OF COMMUNICABLE DISEASES & NON COMMUNICABLE DISEASE

Introduction of Communicable diseases and Specific communicable diseases and infections symptoms, , prevalence, mode of spread, prevention and control, care in specific communicable diseases and infections.

1. Malaria,
2. Dengue,
3. Tuberculosis,
4. Typhoid,
5. Cholera,
6. Worm infestation-hook worm, roundworm ,threadworm,
7. Other gastro-intestinal Infections,

UNIT – V : NON COMMUNICABLE DISEASE

Introduction of Non-Communicable diseases and Specific communicable diseases and infections symptoms, , prevalence, mode of spread, prevention and control, care in specific communicable diseases and infections.

1. Obesity
2. Hypertension
3. Diabetes mellitus
4. Coronary artery disorder
5. Carcinoma of cervix
6. Carcinoma of breast
7. Oral Cancer

Reference Books:

1. Introduction to Public Health by Mary – Jane Schneider.

2. Public Health Management ,Principles and Practice by Sunder Lal Vikas.

3. A Short Book of Public Health by VK Muthu.

E – Content Link:
https//researchguides.uic.edu/public health.

CO Number	CO Statement	Knowledge Level
CO1.	To acquire knowledge and skills related to the performance of health care activities in the community and to understand the concept of public health and develop skills to undertake public health activities and	K1
CO2.	To Acquire knowledge of the principles and practices of health guidance and education. Recognize and utilize opportunities for health education.	K1 – K3
CO3.	Function effectively for the promotion of the health and family welfare by participating in health education activities.	K2, K3,
CO4	To acquire an understanding of major communicable diseases and its implications for protection and restoration of health.	K3
CO5.	To Acquire an understanding of Signs and symptoms, Prevalence, Primordial, Care and Treatment of Non communicable Disease and its implication for protection and restoration of health	K1 – K4

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	High	Strong	Medium	Strong	HIGH
CO2	Strong	High	Strong	Medium	STRONG
CO3	Strong	Medium	Strong	High	STRONG
CO4	Medium	Strong	High	Strong	Medium
CO5	High	Medium	Strong	Medium	Strong

SEMESTER - VI

B.Sc., Chemistry

SEMESTER – VI

Core Paper - II

ORGANIC CHEMISTRY - III

Hours : 6 Per Week **Credits : 5** **Max.100 Marks (Ext: 75 & Int: 25)**

Pass. min:40/100

Objectives

1. To understand the preparation, Chemical properties and importance of Carbohydrates.
2. To Study the different molecular rearrangement reactions .
3. To study the preparation, properties and uses of Terpenes, Nucleic acids and proteins .

Unit I **Carbohydrates :**

a. Introduction and classification : Monosaccharide – preparation , properties and constitution of glucose – configuration – configurational structures – interconversion of glucose and fructose – descending and ascending of sugar series – Epimers and anomors – epimerization - mutarotation .

b. Disaccharides : preparation , properties, constitution and configuration of sucrose .

c. Polysaccharides : A general study of starch and cellulose – uses of cellulose in industries .

Unit II

a. Molecular rearrangements: Detailed mechanisms of the following : pinacol – pinacolone , Hofman , benzyl – benzilic acid , claisen , Beckmann and Fries rearrangements.

b. Free radicals – Definition – preparation and reaction of short lived and long lived free radicals – stability of free radicals – detection of free radicals – Mechanism of stand Meyer reaction .

Unit III **Dyes :**

i) Definition - theory of color and constitution – classification of dyes according to structure and applications .

ii) Azodyes - preparation of congo red and bismark brown.
Triphenyl methane dyes : Preparation of malachite green , rosaniline .

iii) Phthalein dyes: phenolphthalein, fluorescein preparation .

iv) Vat dyes – preparation of Indigo .

