

GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS) KUMBAKONAM
(Curriculum – B.Sc., Chemistry – 2023 - 2024)

Department : Chemistry

Programme Code: USCH

SEMESTER – I

Part	Course Type	Course Code	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
							CIA	ESE	Total
I	LC I	U231T1	Tamil	6	3	3	25	75	100
II	ELC I	U231E1	English	6	3	3	25	75	100
III	CC – I	U23CHC101	General Chemistry - I	5	5	3	25	75	100
III	CC – II	U23CHC102P	Quantitative Inorganic estimation (titrimetry) and Inorganic Preparations	3	2	3	40	60	100
III	EC - I		<u>Maths</u>	6	5	3	25	75	100
			Botany/Zoology	4	4	3	25	75	100
	EC - II		Botany/Zoology	2	1	3	40	60	100
IV	VE	U231VE	Value Education	2	2	3	25	75	100
IV	FC	U23CH1FC	Introductory Chemistry	2	2	3	25	75	100
Total				30	22				700/800

Total marks for Maths allied 700

Total marks for Zoology/ Botany allied 800

SEMESTER - II

Part	Course Type	Course Code	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
							CIA	ESE	Total
I	LC II	U232T2	Tamil	6	3	3	25	75	100
II	ELC II	U232E2	English	6	3	3	25	75	100
III	CC - III	U23CHC203	General Chemistry - II	5	5	3	25	75	100
III	CC - IV	U23CHC204P	Qualitative Organic Analysis and Preparation of Organic Compounds Practical	3	2	3	40	60	100
III	EC - III		Maths	6	5	3	25	75	100
			Botany/Zoology	4	4	3	25	75	100
	EC - IV		Botany/Zoology	2	1	3	40	60	100
IV	SEC - I	U23CH2SE1	Role of chemistry in everyday life	2	2	3	25	75	100
IV	EVS	U232ES	Environmental Studies	2	2	3	25	75	100
Total				30	22				700/800

Total marks for Maths allied 700

Total marks for Zoology/ Botany allied 800

SEMESTER - III

Part	Course Type	Course Code	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
							CIA	ESE	Total
I	LC III		Tamil	6	3	3	25	75	100
II	ELC III		English	6	3	3	25	75	100
III	CC -V		General Chemistry III	6	6	3	25	75	100
III	CC - VI		Qualitative Inorganic Analysis-Practical	3	2	3	40	60	100
III	EC - V		Basic Allied Physics	4	4	3	25	75	100
III	EC - VI		Allied Physics-Practical-I	2	1	3	40	60	100
IV	SEC		Dairy Chemistry	1	1	3	25	75	100
	SEC (NAC)		Hydro Chemistry	2	2	3	25	75	100
Total				30	22				800

HW Health and wellness

23

SEMESTER - IV

Part	Course Type	Course Code	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
							CIA	ESE	Total
I	LC IV		Tamil	6	3	3	25	75	100
II	ELC IV		English	6	3	3	25	75	100
III	CC -VII		General Chemistry IV	5	5	3	25	75	100
III	CC - VIII		Physical Chemistry- Practical - I	3	2	3	40	60	100
III	EC - VII		Advanced Allied Physics	4	4	3	25	75	100
III	EC VIII		Allied Physics Practical II	2	1	3	25	75	100
V	SEC		Waste Management	2	2	3	25	75	100
V	IDSEC		Health Chemistry	2	2	3			
Total				30	22				800
Internship/ Industrial Training*				-	-				

Note : Internship/ Industrial Training during summer vacation. The credits shall be awarded in semester V statement of marks

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Department : Chemistry

(Curriculum – B.Sc., Chemistry – 2023 - 2024)

Programme Code: USCH

Part	Course Type	Course Code	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
							CIA	ESE	Total
III	CC – IX		Organic Chemistry – I	6	6	3	25	75	100
III	CC – X		Physical Chemistry – I	5	5	3	25	75	100
III	CC – XI		Gravimetric analysis Practical	6	3	6	40	60	100
III	CC – XII		Project with Viva voce	3	3	3	40	60	100
III	DSE – I		1.Inorganic Chemistry-I 2.Biochemistry	4	4	3	25	75	100
III	DSE – II		1. Pharamaceutical Chemistry 2. Nano Science	4	3	3	25	75	100
IV	SEC –VI		Instrumental methods of chemical analysis	2	2	3	25	75	100
	AEC - I		Internship/Industrial training	-	2				
Total				30	28				700

Part	Course Type	Course Code	Title of the Course	Hrs/ Week	Credits	Exam Hrs	Marks		
							CIA	ESE	Total
I	CC – XIII		Organic Chemistry – II	5	5	3	25	75	100
II	CC – XIV		Physical chemistry – II	5	5	3	25	75	100
III	CC - XV		Physical chemistry Practical-II	6	3	3	40	60	100
III	DSE – III		1.Inorganic Chemistry-II 2.Polymer science	5	4	3	25	75	100
III	DSE - IV		1.Agricultural Chemistry 2.Fundamentals of Spectroscopy	4	3	3	25	75	100
III	SEC – VII		Business skills in Chemistry	2	2	3	25	75	100
IV	AEC - II		Chemistry for Competitive Examinations	2	2	3	25	75	100
IV	GS		Gender studies	1	1	-	-	-	-
Total				30	25		-	-	700

List of Generic Elective Course

S.NO	SUB. TITLE	CODE	Credit
1	Chemistry for Biological Science - I	U23CHGE1	3
2	Chemistry for Biological Science - II	U23CHGE2	3
3	Chemistry Practical for Physical and biological Science - I	U23CHGE3P	2
4	Chemistry for Physical Science - I	U23CHGE4	3
5	Chemistry for Physical Science – II	U23CHGE5	3
6	Chemistry Practical for physical and Biological science - II	U23CHGE6P	2

List of Discipline Specific Elective Course

S.NO	SUB. TITLE	CODE	Credit
1	Inorganic Chemistry – I	U23CHDE1	3
2	Biochemistry	U23CHDE2	3
3	Pharmaceutical Chemistry	U23CHDE3	3
4	Nano Science	U23CHDE4	3
5	Inorganic Chemistry – II	U23CHDE5	4
6	Polymer Science	U23CHDE6	4
7	Agricultural Chemistry	U23CHDE7	3
8	Fundamentals of Spectroscopy	U23CHDE8	3

C. Arunjit
3/1/22
HOD of Chemistry

SEMESTER I CORE COURSE –I GENERAL CHEMISTRY-I	SUB CODE : U23CHC101 HOURS:5 CREDITS: 5
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Objectives of the course

The course aims at giving an overall view of the

- various atomic models and atomic structure
- wave particle duality of matter
- periodic table, periodicity in properties and its application in explaining the chemical behavior
- nature of chemical bonding, and
- fundamental concepts of organic chemistry

UNIT I Atomic structure and Periodic trends- History of atom (J.J.Thomson, Rutherford); Moseley's Experiment and Atomic number, Atomic Spectra; Black-Body Radiation and Planck's quantum theory - Bohr's model of atom; The Franck-Hertz Experiment; Interpretation of H- spectrum; Photoelectric effect, Compton effect; Dual nature of Matter- De- Broglie wavelength-Davisson and Germer experiment Heisenberg's Uncertainty Principle; Electronic Configuration of Atoms and ions- Hund's rule, Pauli's exclusion principle and Aufbau principle;

Unit II Introduction to Quantum mechanics

Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wave functions, Formulation of Schrodinger wave equation - Probability and electron density-visualizing the orbitals -Probability density and significance of Ψ and Ψ^2 .

Periodicity Features of the periodic table; classification of elements - Periodic trends for atomic size- Atomic radii, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electronegativity-electronegativity scales, applications of electronegativity.

UNIT-III: Structure and bonding – I

Ionic bond

Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle – lattice energies, Madelung constant; relative effect of lattice energy and solvation energy; Ion polarisation – polarising power and polarizability; Fajans' rules - effects of polarisation on properties of compounds; problems involving the core concepts.

Covalent bond Shapes of orbitals, overlap of orbitals – σ and Π bonds; directed valency -hybridization; VSEPR theory - shapes of molecules of the type AB₂, AB₃, AB₄, AB₅, AB₆ and AB₇ Partial ionic character of covalent bond-dipole moment, application to molecules of the type A₂, AB, AB₂, AB₃, AB₄;

percentage ionic character.