Unit IV

a. Heterocyclic compounds: preparation and properties of pyrazole , pyridine , quinoline and isoquinoline .

b. Alkaloids: Definition : Occurrence and extraction of aikaloids – general methods for determining the structure of alkaloids – classification of alkaloids – structure and synthesis of following alkaloids - conine ,piperine and papavarine (No structural elucidation)

Unit V

a) Terpenes:

i. Introduction , classification , occurrence and isolation – general properties – isoprene rule- general methods of determining structure – synthesis – properties and structural elucidation of citral , geranial, terpeniol and menthol .

b) Proteins , nucleic acids and amino acids :

i. Amino acids – definition , classification – preparation and properties of Glycine , Alanine.

ii. Definition – classification of proteins – color reactions of proteins – primary , secondary , tertiary and quaternary structure of proteins . Denaturation of proteins (an elementary idea only) .Nuleic acids: nucleosides- nucleotides. Definition-Examples only.

Reference Books:

1. **A Text Book of Organic Chemistry By- M.K.Jain & S.C.Sharma**
2. **A Text Book of Organic Chemistry By- P.L.Soni**
3. **A Text Book of Organic Chemistry By – K.S.Tewari**

CO Number	CO Statement	Knowledge Level
CO1.	To Understand the configuration of glucose and Surcose.	K1
CO2.	To Explain the mechanism of Molecular rearrangements.	K2
CO3.	To Apply the theory of colour and constitution of dyes.	K3
CO4.	To Interpret the significance of Alkaloids and hetrocyclic compounds	K4
CO5.	To Study the preparation, Properties of Terpenoids, proteins and Nucleic acids.	K1, K3

Mapping with Programme Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	High	Strong	Strong	Strong	High
CO2	Strong	Strong	High	Strong	Strong
CO3	High	Strong	High	Strong	Strong
CO4	Strong	High	Strong	High	Strong
CO5	Strong	Strong	High	High	Strong

B.Sc., Chemistry

Semester- VI

CORE PAPER – XIII - PHYSICAL CHEMISTRY – II

Hours : 6 **Credits : 5** **Max.100 Marks (Ext: 75 & Int: 25)**

Objectives:

1. **To Know the basic concepts of spectroscopy.**
2. **To acquire knowledge of types of spectra and the basics of quantum mechanics.**
3. **To acquire knowledge on purification of colloids and to understand liquid crystals.**

UNIT – I SPECTROSCOPY:

The Electromagnetic spectrum , Absorption Spectroscopy, Mechanism of interaction of Radiation with Materials, Molecular spectra, Molecular Rotation ,Types of molecular Spectra , Rotational Spectra of Diatomic molecules (Microwave Spectra) Rigid Rotator ,The intensities of spectral lines, the Effect of Isotopic Substitution and Non- rigid Rotator.

Unit – II:

Vibration Spectra (Near infra red spectra),Simultaneous Rotation and Vibration in molecules ,Diatomic Vibrating Rotrator, Diatomic molecule as a Harmonic oscillator and Rigid Rotator, Diatomic molecule as Abharmonic oscillator and a Non – Rigid Rotator , Rotational Degree of freedom, Spectra and Vibration modes, Analysis of Infra , red spectra on the Basis of modes of vibration- Electronic spectra , Light scattering and Raman Spectroscopy .The laser and the Maser, Comparison Of Raman Spectroscopy with IR spectroscopy.

Unit – III Quantum Mechanics:

Failure of classical mechanics, black body radiation, photoelectric effect, Compton effect, Heisenberg uncertainty principle, Schrodinger wave equation, Eigen value and Eigen functions, Significance of wave function, postulates of quantum mechanics, energy and wave functions of particle in one dimensional box.

Unit IV : Chemical kinetics and Colloidal State

Chemical kinetics:

Second order reactions – rate equation derivation , half life period derivation – examples. Third order reactions- rate equation derivation- example. Effect of temperature on reaction rates , Arrhenius equation ,theories of reaction rates – collision theory and Activated complex theory of bimolecular gaseous reactions, Lindemann theory of uni molecular gaseous reactions.

Colloidal State:

Colloidal systems – preparation of lyophilic colloids by dispersion and condensation methods, – purification of colloids , properties , electrical , kinetic and optical – Determination of size of colloidal particles by ultra filters, Brownian movement and light scattering methods. Emulsion – types of emulsion – properties – Gels- preparation and application of colloids.

Unit V : Liquid Crystals:

Definition , types-nematic and smectic, the seven segment cell- classification of thermotrophic liquid crystals. Polmorphism in thermotrophic liquid crystals, pressure induced mesomorphism . Molecular arrangements in various states of liquid crystals.

TEXT BOOKS:

1. Text book of Physical Chemistry by P.L.Soni and O.P.Dharmarha ,published by Sultan Chand & Sons, New Delhi,2005
2. Principles of Physical Chemistry by Puri, Sharma and Pathania, Vishal Publishing Co.,Jalandar,2013.

REFERENCE BOOKS:

1. Basics of Spectroscopy by B.K. Sharma
2. Advanced Spectroscopy by Aluwalia
3. Physical Chemistry by Bahl & Arun Bahl.
4. Principles of Physical Chemistry by Abhijit Mallick,Viva Books Private Limited,01.01.2018.
5. Physical Chemistry byPeter Atkins,Julio de Paula and James Keeler,Oxford University Press, 01.07.2018.

CO Number	CO Statement	Knowledge Level
CO1.	To know the basic concepts of spectroscopy	K3
CO2.	To acquire knowledge on types of spectra ,diatomic molecule as harmonic and anharmonic oscillator and laser and maser.	K2
CO3.	To study the basics of quantum mechanics	K1
CO4	To study the reaction rates and their theories, preparation and purification of colloids	K4
CO5.	To acquire knowledge on liquid crystals, their types and their arrangements.	K4

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	High	Strong	Strong	High	High
CO2	Strong	Strong	High	Strong	Strong
CO3	High	Strong	High	Strong	Strong
CO4	Strong	High	Strong	High	Strong
CO5	Strong	Strong	High	High	Strong

B.Sc., Chemistry

SEMESTER – V & VI

PRACTICAL –III-GRAVIMETRIC ANALYSIS AND ORGANIC COMPOUND PREPARATION

Hours : 3+3 **Credits : 5** **Max.100 Marks (Ext: 75 & Int: 25)**

Course Objectives:

To Gain practical Skills on Gravimetric Analysis and in organic Compound Preparations.

Gravimetric Analysis

1. Estimation of lead as lead Chromate.
2. Estimation of barium as Barium Chromate**.**

Organic Compound Preparation

1. Preparation of benzoic acid from

Benzamide (Amide Hydrolysis)
Ethyl benzoate (Oxidation)
Benzaldehyde (Oxidation)

2. Preparation of β – Naphthyl Benzoate from β – naphthol.
3. Preparation of Benzanilide form Aniline.
4. Preparation of Phenyl Benzoate form Phenol.

Reference Books:

1. Basic Principles of Practical Chemistry By - V.Venkateswaran, R.Veeraswamy and A.R.Kulandaivelu.

B.Sc., Chemistry

Semester – V & VI

PRACTICAL –IV- PHYSICAL CHEMISTRY PRACTICALS

Hours : 3+3 **Credits : 5** **Max.100 Marks (Ext: 75 & Int: 25)**

PHYSICAL CHEMISTRY PRACTICALS- LIST OF EXPERIMENTS:

1. Critical Solution Temperature (CST)
2. Effect of impurity on Critical solution Temperature
3. Transition Temperature (T.S.)
4. Rast Method –Determination of Molecular Weight
5. Phase Diagram (Simple eutectic system)
6. Kinetics of Ester Hydrolysis –Determination of Rate Constant
7. Conductometric Acid-Base Titration –Determination of Strength of an Acid/Base
8. Potentiometic Redox Titration –determination strength of $FeSO_4$ / Ferrous Ammonium Sulphate.

Scheme for External Evaluation-Record Note Book:10,Procedure with Formula:20,Performance of the Practicals:20,Result :10 Error Limit $\pm$10%

Reference Books :

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons (1997)
2. Practical Chemistry for B.Sc., students A.O. Thomas, Scientific Book Centre,Cannnore,1992.