UNIT-IV: Structure and bonding - II

VB theory – application to hydrogen molecule; concept of resonance - resonance structures of some inorganic species – CO₂, NO₂, CO₃²⁻, NO₃⁻; limitations of VBT; MO theory - bonding, antibonding and nonbonding orbitals, bond order; MO diagrams of H₂, C₂, O₂, O₂⁺, O₂⁻, O₂²⁻, N₂, NO, HF, CO₂; magnetic characteristics, comparison of VB and MO theories. Coordinate bond: Definition, Formation of BF₃, NH₃, NH₄⁺, H₃O⁺ properties

Metallic bond-electron sea model, VB model; Band theory-mechanism of conduction in solids; conductors, insulator, semiconductor – types, applications of semiconductors

Weak Chemical Forces - Vander Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces; Hydrogen bonding – Types, special properties of water, ice, stability of DNA; Effects of chemical force, melting and boiling points.

UNIT-V: Basic concepts in Organic Chemistry and Electronic effects

Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals; reaction intermediates – carbanions, carbocations, carbenes, arynes and nitrynes.

Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines inductive and electromeric effects.

Resonance – resonance energy, conditions for resonance - acidity of phenols; basicity of aromatic amines, stability of carbonium ions, carbanions and free radicals, reactivity of vinyl chloride, dipole moment of vinyl chloride and nitrobenzene, bond lengths; steric inhibition to resonance.

Hyperconjugation - stability of alkenes, bond length, orienting effect of meth group, dipole moment of aldehydes and nitromethane. Types of organic reactions- addition, substitution, elimination and rearrangements

Recommended Text

1. Madan, R. D. and Sathya Prakash, *Modern Inorganic Chemistry*, 2nd ed.; S. Chand and Company: New Delhi, 2003.
2. Rao, C.N. R. *University General Chemistry*, Macmillan Publication: New Delhi, 2000.
3. Puri, B. R. and Sharma, L. R. *Principles of Physical Chemistry*, 38th ed.; Vishal Publishing Company: Jalandhar, 2002.
4. Bruce, P. Y. and Prasad K. J. R. *Essential Organic Chemistry*, Pearson Education: New Delhi, 2008.

5. Dash UN, Dharmarha OP, Soni P.L. Textbook of Physical Chemistry, Sultan Chand & Sons: New Delhi, 2016

Reference Books

1. Maron, S. H. and Prutton C. P. *Principles of Physical Chemistry*, 4th ed.; The Macmillan Company: New York, 1972.
2. Lee, J. D. *Concise Inorganic Chemistry*, 4th ed.; ELBS William Heinemann: London, 1991.
3. Gurudeep Raj, *Advanced Inorganic Chemistry*, 26th ed.; Goel Publishing House: Meerut, 2001.
4. Atkins, P.W. & Paula, J. *Physical Chemistry*, 10th ed.; Oxford University Press: New York, 2014.
5. Huheey, J. E. *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th ed.; Addison, Wesley Publishing Company: India, 1993

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Website and e-learning source

- 1) <https://onlinecourses.nptel.ac.in/>
- 2) http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm
- 3) http://www.iias.ac.in/initiat/sci_ed/resources/chemistry/inorganic.html
- 4) <https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding>
<https://www.chentube3d.com/>

Course Learning Outcomes

- CO1:** explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.
- CO2:** classify the elements in the periodic table, types of bonds, reaction intermediates electronic effects in organic compounds, types of reagents.
- CO3:** apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, Δx , Δp electronegativity, percentage ionic character and bond order.
- CO4:** evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects
- CO5:** construct MO diagrams, predict trends in periodic properties, assess the properties of elements, and explain hybridization in molecules, nature of H – bonding and organic reaction mechanisms.

COURSE MAPPING CO -PO

COURSE MAPPING CO -PSO

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

C. Jyoti
HOD of Chemistry

**CORE COURSE – II
QUANTITATIVE INORGANIC
ESTIMATION (TITRIMETRY)
AND INORGANIC
PREPARATION**

**SUB CODE :U23CHC102P
HOURS: 3
CREDITS :2**

Objectives of the course

This course aims

- To learn about titrimetric analysis
- To predict the concentrations of different solutions

I. Acidimetric and Alkalimetry

II. Permanganometry

1. Estimation of Mohr's salt
2. Estimation of Oxalic acid
3. Estimation of Calcium

III. Dichrometry

4. Estimation of Ferrous Ion

IV. Iodo and Iodimetry

5. Estimation of Copper
6. Estimation of Potassium Dichromate
7. Estimation of Arsenious oxide

V. Inorganic preparation

1. Potash alum
2. Tetraammine copper (II) sulphate
3. Hexamminecobalt (III) chloride
4. Mohr's Salt

Recommended text

1. Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. *Basic Principles of Practical Chemistry*, 2nd ed.; Sultan Chand & Sons: New Delhi, 1997.
2. Nad, A. K.; Mahapatra, B.; Ghoshal, A.; *An advanced course in Practical Chemistry*, 3rd ed.; New Central Book Agency: Kolkata, 2007.

Reference Books:

1. Mendham, J.; Denney, R. C.; Barnes, J. D.; Thomas, M.; Sivasankar, B.;
- Vogel's Textbook of Quantitative Chemical Analysis*, 6th ed.; Pearson Education Ltd: New Delhi, 2000.

Web References:

1) <http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis>
<https://chemdictionary.org/titration-indicator/>

Course Learning Outcomes

CO1: explain the basic principles involved in titrimetric analysis and inorganic preparations.

CO2: compare the methodologies of different titrimetric analysis.

CO3: calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution.

CO4: assess the yield of different inorganic preparations and identify the end point of various titrations.

COURSE MAPPING CO -PO

CO /PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

COURSE MAPPING CO -PSO

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓

C. John
HOD of Chemistry

VALUE EDUCATION	SUB CODE:U231VE HOURS:2 CREDITS:2	UNIT IV உடல் நலம் மனநலம்	
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Unit I

முன்னுரை- விழுமிய கல்வி

1. வாழ்வியல் விழுமியங்கள்
2. விழுமியங்களின் வகைகள்
3. வாழ்வியல் விழுமியங்களை பாதிக்கும் காரணிகள்.
4. விழுமியக் கல்வியின் அவசியம்

Unit II

நன்னடத்தைகள்

1. பெற்றோரை மதித்தல்
2. ஆசிரியரை மதித்தல்
3. இறை வழிபாடு
4. சுயமதிப்பு

UNIT III

சமூகம் சார்ந்த மதிப்புகள்

1. ஒற்றுமை
2. சமத்துவம். சகோதரத்துவம்
3. குடும்பம்

1. உணவு ஒழுக்கம்

2. தனி மனித சுகாதாரம்

3. மகளிர் ஆரோக்யம்

4. எண்ணங்களின் வலிமை

Unit V

சீர்கேடுகளும் சீர்திருத்தங்களும்

சீர்கேடுகளும்

1. வாழ்க்கை விழுமியங்கள் மற்றும் அறங்களில் உலகமயமாதலின் பாதிப்பு

2. ஊடகங்களின் பாதிப்பு.

சீர்திருத்தங்கள்

3 மனக்கட்டுப்பாடு விருப்பங்களை நெறிப்படுத்துதல்

4. உடற்பயிற்சி தியானம் யோகா

FOUNDATION COURSE -FC INTRODUCTORY CHEMISTRY	SUB CODE :U23CH1FC
	HOURS:2
	CREDITS:2

Objectives of the course

- To create interest for the subject and research
- To providing knowledge on preparations of laboratory solutions
- To giving an overall view of latest trends in chemistry

UNIT –I

Definition –Chemistry, Electron, Proton, Neutron-Rutherford's nuclear model of the atom-Periodic table-electronic configuration of the s, p, d - block elements.

UNIT-II

Principles of Volumetric Analysis. Definition –Standard Solution, Titration, equivalence point, End point Indicator, Titrant.

Preparations of solution

Definition –Normality, 1N, 0.5N, 0.1N solution preparation.

UNIT-III- Preparation of laboratory reagents

4N HCl, 4N HNO₃, 4 N H₂SO₄, Aqueous ammonia (5N), 2N NaOH, Lime water, FeCl₃(0.5N), KMnO₄(0.1N), CuSO₄ (0.5N), Yellow ammonium sulphide, Na₂S₂O₄ (0.2N), Nessler's reagent, Ammonical silver nitrate, Bromine water, Fehling's solution A & B, Iodine solution, Schiff's reagent, Tollen's reagent Borche's reagent

UNIT-IV Test for organic subatances

Preminary test, Litmus test, Test for nitrogen , aromatic, aliphatic saturated unsaturated substances, NaHCO₃, NaOH

Test for functional groups Carboxylic acids, aldehyde, ketone, diamide, primary amine, carbohydrate, phenol, nitro compounds.

UNIT-V

Definition – Solution, solvent, solute, electrolytes, Melting point, Boiling point.

Introduction and Benefits of Green Chemistry, Nano Chemistry, Polymer Chemistry, Pharmaceutical Chemistry, Sono Chemistry and Phytochemistry

Green Chemistry

Definition - Green chemistry, 12 principles, green chemistry metrics - atom economy, E factor, microwave assisted reactions.

Reference Books:

1. Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. *Basic Principles*

of Practical Chemistry, 2nd ed.; Sultan Chand & Sons: New Delhi, 1997.

2. Nad, A. K.; Mahapatra, B.; Ghoshal, A.; *An advanced course in Practical*

3. *Chemistry*, 3rd ed.; New Central Book Agency: Kolkata, 2007.

Web References:

<http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis>

<https://chemdictionary.org/titration-indicator/>

Course Learning Outcomes

CO1: learn about the fundamental Theoretical knowledge of chemistry

CO2: learn about the fundamental Practical knowledge of chemistry

CO3: acquire information solution making.

CO4: acquire information reagents

CO5: have an idea about the Green Chemistry and its applications.

COURSE MAPPING CO-PO

CO /PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

COURSE MAPPING CO-PSO

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

C. Fotomi
HOD of Chemistry

**SEMESTER II
CORE COURSE –III
GENERAL CHEMISTRY-II**

SUB CODE :U23CHC203

HOURS:5

CREDITS:3

Objectives of the course

- This course aims at providing an overall view of the
- chemistry of acids, bases and ionic equilibrium
- properties of s and p-block elements
- chemistry of hydrocarbons
- applications of acids and bases
- compounds of main block elements and hydrocarbons

UNIT-I Acids, bases and Ionic equilibria

Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept, Lewis concept; Relative strengths of acids, bases and dissociation constant; dissociation of poly basic acids, ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degree of dissociation; acid base indicators, theory of acid base indicators – action of phenolphthalein and methyl orange, titration curves - use of acid base indicators;

Buffer solutions – types, mechanism of buffer action in acid and basic buffer, Henderson-Hasselbalch equation; Salt hydrolysis - salts of weak acids and strong bases, weak bases and strong acids, weak acids and weak bases - hydrolysis constant, degree of hydrolysis and relation between hydrolysis constant and degree of hydrolysis; Solubility product - determination and applications; numerical problem

Unit-II Chemistry of s - Block Elements

Hydrogen: Position of hydrogen in the periodic table. Alkali metals: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Preparation, properties and uses of NaOH, Na₂CO₃, KBr, KClO₃ alkaline earth metals. Anomalous behaviour of Be.

Chemistry of p- Block Elements (Group 13 & 14)

preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Alloys of Al.

comparison of carbon with silicon. Carbon-di-sulphide – Preparation, properties, structure and uses. Percarbonates, per monocarbonates and per dicarbonates.

UNIT-III Chemistry of p- Block Elements (Group 15-18)

General characteristics of elements of Group 15; chemistry of H₂N-NH₂, NH₂OH, HN₃ and HNO₃. Chemistry of PH₃, PCl₃, PCl₅, POCl₃, P₂O₅ and oxy acids of phosphorous (H₃PO₃ and H₃PO₄). General properties of elements of group 16 - Structure and allotropy of elements - chemistry of ozone - Classification and

properties of oxides - oxides of sulphur and selenium – Oxy acids of sulphur (Caro's and Marshall's acids).

Chemistry of Halogens: General characteristics of halogen with reference to electro negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI), oxides and oxy acids (HClO₄, Inter-halogen compounds (ICl, ClF₃, BrF₅ and IF₇), pseudo halogens [(CN)₂ and (SCN)₂] and basic nature of Iodine.

Noble gases: Position in the periodic table. Preparation, properties and structure of XeF₂, XeF₄, XeF₆ and XeOF₄; uses of noble gases - clathrate compounds.

UNIT-IV Hydrocarbon Chemistry-I

Petroproducts: Fractional distillation of petroleum; cracking, isomerisation, alkylation reforming and uses

Alkenes-Nomenclature, general methods of preparation – Mechanism of π - elimination reactions – E1 and E2 mechanism - factors influencing – stereochemistry – orientation – Hofmann and Saytzeff rules. Reactions of alkenes – addition reactions – mechanisms – Markownikoff's rule, Kharasch effect, oxidation reactions – hydroxylation, oxidative degradation, epoxidation, ozonolysis; polymerization.

Alkadienes Nomenclature - classification – isolated, conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to conjugated dienes - 1, 2 and 1, 4 additions; free radical addition to conjugated dienes – Diels–Alder reaction – polymerisation – polybutadiene, polyisoprene (natural rubber), vulcanisation, polychloroprene.

Alkynes Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, polymerisation and isomerisation.

Cycloalkanes: Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations. Conformational analysis of cyclohexane, mono and di substituted cyclohexanes. Geometrical isomerism in cyclohexanes

UNIT-V Hydrocarbon Chemistry - II

Benzene: Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's (4n+2) rule and its applications. Electrophilic substitution reactions - General mechanism of aromatic electrophilic substitution - nitration, sulphonation, halogenation, Friedel-Craft's alkylation and acylation. Mono substituted and disubstituted benzene - Effect of substituent – orientation and reactivity.

Polynuclear Aromatic hydrocarbons: Naphthalene – nomenclature, Haworth synthesis; physical properties, reactions – electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation & alkylation, preferential substitution at β - position – reduction, oxidation – uses. Anthracene – synthesis by Elbs reaction, Diels – Alder reaction and Haworth synthesis; physical properties; reactions - Diels-Alder reaction, preferential substitution at C-9 and C-10; uses.

Recommended Text

1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nded, S.Chand and Company, New Delhi.
2. Sathya Prakash, Tuli G D, Basu S K and Madan R D, (2003), Advanced Inorganic Chemistry, 17th ed., S.Chand and Company, New Delhi.
3. Bahl B S, Arul Bhal, (2003), Advanced Organic Chemistry, 3rd ed., S.Chand and Company, New Delhi.
4. Tewari K S, Mehrothra S N and Vishnoi N K, (1998), Text book of Organic Chemistry, 2nd ed., Vikas Publishing House, New Delhi.

Puri B R, Sharma L R, (2002), Principles of Physical Chemistry, 38th ed., Vishal Publishing Company, Jalandhar.

Reference Books

1. Maron S H and Prutton C P, (1972), Principles of Physical Chemistry, 4th ed., The Macmillan Company, New York.
2. Barrow G M, (1992), Physical Chemistry, 5th ed., Tata McGraw Hill, New Delhi.
3. Lee J D, (1991), Concise Inorganic Chemistry, 4thed., ELBS William Heinemann, London.
4. Huheey J E, (1993), Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed., Addison Wesley Publishing Company, India.
5. Gurudeep Raj, (2001), Advanced Inorganic Chemistry Vol – I, 26th ed., Goel Publishing House, Meerut.

Agarwal O P, (1995), Reactions and Reagents in Organic Chemistry, 8thed., Goel Publishing House, Meerut.