COURSE OBJECTIVES:

1. To gain practical skills in physical chemistry experiments and also to apply this in various fields for their career.

B.Sc., CHEMISTRY

SEMESTER-VI

Elective -III

Petro Chemistry

Hours : 6 Per week **Credits : 4** **Marks: 75(Ext); 25 (Int)**

Course Objectives:

1. **To Understand the occurrence, composition and uses of petro chemicals.**
2. **To acquire knowledge on the classification of petroleum products.**
3. **To understand the chemistry of petroleum products and purification process**

Unit – I

a) Introduction, petrochemicals - definition, occurrence, composition, examples and uses. crude petroleum- collection of petroleum and gas at oil wells. Fractional distillation of petroleum, cracking, octane number, flash point and setane number.
b) Synthetic petroleum- Definition, preparation from coal by Bergius method and Fischer - Tropsch process.

Unit – II

a) Petroleum as a source of aromatics, natural gas, gasoline, extraction methods of light hydrocarbons (refrigerated absorption and low temperature distillation).
b) Precursors for petrochemicals, classification of petroleum products, Liquified hydrocarbon gases and fuels, liquification by gases – fuel for carbureted engine, aviation motor.

Unit – III

Fuel oils or Boiler oils

Fuel oil – types, quality of fuel oil, fuels for jet and gas turbine engine. Lubriants- Classification, characteristics, kinds of mineral oils - aviation oil, Industrial oil, turbine oil, insulating oil, compressor oil.

Unit- IV

Paraffins, Ceresins, Medical, capacitor petroleum and miscellaneous, petroleum products, greases, bitumens, solvents kerosene, productivity, greases domestic kerosene, coke carbon black and their uses.& Inter – relationship of precursors from natural gas, petroleum cuts & Coal.

Unit – V

Purification of petroleum products

Introduction, - Types of purification process (absorptive and adsorptive sulphuric acid purification), alkaline purification, hydrofining Purification in a DC electric field, new methods of purification - Demercaptanisation and stabilization.

Reference Books:

1. A Text on Petrochemicals by B.K.Bhaskararao.
2. A Text on Petrochemicals – Petroleum Refining Technology by Dr.Ram Prasad.
3. Fundamentals of Petroleum and Petrochemical Engineering by Uttam Ray Chaudhuri.

CO Number	CO Statement	Knowledge Level
CO1	To understand the occurrence ,composition, uses of petrochemicals and also to know the preparation of synthetic petroleum	K1 – K5
CO2	To acquire knowledge on extraction of hydrocarbons and classification of petroleum products	K1 – K3
CO3	To sketch the fuel oils and classification of lubricants	K2, K3
CO4	To understand chemistry of petroleum products and Inter – relationship of precursors from natural gas, Petroleum cuts & Coal.	K2, K3
CO5	To outline the purification processes of petroleum products	K1 – K4

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	High	Strong	Medium	Strong	High
CO2	Strong	High	Strong	Medium	Strong
CO3	Strong	Strong	Strong	High	Strong
CO4	Medium	Strong	High	Strong	Medium
CO5	High	Medium	Strong	High	Strong

B.Sc., Chemistry

Semester – VI

Elective - III

APPLIED CHEMISTRY (Optional)

Hours : 6 **Credits : 4** **Max.100 Marks (Ext: 75 & Int: 25)**

Objectives:

1. **To Acquire knowledge about different system of medicine.**
2. **To Understand the types of polymerization.**
3. **To Get knowledge about fertilizers, match industries and silicate industry.**

Unit I: Medicinal Chemistry

Introduction to the different system of medicine ; Ayurveda, Siddha, Homepathy and Allopathy-History of medicinal chemistry.

Analgesics and antibyretics; Narcotic analgesics - Morphine and derivatives. Totally synthetic analgesics – pethidine and methadones.(Medicinal uses and structure only)]Antipyretic analgesics-salicylic acid derivatives and P-amino phenol derivatives. (Medicinal uses and structure only) Diagnostic tests and estimation of sugar, salt(including lithium) and cholesterol in serum,urine etc.,

Unit II: Chemotherapy and application of a few drugs (Elementary study)

Sulpha drugs- Sulphadiazine, prontosil and prontosil S

Antimalarials-quinnie,plasmoquine

Arsenical drugs-salvarasan-606-Neosalvarasan.