Website and e-learning source

https://onlinecourses.nptel.ac.in/http://cactus.dixie.edu/smbblack/chem1010/lecture_notes/4B.html

<http://www.auburn.edu/~deruija/pdareson.pdf> <https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding>

MOOC components

<http://nptel.ac.in/courses/104101090/>

Lecture 1: Classification of elements and periodic properties
<http://nptel.ac.in/courses/104101090/>

Course Learning Outcomes

- CO1:** explain the concept of acids, bases and ionic equilibria; periodic properties of s and p block elements, preparation and properties of aliphatic and aromatic hydrocarbons
- CO2:** discuss the periodic properties of s and p- block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids
- CO3:** classify hydrocarbons, types of reactions, acids and bases, examine the properties of s and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons
- CO4:** explain theories of acids, bases and indicators, buffer action and important compounds of s-block elements
- CO5:** assess the application of hard and soft acids indicators, buffers, compounds of s and p- block elements and hydrocarbons

COURSE MAPPING CO -PO

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

COURSE MAPPING CO -PSO

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

C. Jayaraj
HOD of Chemistry

**CORE COURSE -IV
QUALITATIVE ORGANIC
ANALYSIS AND PREPARATION
OF ORGANIC COMPOUNDS
PRACTICAL**

SUB CODE : U23CHC204P

HOURS:3

CREDITS:2

Objectives of the course

This course aims at providing knowledge on

- laboratory safety & handling glass wares
- analysis of organic compounds
- preparation of organic compounds

Qualitative Organic Analysis

Preliminary examination, detection of special elements - nitrogen, sulphur and halogens

Aromatic and aliphatic nature, Test for saturation and unsaturation, identification of functional groups using solubility tests

Confirmation of functional groups

- monocarboxylic acid, dicarboxylic acid
- monohydric phenol, polyhydric phenol
- aldehyde, ketone, ester
- carbohydrate (reducing and non-reducing sugars)
- primary, secondary, tertiary amine
- monoamide, diamide, thioamide anilide, nitro compound
- Preparation of derivatives for functional groups

Preparation of Organic Compounds

- i. Nitration - picric acid from Phenol
- ii. Halogenation - p-bromo acetanilide from acetanilide
- iii. Oxidation - benzoic acid from Benzaldehyde
- iv. Microwave assisted reactions in water:
 - v. Methyl benzoate to Benzoic acid
 - vi. Salicylic acid from Methyl Salicylate
 - vii. Rearrangement - Benzil to Benzilic Acid
 - viii. Hydrolysis of benzamide to Benzoic Acid

Reference books

1. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. *Basic Principles of Practical Chemistry*, 2nd ed.; Sultan Chand: New Delhi, 2012.
2. Manna, A.K. *Practical Organic Chemistry*, Books and Allied: India, 2018.
3. Gurtu, J. N; Kapoor, R. *Advanced Experimental Chemistry (Organic)*, Sultar Chand: New Delhi, 1987.
4. Furniss, B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A.R. *Vogel's Textbook of Practical Organic Chemistry*, 5th ed.; Pearson: India, 1989.

Website and learning source

<https://www.vlab.co.in/broad-area-chemical-sciences>

Course Learning Outcomes

CO1: observe the physical state, odour, colour and solubility of the given organic compound.

CO2: identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.

CO3: compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing and non-reducing sugars and explain the reactions behind it.

CO4: exhibit a solid derivative with respect to the identified functional group.

COURSE MAPPING CO-PO

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓

SEC-I ROLE OF CHEMISTRY IN DAILY LIFE	SUB CODE :U23CH2SE1 HOURS:2 CREDITS:2
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Objectives of the Course

This course aims at providing an overall view of the

- importance of Chemistry in everyday life
- chemistry of building materials and food
- chemistry of Drugs and pharmaceuticals

UNIT-I

General survey of chemicals used in everyday life. Air - components and their importance; photosynthetic reaction, air pollution, green - house effect and the impact on our life style. Water - Sources of water, qualities of potable water, soft and hard water, methods of removal of hardness-water pollution

Unit-II

Building materials - cement, ceramics, glass and refractories - definition, composition and application only. Plastics - polythene, PVC, bakelite, polyesters, melamine-formaldehyde resins -preparation and uses only.

UNIT-III

Food and Nutrition - Carbohydrates, Proteins, Fats - definition and their importance as food constituents – balanced diet – Calories minerals and vitamins (sources and their physiological importance). Cosmetics – tooth paste, face powder, soaps and detergents, shampoos, nail polish, perfumes - general formulation and preparations - possible hazards of cosmetic use.

UNIT-IV

Chemicals in food production – fertilizers - need, natural sources; urea,NPK fertilizers and super phosphate. Fuel – classification - solid, liquid and gaseous; nuclear fuel examples and uses.

UNIT-V

Pharmaceutical drugs - analgesics and antipyretics - paracetamol and aspirin. Colour chemicals - pigments and dyes - examples and applications. Explosives - classification and examples.

Recommended Text

- 1.Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.
- 2.A textbook of pharmaceutical chemistry by Jayashree Ghosh, S Chand publishing,

2012.

- 3.S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
- 4.B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.Introduction to forensic chemistry, Kelly M. Elkins, CRC Press Taylor & Francis Group, 2019.
5. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co.Publishers, second edition, 2006.

Reference Book

- 1.Randolph. Norris Shreve, Chemical Process Industries, McGraw-Hill,Texas, fourthedition, 1977.
- 2.W.A.Poucher,JosephA.Brink,Jr.Perfumes,Cosmetics and Soaps,Springer,2000.
3. A.K.De,EnvironmentalChemistry,NewAge InternationalPublicCo.,1990.

Course Learning Outcomes

- CO1:** learn about the chemicals used in everyday life as well as air pollution and waterpollution.
- CO2:** get knowledge on building materials cement, ceramics, glass and plastics, polythene,PVC bakelite, polyesters,
- CO3:** acquire information about Food and Nutrition. Carbohydrates, Proteins, Fats Alsohave an awareness about Cosmetics Tooth pastes, face powder, soaps and detergents.
- CO4:** discuss about the fertilizers like urea, NPK fertilizers and super phosphate. Fuel classification solid, liquid and gaseous; nuclear fuel - examples and uses
- CO5:** have an idea about the pharmaceutical drugs analgesics and antipyretics like paracetamol and aspirin and also about pigments and dyes and its applications

COURSE MAPPING CO -PO

CO /PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

COURSE MAPPING CO -PSO

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

C. J. Jini
HOD of Chemistry

**PART-IV
ENVIRONMENTAL STUDIES**

**SUB CODE:U232ES
HOURS:2
CREDITS:2**

UNIT:1 The Multidisciplinary nature of environmental studies

- ❖ Definition ,scope and importance
- ❖ Need for public awareness
- ❖ Natural resources
- ❖ Renewable and non- renewable resources
- ❖ Natural resources and associated problems

Unit –II Biodiversity and its conversation

- ❖ Introduction- definition, genetic , species and ecosystem diversity
- ❖ Biodiversity at global, national and local levels
- ❖ India as mega- diversity nation
- ❖ Hot – spots of biodiversity
- ❖ Conservation of Biodiversity. In-Situ and Ex-situ conservation of biodiversity

Unit- III Environmental problems

- ❖ Definition
- ❖ Causes , effects and control measures of
- ❖ Air pollution
- ❖ Water pollution
- ❖ Soil pollution
- ❖ Marine pollution
- ❖ Noise pollution
- ❖ Thermal pollution
- ❖ Nuclear hazard (Radioactive pollution)
- ❖ Solid waste management: causes effects and control measure of urban and industrial wastes.
- ❖ Role of an individual in prevention of pollution
- ❖ Pollution case studies
- ❖ Disaster management: floods earthquake, cyclone and landslides.

UNIT- IV

- ❖ From un sustainable to sustainable development
- ❖ Urban problems related to energy
- ❖ Water conservation rain water harvesting watershed management

- ❖ Resettlement and rehabilitation of people , its problems and concerns case studies
- ❖ Environmental ethics: issues and possible solution
- ❖ Climate change , global warming acid rain ozone layer depkletion
- ❖ Nuclear accidents and holocaust, case studies.
- ❖ Wasteland reclamation
- ❖ Consumerism and waste products
- ❖ Environment protection act
- ❖ Air (prevention and control pollution)
- ❖ Water (prevention and control pollution)
- ❖ Wildlife protection Act
- ❖ Forest conservation Act
- ❖ Issues involved in enforcement of environmental legislation
- ❖ Public awareness.

UNIT-V Human population and environment

- ❖ Population growth, variations among nations
- ❖ Population explosion – family welfare programme
- ❖ Environment and human health
- ❖ Human rights
- ❖ HIV/ AIDS
- ❖ Women and child welfare
- ❖ Role of information technology in environmentl human health
- ❖ Case studies.

EFFECTS OF FIRE WORKS

Man ,Environment and climate change – fire work celebrations- fire works and health hazards- types of fire- types and uses of fire extinguishers- fireworks and safety- creating awareness on reducing the usage of fire works.

C. P. S. S.
HOD of Chemistry

**ELECTIVE COURSE -
CHEMISTRY FOR PHYSICAL
SCIENCES I (FOR
MATHEMATICS & PHYSICS
STUDENTS)**

SUBCODE: U23CHGE4

HOURS:6

CREDITS:5

Objective of the course

This course aims to provide knowledge on the

- basics of atomic orbitals, chemical bonds, hybridization
- concepts of thermodynamics and its applications.
- concepts of nuclear chemistry
- importance of chemical industries
- Qualitative and analytical methods.