Antibiotics: Definition, Penicillin- Tetracyclline(Auromycin and Terramycin) streptomycin and chloromyceitin - structure and uses.

Hormones and Vitamins:

Definition and classification, Testosterone, Progesterone, Thyroxise, Vitamin C structure only (Structural elucidation not necessary)

Anaesthetics:

Gaseous anesthetics- Vinyl ether-Cyclopropane-Halohydrocabons-Chloroform-Halothane-Trichloroethylene-Intravenous anesthetics-Thio pentone-Local anesthetics-Cocaine and its derivatives.

Unit III: Rubber: Natural and synthetic rubbers- composition of natural rubber , Neoprene, Styrene- Butadiene rubber (SBR).

Polymer Chemistry: Types of polymerization – Addition and Condensation-Mechanism-Copolymer-Definition with Examples Homopolymer-Definitionof natural and synthetic fibres-natural and synthetic resins- distinction between plastics – classification of plastics-properties-Bakelite, Urea formaldehyde resins,Deflons,Nylon-66 and Dacron.

Oils and Fats:

Saponification value, iodine value Reichert-Meissan value, Acid value, Definition and their determination-Applications-Manufacture of soap-detergents-cleasning action of soap and detergents.

Unit IV:

Fertilizers: Definition- Nutrients for plants –Role of various elements in plant growth-natural and chemical fertilizers- classification of chemical fertilizers – Urea, super phosphate and potassium nitrate- mixed fertilizer- fertilizer industry in India.

Insectisides and pestisides:

Definition- classification- inorganic pesticides-preparation and application –Lead arsenate, paris green, limesulphur, hydrocyanic acid, organic pesticides, naturaland synthetic – fungicides-repellants. Preparation of domestically useful chemical products; Washing powder, cleaning powder – phenols(white, black and colour)-shampoo, insence sticks, liquid blue, blue red and green inks, soap soil, face powder and pain balm.

Unit V: Match Industry: Pyrotechnics and explosives- Raw materials needed for match industry- Manufacturing process- Pyrotechnics- Colored smokes explosives-Definition- Classification- Nitroglycerine, Dynamite, Cordite, TNT and Picric acid.

Silicate Industry:

Raw materials & Manufacture of cement, Glass&Ceremics. Paints and Lacquers:

Pigment- Paints- Ingredients in paints- Manufature- Lacquers- Varnishes.

TEXT BOOKS:

1. Applied Chemistry and chemical engineering, by A.K.Haghi, Devrim Balkose, Omari V.Mukbaniani, Apple Academic Press, published on 20.03.2018.

REFERENCE BOOKS:

1. J.C. Kuriacose, J. Rajaram – Chemistry in engineering and Technology – Vol-2 Tata McGraw – Hill Publishing Company Limited – New Delhi – 1979.
2. P.C.Jain & Manika Jain – "Engineering Chemistry" 15th Ed., (2005), Dhanpath Raj publishing company, New Delhi.
3. B.K.Sharma - "Industrial Chemistry", 1st Ed., (1984), Goel Publishing House – Meerut.
4. P.L.Soni, H.M.Chawla – "Text Book of Organic Chemistry" (1994), Sultan Chand & Sons, New Delhi.
5. Arun Bahl and B.S.Bahl - "Text Book of Organic Chemistry" 11th and 18th Ed., S.Chand, New Delhi.
6. Krishnamoorthy, P.Vallinayagan & K.Jaya Subramanian – "Applied Chemistry", 2nd Ed., (1999-2001), Tata McGraw – Hill Publishing Co Ltd., New Delhi.

CO Number	CO Statement	Knowledge Level
CO1.	To know the systems of medicine	K2
CO2.	To acquire knowledge on chemotherapy, harmones and vitamins and their functions an anaesthetics.	K1
CO3.	To attain knowledge on preparation of rubber, polymerization and various values of oils and fats	K4
CO4	To apprehend on fertilizers, insecticides and pesticides	K3
CO5.	Cognizant on pyrotechniques and manufacture of cement, glass and ceramics.	K3

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	High	Strong	High	Strong	High
CO2	Strong	Medium	High	Strong	High
CO3	High	High	Medium	High	Medium
CO4	Strong	Medium	High	Strong	Medium
CO5	Strong	High	Strong	Strong	Medium

PART – IV –EVS –ENVIRONMENTAL STUDIES

Hours : 2 **Credits : 2** **Max.100 Marks (Ext: 25 & Int: 75)**

SBC – PROJECT

Hours : 2 **Credits : 2** **Max.100 Marks (Int : 75 & Ext: 25)**

Group Project Work

5-7 Students for a faculty to guide a project of a single title.

75 Marks for internal performance only.

25 Marks for Viva Voce Only.

B.Sc., Chemistry

Semester- VI

NME - II

AGRICULTURAL CHEMISTRY

Hours : 2 Per Week **Credits :2** **Max. Marks: 75 (Ext) ; 25 (Int)**

Unit – I- Soil Chemistry

Introduction of soil chemistry – Soil analysis. Composition of soil - organic and Inorganic constituents. soil acidity - buffering capacity of soils - Limiting of soil. Absorption of cations and anions - availability of soil nutrients to plants.

Unit – II Fertilizers

Introduction – Classification – peat and organic manures (composts) – role of humus. Effluent form gobar gas plants. Use of fertilizers - Urea, DAP, Super phosphate, Gypsum, NPK – mixed fertilizers. optional addition of fertilizers to obtain estimated yields.

Unit III – Fungicides

Inorganic (Bordeaux mixture) and organic (dithiocarbamate) Industrial Fungicides- Creosote fractions. Herbicides and weedicides - Selective and non – selective 2, 4- D and 2,4,5-t .

Unit – IV – Plant growth regulators

3 - Indole acetic acid- Naphthalene acetic acid- Ethepon (2 Chloroethyl phosphoric acid) – Alar (succinin acid – 2, 2- dimethylhydrazine) their function. plant hormones. Gibberlin, Cyclocel, phosphon, dwarfing compound (ccc:2, Chloroethyltrimethyl ammonium chloride) defoliants.

Unit – V Insecticides

Introduction of Insecticides, stomach poisons, contact insecticides, fumigants. Applications of insecticides, DDT, BHC, Pyrethrin and pentachlorophenol.

Text Books:

1. D.Choudhary, Basics of Agricultural Chemistry , Anmol publications, 2009.
2. J.Subbiah, An Introduction of Agricultural Chemistry, JV Publishers, 2020.

Reference Books:

1. R. Rajeswari et, al., Elements of Agricultural Chemistry, Satish serial publishing House, 2014.
2. T. Anderson, Elements of Agricultural Chemistry, Good Press Publisher, 2019.

CO Number	CO Statement	Knowledge Level
CO1.	To understand the chemistry of food adulteration and adulterants	**K2**
CO2.	To know the chemistry of food poisoning	**K2**
CO3.	To acquire knowledge about food additives	**K2**
CO4	To understand the chemistry of beverages and soft drinks and to know the methods of preparing the soft drinks by field visits.	**K2**
CO5.	To acquire knowledge about objectives of cooking and role of oil in cooking.	**K2**

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	High	Strong	High	Strong	High
CO2	Strong	Medium	High	Strong	High
CO3	High	High	Medium	High	Medium
CO4	Strong	Medium	High	Strong	Medium
CO5	Strong	High	Strong	Strong	Medium

EXTRA CREDIT PAPERS

EXTRA CREDIT PAPERS

Semester - I

FOOD CHEMISTRY

Hours: 2 **Credit: 2** **Max Marks (Internal: 100)**

Objectives:

1. **To get knowledge about food adulteration.**
2. **To acquire knowledge about food additives and food poisons.**
3. **To get thorough knowledge about beverages and edible oils.**

UNIT 1: FOOD ADULTERATION :

Sources of food, types, advantages and disadvantages, Food adulteration –contamination of Wheat, Rice, Alial, Milk, Butter etc. with clay stones, water and toxic chemicals –Common adulterants. Common adulterants Ghee adulterants and their detection. Detection of adultered Foods by simple analytic techniques. (10hrs Theory + 5hrs Practical).