UNIT I Chemical Bonding and Nuclear Chemistry

Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.

Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences - Stellar energy. Applications of radio isotopes - carbon dating, rock dating and medicinal applications.

Unit II Industrial Chemistry Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses of silicones. Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.

UNIT III Fundamental Concepts in Organic Chemistry Hybridization: Orbital overlap, hybridization and geometry of CH₄, C₂H₄, C₂H₂ and C₆H₆. Electronic effects: Inductive effect and consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric- examples

Reaction mechanisms: Types of reactions-aromaticity (Huckel's rule) - aromatic electrophilic substitution; nitration, halogenation, Friedel- Craft's

alkylation and acylation. Heterocyclic compounds: Preparation, proper of pyrrole and pyridine.

UNIT IV Thermodynamics and Phase Equilibria Thermodynam Types of systems, reversible and irreversible processes, isotherm and adiabatic processes and spontaneous processes. Statements of 1 law and second law

of thermodynamics .Carnot's cycle and efficiency of heat engine. Entropy and its significance. Free energy change and its importance (no derivation).Conditions for spontaneity in terms of entropy and Gibbs free energy. Relationship between Gibbs free energy and entropy. Phase Equilibria: Phase rule - definition of terms in it. Applications of phase rule to water system. Two component system - Reduced phase rule and its application to a simple eutectic system (Pb-Ag).

UNIT V Analytical Chemistry Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques - extraction, distillation and crystallization. Chromatography principle and application of column, paper and thin layer chromatography

RecommendedText

1. V.Veeraiyan, Text book of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009.
2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006.
3. S.ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, NewDelhi, twenty third edition, 2012.
4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

Reference book

5. P.L.Soni,MohanKatyal,TextbookofInorganicchemistry;SultanChandandCompany,New Delhi, twentieth edition, 2007.
6. B.R.Puri,L.R.Sharma,M.S.Pathania,TextbookPhysicalChemistry;VishalPublishingCo., New Delhi, fortyfourth edition, 2018.
7. B.K,Sharma,IndustrialChemistry;GOELpublishinghouse,Meerut,sixteenth edition, 2014.

Course Learning Outcomes

- CO 1: gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications.
- CO 2: evaluate the efficiencies and uses of various fuels and fertilizers
- CO 3: explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.
- CO 4: apply various thermodynamic principles, systems and phase rule.
- CO 5: explain various methods to identify an appropriate method for the separation of chemical components

CO /PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

COURSE MAPPING CO-PSO

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓

C. Johni
HOD of Chemistry

**CHEMISTRY FOR
BIOLOGICAL SCIENCES I
(FOR BOTANY AND
ZOOLOGY STUDENTS)**

SUB CODE : U23CHGE1

HOURS:6

CREDITS:5

Objectives of the course

- This course aims at providing knowledge on
- basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry
- nuclear chemistry and industrial chemistry
- importance of speciality drugs and
- separation and purification techniques.

UNIT I

Chemical Bonding and Nuclear Chemistry

Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M. O diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.

Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions- group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences - Stellar energy. Applications of radioisotopes - carbon dating, rock dating and medicinal applications.

Unit II

Industrial Chemistry

Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required).

Silicones: Synthesis, properties and uses of silicones.

Fertilizers: Urea, ammonium sulphate, potassium nitrate NPK fertilizer, superphosphate, triple superphosphate.

UNIT III

Fundamental Concepts in Organic Chemistry

Hybridization: Orbital overlap hybridization and geometry of CH₄, C₂H₄, C₂H₂ and C₆H₆. Polar effects: Inductive effect and

consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation. Reaction mechanisms: Types of reactions- aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

UNIT IV Drugs and Speciality

Chemicals Drugs and Speciality Chemicals

Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen;

Artificial Sweeteners viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon.

UNIT V:

Analytical Chemistry

Introduction qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques: extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.

Recommended Text

1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009.
2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
3. ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.
4. P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

Reference Books

1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.
2. B.K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.
3. Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.

Course Learning Outcomes

CO1: state the theories of chemical bonding, nuclear reactions and its applications.

CO 2: evaluate the efficiencies and uses of various fuels and fertilizers.

CO 3: explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.

CO 4: demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.

CO 5: analyse various methods to identify an appropriate method for the separation of chemical components.

COURSE MAPPING CO -PO

CO /PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

COURSE MAPPING CO -PSO

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

C. J. Jini
HOD of Chemistry

**CHEMISTRY PRACTICAL
FOR PHYSICAL AND
BIOLOGICAL SCIENCES-I**

SUB CODE :

HOURS:3

CREDITS:4

7 Sem

OBJECTIVES

- To enable the students acquire the quantitative skills in volumetric analysis

VOLUMETRIC ANALYSIS:

1. Acidimetry and Alkalimetry

- a. Strong acid Vs Strong base
- b. Weak acid Vs Strong base

2. Permanganometry

- a. Estimation of Ferrous sulphate
- b. Estimation of Oxalic acid

3. Iodometry (demonstration only)

COURSE OUTCOMES

Students will be able to

- CO 1: To explain about standard solutions and given solution
- CO 2: Understand the handling of apparatus

COURSE MAPPING CO -PO

CO /PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO 1	✓	✓	✓	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓	✓	✓	✓

CO /PSO	PSO1	PSO2	PSO3	PSO4	
CO1	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	

C. John
HOD of Chemistry

**ELECTIVE COURSE
CHEMISTRY FOR PHYSICAL
SCIENCES II (FOR
MATHEMATICS & PHYSICS
STUDENTS)**

SUB CODE : 023CHGE5

HOURS:

CREDITS:

Objectives of the course

This course aims at providing knowledge on the

- Co-ordination Chemistry and Water Technology
- Carbohydrates and Amino acids
- basics and applications of electrochemistry
- basics and applications of kinetics and catalysis
- Various photochemical phenomenon.

UNIT I

Co-ordination Chemistry and Water Technology

Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature - Werner's theory - EAN rule - Pauling's theory - Postulates - Applications to $[\text{Ni}(\text{CO})_4]$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Co}(\text{CN})_6]^{3-}$ Chelation - Biological role of Haemoglobin and Chlorophyll (elementary idea) - Applications in qualitative and quantitative analysis.

Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques-BOD, COD.

Unit II

Carbohydrates and Amino acids

Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain ring structures of glucose and fructose. Glucose - fructose interconversion. Properties of starch and cellulose.

Amino acids: Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).

UNIT III

Electrochemistry

Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials - electrochemical series. Strong and weak electrolytes - ionic product of water - pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method - buffer solutions and its biological applications - electroplating - Nickel and chrome plating - Types of cells - fuel cells - corrosion and its prevention.

UNIT IV

Kinetics and Catalysis

Order and molecularity. Integrated rate expression for I and II (2A & Products) order reactions. Pseudo first order reaction, methods of determining order of a reaction Half-life period - Catalysis - homogeneous and heterogeneous, catalyst used Contact and Haber's processes. Concept of energy of activation and Arrhenius equation.

UNIT V

Photochemistry Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).

Recommended Text

1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009.
2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
3. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company New Delhi, twenty third edition, 2012.
4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

Reference Book

1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand & Company, New Delhi, twentieth edition, 2007.
2. R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.
3. B.K, Sharma, Industrial Chemistry; Meerut, sixteenth edition, 2014.

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette. CO 2: design, carry out, record and interpret the results of volumetric titration.

CO 3: apply their skill in the analysis of water/hardness.

CO4: analyze the chemical constituents in allied chemical products

CO /PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10
CO 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

COURSE MAPPING CO -PSO

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

C. Jotham
 HOD of Chemistry

This course aims to provide knowledge on

- nomenclature of coordination compounds and carbohydrates.
- Amino Acids and Essential elements of biosystem
- understand the concepts of kinetics and catalysis
- provide fundamentals of electrochemistry and photochemistry

UNIT I

Co-ordination Chemistry and Water Technology

Co-ordination Chemistry: Definition of terms - IUPAC Nomenclature- Werner's theory - EAN rule - Pauling's theory - Postulates - Applications to $[\text{Ni}(\text{CO})_4]$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Co}(\text{CN})_6]^{3-}$ Chelation - Biological role of Hemoglobin and Chlorophyll (elementary idea) - Applications in qualitative and quantitative analysis.

Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques -BOD and COD.

Unit II Carbohydrates

Classification, preparation and properties of glucose and fructose.

Discussion of open chain ring structures of glucose and fructose. Glucose-fructose interconversion. Preparation and properties

of sucrose, starch and cellulose.

UNIT III

Amino Acids and Essential elements of biosystem

Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method - Proteins- classification - structure - Colour reactions - Biological functions - nucleosides -nucleotides - RNA and DNA - structure. Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg.

UNIT IV

Electrochemistry

Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method - buffer solutions and its biological applications - electroplating - Nickel and chrome plating - Types of cells -fuel cells-corrosion and its prevention.

UNIT V

Photochemistry

Grothus - Drapper's law and Stark-Einstein's law of photochemical equivalence,

examples).

Recommended Book

1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009.
2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
3. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chandand Company, New Delhi, twenty third edition, 2012.
4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

Reference Book

1. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.
2. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
3. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.
4. B.R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.
5. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

SEMESTER - III
SUB CODE: U23CHC 305 /

CORE COURSE - V
GENERAL CHEMISTRY-III

U23CHC 305

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTERNAL	TOTAL
THEORY	6				3	25	75	100

COURSE OBJECTIVES

- This course aims to provide a comprehensive knowledge on
 - the physical properties of gases, liquids, solids and X-ray diffraction of solids.
 - fundamentals of nuclear chemistry and nuclear waste management.
 - applications of nuclear energy
 - basic chemistry of halo-organic compounds, phenol and other aromatic alcohols.

preparation and properties of phenols and alcohols.

UNIT I- Gaseous state

Kinetic molecular model of a gas: postulates and derivation from the kinetic gas equation; The Maxwell-Boltzmann distribution of speed of molecules- average, root mean square and most probable velocity and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Collision frequency; collision diameter; mean free path and viscosity of gases.

Real gases: Deviations from ideal gas behaviour, (Andrew's and Amagat's plots); compressibility factor, Z, and its variation with pressure for different gases. equations of states for real gases-van der Waal's equation; Virial equation; Boyle temperature; continuity of state-Van der waal's equation and the critical state; law of corresponding states-liquefaction of gases;.

UNIT-II- Liquid and Solid State

Properties of Liquids- Surface tension, viscosity and their applications. Crystalline and amorphous - differences - geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism

Crystals -size and shape; laws of crystallography; symmetry elements - plane, centre and axis; Miller indices, unit cells and space lattices; classification of crystal systems; Bravais lattices; X - ray diffraction - Bragg's equation

Packing in atomic solids - simple cubic, body centered cubic, face centered and hexagonal close packing; Co-ordination number in typical structures - NaCl, CsCl, ZnS,

TiO₂; comparison of structure and properties of diamond and graphite; Defects in solids - stoichiometric and nonstoichiometric defects.

UNIT-III- Nuclear Chemistry

Natural radioactivity - α , β and γ rays; half-life period; Fajan-Soddy group displacement law; Geiger-Natta rule; isotopes, isobars, isotones, mirror nuclei, isodiaphers; nuclear isomerism; radioactive decay series; magic numbers; units - Curie, Rutherford, Roentgen nuclear stability - neutron-proton ratio; binding energy; packing fraction; mass defect Simple calculations involving mass defect and B.E., decay constant and $t_{1/2}$ and radioactive series. Isotopes - uses - tracers - determination of age of rocks by radiocarbon dating. Nuclear energy: nuclear fission and fusion - major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures

UNIT-IV- Halogen derivatives Aliphatic halogen derivatives

Nomenclature and classes of alkyl halides - isomerism, physical properties, Chemical reactions. Nucleophilic substitution reactions - S_N1, S_N2 and S_Ni mechanisms stereochemical aspects and effect of solvent.

Di, Tri & Tetra Halogen derivatives: Nomenclature, classification, preparation properties and applications

Aromatic halogen compounds

Nomenclature, preparation, properties and uses

Mechanism of nucleophilic aromatic substitution - benzyne intermediate.

Aryl alkyl halides

Nomenclature, benzyl chloride - preparation - preparation properties and uses

UNIT-V -Phenols

Nomenclature; classification, Preparation from diazonium salts, cumene, process, Raching process; properties - acidic character and effect of substituent acidity. Reactions - Fries, claisen rearrangement, Electrophilic substitution reactions Reimer - Teimen, Kolbe, Schmidt, Gattermann synthesis, Libermann, nitro phthalic reaction.

Resorcinol, quinol, picric acid - preparation, properties and uses

Aromatic alcohols

Nomenclature, benzyl alcohol - methods of preparation - hydrolysis, reduction benzaldehyde, Cannizzaro reaction, Grignard synthesis, physical properties, reaction with sodium, phosphorus pentachloride, thionyl chloride, acetic anhydride hydrogen iodide, oxidation - substitution on the benzene nucleus, uses.

Thiols: Nomenclature, structure, preparation and properties.

Recommended Text

1. B.R. Puri, L.R. Sharma, M.S. Pathania; *Principles of Physical Chemistry*, 4th edition, Vishal Publishing, 2020.
2. B.R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009

3. P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, Sultan Chand & Sons, twentieth edition, 2006.
4. M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, Vishal Publishing, fourth reprint, 2003.

S.M. Mukherji, and S.P. Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.

Reference Text

1. T. W. Graham Solomons, *Organic Chemistry*, John Wiley & Sons, fifth edition, 1992.
2. A. Carey Francis, *Organic Chemistry*, Tata McGraw-Hill Education Pvt., Ltd., New Delhi, seventh edition, 2009.
3. I. L. Finar, *Organic Chemistry*, Wesley Longman Ltd, England, sixth edition, 1996.
4. P. L. Soni, and H. M. Chawla - *Text Book of Organic Chemistry*, New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007.
5. J.D. Lee, *Concise Inorganic Chemistry*, Blackwell Science, fifth edition, 2005.

Website and e-learning source

MOOC components <https://nptel.ac.in/courses/104104101> Solid state chemistry
<https://nptel.ac.in/courses/103106071> Nuclear industries and safety
<https://nptel.ac.in/courses/104106119> Introduction to organic chemistry

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

Course Learning Outcomes: Students will be able	
CO 1	explain the kinetic properties of gases by using mathematical concepts.
CO 2	describe the physical properties of liquid and solids; identify various types of crystals with respect to its packing and apply the XRD method for crystal structure determinations
CO 3	write the nomenclature, physical & chemical properties and basic mechanisms of haloorganic compounds and alcohols.
CO 4	investigate the radioactivity, nuclear energy and its production, also the nuclear waste management
CO 5	investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol including thiol.

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	4	4	4	4	4
CO 2	4	4	4	4	3
CO 3	4	4	2	4	3
CO 4	4	4	4	4	4
CO 5	4	4	4	2	4

C. Sharma

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTERNAL	TOTAL
PRACTICAL	3				2	25	75	100
COURSE OBJECTIVES								

COURSE OBJECTIVES

To develop the skill on systematic analysis of simple inorganic salts and mixture of salts.

Semi - Micro Qualitative Analysis

1. Analysis of simple acid radicals: Carbonate, sulphide, sulphate, thiosulphite, chloride, bromide, iodide, nitrate
2. Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate, arsenate, arsenite.
3. Elimination of interfering acid radicals and Identifying the group of basic radicals
4. Analysis of basic radicals (group wise): Lead, copper, bismuth, cadmium, tin, antimony, iron, aluminium, arsenic, zinc, manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium

Analysis of a mixture - I to VIII containing two cations and two anions (of which one is interfering type)

Reference Books:

1. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition, 1997.

Website and e-learning source : <https://www.vlab.co.in/broad-area-chemical-sciences>

Course Learning Outcomes (for Mapping with POs and PSOs)

On successful completion of the course the students should be able to

Course Learning Outcomes: Students will be able to		Level
CO 1	acquire knowledge on the systematic analysis of Mixture of salts.	K1
CO 2	identify the cations and anions in the unknown substance.	K3
CO 3	identify the cations and anions in the soil and water and to test the quality of water.	K3
CO 4	assess the role of common ion effect and solubility product	K4

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	4	4	3	3	4
CO 2	4	4	3	3	4
CO 3	4	4	4	4	4
CO 4	4	4	4	4	4
CO 5	4	4	2	2	4

C. J. J. J.

U23CH3DC

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTERNAL	TOTAL
THEORY	6				3	25	75	100

Course objectives:

This course enriches the student's understanding about the milk and the various techniques involved during the processing and preservation of milk. This course also deals with various dairy products such as special milk, milk derivatives, and fermented milk products derived from milk.