UNIT 2: FOOD POISON: Food poisons –natural poisons (alkaloids –nephrotoxing) –pesticides, (DDT, BHC, and Malathion) - Chemical poisons and First aid for poison consumed victims. (15hrs).

UNIT 3: FOOD ADDITIVES: Food additives –artificial sweetners-Saccharin-Cyclomater and aspartate. Food flavours –esters, aldehydes and heterocyclic compound. Food colors –restricted use –spurious colors –Emulsifying agents –preservatives learning agents. Baking powder yeast –taste makers –MSG vinegar. .

UNIT 4: BEVERAGES:

Beverages –Soft drinks –soda –fruit juices –alcoholic beverages examples. Carbonation –addiction to alcohol –cirrhosis of liver and social problems.

UNIT 5 EDIBLE OILS:

Fats, Oils –Sources of oils –Production of Refined vegetables oils –Preservation. Saturated and unsaturated fatty acids –I_2 value, saponification values and their significance. Estimation of I_2 and RM values in Edible oils.

Books for Reference:

1. Swaminathan M.Food Science and Experimental foods, Ganesh and Company.
2. Jayashree Ghosh, Fundamental concepts of Applied chemistry, S.Chand & Co., publishers.
3. Thanlamma Jacob, Text Books of applied chemistry for Home Science and allied Sciences, Macmillan.

CO Number	CO Statement	Knowledge Level
CO1.	To understand the chemistry of food adulteration and adulterants	**K2**
CO2.	To know the chemistry of food poisoning	**K2**
CO3.	To acquire knowledge about food additives	**K2**
CO4	To understand the chemistry of beverages and soft drinks and to know the methods of preparing the soft drinks by field visits.	**K2**
CO5.	To acquire knowledge about various edible oils and the processing techniques related to oils.	**K2**

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	High	Strong	High	Strong	High
CO2	Strong	Medium	High	Strong	High
CO3	High	High	Medium	High	Medium
CO4	Strong	Medium	High	Strong	Medium
CO5	Strong	High	Strong	Strong	Medium

Semester - III

CHEMISTRY IN DAY TODAY LIFE

Hours : 2 **Credits : 2** **Max. Marks (Internal : 100)**

Objectives:

1. **To Visualise the importance of chemistry in Everyday life.**
2. **To explain the terms soaps and detergents.**
3. **To know about health hazards of corrosive chemicals used in manual cleaning of household vessels.**

UNIT – I :

TEXTILE CHEMISTRY – Brief introduction to types of fabrics-natural and synthetic fabrics (cotton, fur, jute, silk, polymeric metallic)-durability and maintenance of cloth, fading and introduction to natural and synthetic dyes for colouring textiles, starching process.

UNIT – II: Soaps and detergents –types of soaps, surfactants-types, importance, fabric whiteners, stiffeners, flavouring agents, ultramarines ,brighteners, selection of cost effective washing powders-pleasant odours, flavouring liquids for fabrics-collar and surf dirty remover liquids.

UNIT –III : Dishwashers-soft and hard utensil cleaning liquid soaps-brighteners. Efficient way of using and maintenance-significance in health hazards of corrosive chemicals used in manual cleaning of household vessels, awareness on healthy way of using cleaning chemicals in day today life.

UNIT –IV:

Floor cleaning agents used in vacuum cleaners (lizol, phenoyl - sanifresh) deodorants, room air freshners.LPG stove top made of SS, glass, GI, chromium alloys-cleaning liquids not affecting metals and glass. Anti mosquito repellant machines –evaporators-liquid, solids and gases.

UNIT-V:

Chemicals used in water purifiers-germicidal effect of uv radiation exposure-nutrient elements-sedimentation alum-types of water purifiers-water borne diseases-health care

awareness on purified drinking water.

REFERENCE BOOKS:

1. Industrial Chemistry by B.K.Sharma, Goel publishing House 1995,websites manual of home appliances-healthcare printouts from the hospitals related to the syllabus mentioned above.