Unit – I Composition of milk

Composition and structure of milk – constituents of milk – lipids, proteins, carbohydrates, vitamins and minerals – Properties of milk – odour, density, viscosity, optical properties, acidity, freezing point – Recknagel's effect – estimation of fats and total solids in milk.

Unit – II Milk processing and preservation

Microbiology of milk – Destruction of microorganism in milk – pasteurisation – types of Pasteurisation – bottle, Batch and HTST – ultra high temperature pasteurisation – preservatives and neutraliser.

Unit – III Milk Derivatives Cream – composition – chemistry of creaming process Butter – composition – desibutter – salted butter .Ghee – major constituents – common adulterants added to ghee and their detection – rancidity – definition – prevention – antioxidants.

Unit– IV Special Milk

Definition – merits – flow diagram for manufacturing – reconstituted milk – homogenised milk – flavoured milk – vitaminised milk – toned milk – imitation milk – condensed milk – definition, composition and nutritive value

cream – Ice cream – Types- ingredients-manufacture-stabilizer-emulsifiers and their role-Milk powder-Skimmed milk powder-whole milk powder- butter milk powder- cheese – un ripened cheese – ripened cheese – paneer – yohurt and mazzorola cheese.Types of drying process.

References:

1. Sukumar De, Outlines of Dairy Technology, Oxford Univer Press, New Delhi, 2001
2. Lillian Hoagland Meyer, Food Chemistry, CBS Publishers, Delhi.2004

Course Outcome:

At the end of the course, the students will be able to

Course Learning Outcomes: Students will be able		Lev
CO 1	Define and construct the flow chart for manufacturing various kinds of special milks	K1
CO 2	Explain composition, chemistry of milk derivatives and Identify the common adulterants in ghee	K2
CO 3	Describe physical properties, composition, structure and constituents of milk	K3
CO 4	Describe various milk products	K3
CO 5	Discuss the microbiology of milk and various pasteurisation techniques	K6

COURSE MAPPING CO -PSO

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSC
CO1	4	3	3	4	3
CO2	4	3	3	4	3
CO3	4	2	4	4	2
CO4	4	3	3	4	4
CO 5	4	4	4	2	4

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CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTERNAL	TOTAL
ORY						25	75	100

OBJECTIVES

- To learn about the quality of water and water pollution
- To know about of toxicity of metals in water and its treatment
- To understand the various separation and purification techniques

I

Source of water - impurities in water - hardness of water – types of hardness - unit of hardness – important specifications of drinking water (WHO).

I -II

Water pollution: Various water pollutants (sewage & other oxygen demanding substances, infectious agents, exotic organic chemicals, inorganic minerals & chemical compounds, sediments, radioactive substances, heat, oil and detergents)

UNIT -III Toxicity in Water

Mn, Cu, Se, Mo, Cd, I, Hg, Pb, Fe and Zn - treatment of domestic water by primary, secondary treatments and tertiary treatments by ion exchange process and Reverse Osmosis Process.

UNIT-IV

Separation and Purification techniques: Principles and techniques of precipitation, fractional crystallization, sublimation, simple distillation, fractional

distillation and steam distillation, distillation under reduced pressure and solvent extraction (using Soxhlet extraction).

UNIT - V

Chromatographic techniques: Mobile phase and stationary phase- TLC and paper Chromatographic techniques (sampling, development, R_f values, identification)

REFERENCE BOOKS:

- Balasubramanian M.R., Krishnamoorthy S., Murugesan V., Engineering Chemistry – A text book, Allied publishers Ltd., New Delhi.
- Puri B.R. Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, Milestone Publishers, Delhi (2008)
- Usharani S., Analytical Chemistry, Macmillan India Ltd New Delhi (2000)
- Gopalan. R., Subramaniam P.S. and Rengarajan K., Elements of Analytical Chemistry, Sultan Chand and Sons, New Delhi (2000).

Course Learning Outcomes: Students will be able to		Level
CO 1	To learn about the quality of water and water pollution	K2
CO 2	To Know about toxicity of metals in water and its treatment	K3
CO 3	To understand the various separation technique	K6
CO 4	To understand purification technique	K4

COURSE MAPPING CO -PSO

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	4	3	4	3	4
CO2	4	3	4	3	4
CO3	4	4	2	4	4
CO4	4	4	4	2	4

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTERNAL	TOTAL
COURSE	6				3	25	75	100

COURSE OBJECTIVES

This course aims to provide a comprehensive knowledge on

- thermodynamic concepts on chemical processes and applied aspects.
- thermo chemical calculations
- transition elements with reference to periodic properties and group study of transition metals.
- the organic chemistry of ethers, aldehydes and ketones
- organic chemistry of carboxylic acids

UNIT I

Thermodynamics- I

Terminology – Intensive, extensive variables, state, path functions; isolated, closed and open systems; isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible processes; First law of thermodynamics – Concept and significance of heat (q), work (w), internal energy (E),

enthalpy (H); calculations of q, w, E and H for reversible, irreversible expansion of ideal and real gases under isothermal and adiabatic conditions; relation between heat capacities (C_p & C_v); Joule Thomson effect- inversion temperature, thermochemistry - heats of reactions, standard states; types of heats of reactions and their applications; effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions; Hess's law and its applications; determination of bond energy; Zeroth law of thermodynamics-Absolute Temperature scale

UNIT II

Thermodynamics- II

Second law of thermodynamics - Limitations of first law, spontaneity and randomness, Carnot's cycle; Concept of entropy, entropy change for reversible and irreversible processes, entropy of mixing, calculation of entropy changes of an ideal gas and a van der Waals gas with changes in temperature, volume and pressure, entropy and disorder. Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application. Third law of thermodynamics - Nernst heat theorem; Applications of third law - evaluation of absolute entropies from heat capacity measurements, exceptions to third law.

UNIT III

General Characteristics of d-block elements

Transition Elements- Electronic configuration - General periodic trend variable valency, oxidation states, stability of oxidation states, colour, magnetic properties, catalytic properties and tendency to form complexes. Comparative study of transition elements and non transition elements – comparison of II and III transition series with I transition series. Group study of Titanium, Vanadium, Chromium, Manganese, Iron, Cobalt, Nickel and Zinc groups.

UNIT IV Ethers, Thio ethers and Epoxides

Nomenclature, isomerism, general methods of preparations, reactions involving cleavage of C-O linkages, alkyl group and ethereal oxygen. Zeisel's method of estimation of methoxy group.

Reactions of epoxides with alcohols, ammonia derivatives and LiAlH_4 Thioethers - nomenclature, structure, preparation, properties and uses.

Aldehydes and Ketones

Nomenclature, structure and reactivity of aliphatic and aromatic aldehydes and ketones; general methods of preparation and physical properties. Nucleophilic addition reactions: base catalysed reactions with mechanism- Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. Oxidation of aldehydes. Baeyer - Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf -Kishner reduction, Meerwein - Ponnorf Verley reduction, reduction with LiAlH_4 and NaBH_4 .

Addition reactions of unsaturated carbonyl compounds: Michael addition.

UNIT V Carboxylic Acids: Nomenclature, structure, physical and aromatic monocarboxylic acids. Physical properties, acidic nature, effect of substituent on acidic strength. H^+ reaction, Claisen ester condensation, Bouveault Blanc reduction, decarboxylation, Hunsdiecker reaction. Formic acid-reducing property. Reactions of dicarboxylic acids, hydroxy acids and unsaturated acids.

Carboxylic acid Derivatives: Preparations of aliphatic and aromatic acid chlorides, esters, amides and anhydrides. Nucleophilic substitution reaction at the acyl carbon of acyl halide, anhydride, ester, amide. Schotten-Baumann reaction. Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann bromamide degradation and Curtius rearrangement.

Active methylene compounds: Keto – enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate

Halogen substituted acids – nomenclature; preparation by direct halogenation, iodination from unsaturated acids, alkyl malonic acids

Hydroxy acids – nomenclature; preparation from halo, amino, aldehydic and ketonic acids, ethylene glycol, aldol acetaldehyde; reactions – action of heat on α, β , hydroxy acids.