CO Number	CO Statement	Knowledge Level
CO1.	To learn the types of fabrics, fading, starching process.	**K2**
CO2.	To acquire knowledge about types of soaps whiteners, stiffeners, flavouring agents	**K2**
CO3.	To understand soft and hard utensil cleaning liquid soaps	**K2**
CO4	To acquire a comprehensive knowledge about Floor cleaning agents and Anti mosquito repellant machines	**K2**
CO5.	To understand the Chemicals used in water purifiers and germicidal effect of uv radiation	**K2**

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**Strong**	**Strong**	**High**	**Strong**	**High**
CO2	**Strong**	**Medium**	**High**	**Strong**	**High**
CO3	**High**	**High**	**Medium**	**Strong**	**Medium**
CO4	**Strong**	**Medium**	**High**	**Strong**	**Medium**
CO5	**Strong**	**High**	**Strong**	**Strong**	**Medium**

B.Sc Chemistry

Semester - V

Extra Credit Paper

Forensic Science & Crime Investigation

Hours : 2 **Credit :2** **Max. Marks (Internal : 100)**

Sub Code: UGEFCI

Objectives:

1. **To Understand the types of crime, Indian Penal code.**
2. **To get thorough knowledge about explosives and Arson.**
3. **To acquire knowledge about types of poisons and diagnosis of poisoning.**

Unit 1:

Crimonology – Definition – Nature and Scope – types of Crime – penology – Indian Penal Code- Indian Evidence Act- Indian Crininal Procedure Code.

Unit- II

a) Forensic Science – Definition , Principles and uses in Crime Investigation.
b) Finger Prints- Patterns – Classification , Uses of finger prints in Crime investigation.
c) Tracks and traces – Foot prints – casting of Foot prints – Residue Prints.
d) Biological Substance – Blood, Semen, Saliva, Sweat, Urine and hair.

Unit – III

A) Arson- Natural fires and arson – Nature of action of fire- Frigts and air supply burning characteristics and Chemistry of combustible material – nature of combustion.
B) Explosives- Definition – classification – composition and mechanism of explosion bombs.
C) Ballistic – Classification – Internal, External and Terminal ballistic and overall view.
D) Small arms – classification and characteristic laboratory examination of the barrel washing and detection of power residues by chemical tests.

Unit – IV

Documents – chemistry of paper ink – writing paper- carbon paper – safety paper. Ink various writing inks – chalk – coloured chalk – Adhesives- sealing waxes. Different types of forged signature – Simulated and traced forgeries – Inherent signs of forgery models- writing deliberately- modified – Uses of ultraviolet Rays- comparison of type written letters – counterfeit currency and coins.

Unit – V

Poison – types and classification – diagnosis of poisoning in the living and in the dead clinical symptoms - Post Mortem appearances – treatment in cases of poisoning – uses of antidotes.

TEXT BOOKS:

1. Forensic Science Principles and applications by Dr.Nishant Singh, Ancient Publishing House, 01.01.2011.

REFERENCE BOOKS:

1. T.H. James, Forensic Sciences , Stanley Thornes Ltd.,
2. Richard, Criminalistics – An introduction to Forensic Science College Version), 8th Edition Sofestein, Printice Hall.,

CO Number	CO Statement	Knowledge Level
CO1.	To learn crime investigation through diagnosis of poisoning and postmortem	**K2**
CO2.	To acquire knowledge about explosions, the causes (gelatin sticks, TDX etc) and the security measures.	**K2**
CO3.	To understand the methods of detecting Forgery in bank and educational records.	**K2**
CO4	To acquire a comprehensive knowledge about tracks and traces.	**K2**
CO5.	To understand the chemical methods used in crime investigation (Medical aspects).	**K2**

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**Strong**	**Strong**	**High**	**Strong**	**High**
CO2	**Strong**	**Medium**	**High**	**Strong**	**High**
CO3	**High**	**High**	**Medium**	**Strong**	**Medium**
CO4	**Strong**	**Medium**	**High**	**Strong**	**Medium**
CO5	**Strong**	**High**	**Strong**	**Strong**	**Medium**