Recommended Text

1. B.R. Puri and L.R. Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chand and Co., thirty three edition, 1992.
 2. K. L. Kapoor, *A Textbook of Physical chemistry*, (volume-2 and 3), Macmillan, India Ltd, third edition, 2009.
 3. P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, Sultan Chand & Sons, twentieth edition, 2006.
 4. M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, Vishal Publishing, fourth reprint, 2003.
- S.M. Mukherji, and S.P. Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.

Reference Books

1. Maron, S. H. and Prutton C. P. *Principles of Physical Chemistry*, 4th ed.; The Macmillan Company: New York, 1972.
2. Lee, J. D. *Concise Inorganic Chemistry*, 4th ed.; ELBS William Heinemann: London, 1991.
3. Gurudeep Raj, *Advanced Inorganic Chemistry*, 26th ed.; Goel

Press: New York, 2014.

Huheey, J. E. *Inorganic Chemistry: Principles of Structure and Reactivity*, Addison Wesley Publishing Company: India, 1993.

Website and learning source

MOOC components <https://nptel.ac.in/courses/112102255> Thermodynamics
<https://nptel.ac.in/courses/104101136> Advanced transition metal chemistry

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

Course Learning Outcomes: Students will be able	
CO 1	explain the terms and processes in thermodynamics; discuss the various laws of thermodynamics and thermo chemical calculations.
CO 2	investigate the chemistry of transition elements with respect to various periodic properties and group wise discussions.
CO 3	discuss the second law of thermodynamics and its application to heat engine; discuss third law and its application on heat capacity measurement.
CO 4	discuss the fundamental organic chemistry of ethers, epoxides and carbonyl compounds including named organic reactions.
CO 5	discuss the chemistry and named reactions related to carboxylic acids and their derivatives; discuss chemistry of active methylene compounds, halogen substituted acids and hydroxyl acids

COURSE MAPPING CO -PSO

CO / PSO	PSO1	PSO2	PSO3	PSO4
CO1	4	4	4	4
CO2	4	3	4	4
CO3	3	4	2	3
CO4	4	4	3	2
CO5	4	4	3	4

th

HOURS				CREDITS	MARKS		
L	T	P	O		CIA	INTERNAL	TOTAL
					25	75	100

Introduction to Environment Ecosystem –meaning– types – structure – functions, levels of organization in nature– food chain structure, biogeochemical cycles, energy flow.

–meaning– types –components– structure – functions, levels of organization in nature– food chain and trophic structure, biogeochemical cycles.

Municipal solid waste

– sources and types of solid waste– composition and its determinants of factors influencing of municipal solid waste – generation–methods of and characterization.

Collection and Transfer

of solid waste – collection system, equipments – labour requirement – selecting collection–need for transfer operation – transfer stations – types – means and methods – location of transport stations – manpower requirement.

Processing Techniques and Recovery of Energy

g techniques – purposes mechanical volume reduction – chemical reduction – components separation – methods – drying and drying–recovery of resources, conversion products and energy recovery– operation with heat recovery.

Disposal of Solid Wastes

of municipal and bio-wastes– various methods – principal features of an incinerator – site selection and plant layout of an incinerator – sanitary landfill– of operation – advantages and disadvantages of sanitary land fill.

For Study

1. John Pichtel *Waste Management Practices* CRC Press, Taylor and Francis Group 2005.
Unit– I Chapter 1Unit– II Chapter 4

2. LaGrega, M.D. Buckingham, P.L. and Evans, J.C.*Hazardous Waste Management*,

U23CH4WM

McGraw Hill International Editions, New York, 1994.
Unit– III Chapter 2

3. Richard J. Watts, *Hazardous Wastes – Sources, Pathways, Receptors*, John Wiley and Sons, New York, 1997.
Unit– IV Chapter – 2.3 and 2.5Unit– V Chapter – 7.1,7.2, 7.5

Book for Reference

1. George Tchobanoglous, *Integrated Solid Waste Management*, 2nd Edition,, McGraw – Hill, New York, 1993.
2. Tchobanoglous Thiesen Ellasen, *Solid Waste Engineering Principles and Management*, McGraw – Hill, New York, 1997.*Manual on Municipal Solid waste Management*, CPHEEO, Ministry of Urban Development, Govt. Of. India, New Delhi, 2000

COURSE OUTCOMES

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

Course Learning Outcomes: Students will be able to		Level
CO 1	Understand the protection of the environment through effective waste management measures	K2
CO 2	Apply the knowledge of solid waste into useful	K3
CO 3	Increase consumer awareness of waste minimization issues	K6
CO 4	Analysis and recommend the people about the protection of health and wellbeing of people by providing an affordable waste collection service	K4
CO 5	Design and manufacture of products that avoid or minimize waste (2 hours) Processing techniques – purposes mechanical volume r	K6

COURSE MAPPING CO -PSO

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO
CO1	4	4	4	4	4
CO2	(12 Hqurs)	4	4	2	4
CO3	4	4	2	4	4
CO4	4	4	4	2	4

[Signature]

SEMESTER – IV
SUB CODE:

CORE COURSE – VIII
PHYSICAL CHEMISTRY PRACTICAL-I

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTERNAL	TOTAL
THEORY	6				3	25	75	100

UNIT I

Chemical kinetics

1. Determination of rate constant of acid catalysed hydrolysis of an ester (methyl acetate).
2. Determination of order of reaction between iodide and persulphate(initial rate method).
3. Polarimetry: Determination of rate constant of acid catalysed inversion of cane sugar

Thermochemistry

4. Determination of heat of neutralisation of a strong acid by a strong base.
5. Determination of heat of hydration of copper sulphate.

UNIT II

Electrochemistry – Conductance measurements

6. Determination of cell constant
7. Determination of molar conductance of strong electrolyte
8. Determination of dissociation constant of acetic acid

Colorimetry

5. Determination of concentration of copper sulphate solution

UNIT III

Colligative property

10. Determination of molecular weight of an organic compound by Rast method using

naphthalene or diphenyl as solvent

Adsorption

11. Construction of Freundlich isotherm for the adsorption of acetic acid on charcoal

Reference Books

1. Sindhu, P.S. *Practicals in Physical Chemistry*, Macmillan India 2005.
2. Khosla, B. D. Garg, V. C.; Gulati, A.; *Senior Practical Physical Chemistry*, R. Chand : New Delhi, 2011.
- Gupta, Renu, *Practical Physical Chemistry*, 1st Ed.; New Age International, 2017.

Website and

e-learning source

<https://www.vlab.co.in/broad-area-chemical-sciences>

Course Learning Outcomes (for Mapping with POs and PSO)

On completion of the course the students should be able to

Course Learning Outcomes: Students will be able to	
CO 1	describe the principles and methodology for the practical work
CO 2	demonstrate laboratory skills for safe handling of the equipment and chemicals
CO 3	apply the principles of electrochemistry, kinetics for carrying out the practical work.
CO 4	explain the procedure, data and methodology for the practical work

COURSE MAPPING CO-PSO

CO / PSO	PSO1	PSO2	PSO3	PSO4
CO1	4	4	3	5
CO2	4	4	4	2
CO3	4	4	4	4
CO4	4	4	2	

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTERNAL	TOTAL
CATEGORY	2				3	25	75	100

I Nutrition

Definition – food pyramid – health – hygiene – nutritional foods – significance of nutritional supplements – malnutrition – under nutrition – over nutrition – causes and remedies.

II Carbohydrates, Proteins and Vitamins (6 Hours) Carbohydrates – definition – classification – examples – simple qualitative analysis of carbohydrates – biological functions – proteins – definition – classification – examples – simple qualitative analysis of proteins – biological functions – vitamins – definition – classification – examples – biological functions.

III Enzymes and Hormones in Digestion (6 Hours) Enzymes and hormones – types of enzymes – enzyme action – hormones – types of hormones – function of hormones – examples of essential hormones – digestion in mouth, stomach, intestine and pancreas

IV Common Diseases Diseases – malaria, typhoid, dysentery, vomiting, jaundice, asthma, epilepsy, anemia, diabetes and their causes.

V Drugs – classification of drugs – definition and examples of antipyretics, antibiotics, antiseptics, analgesics, anti-convulsant agents, anaesthetics and cardiovascular drugs.

Books for Study

- Jayashree Ghosh, *Fundamental Concepts of Applied Chemistry*, 2nd Edition, New Delhi, 2006.

- Alex V Ramani, *Food Chemistry*, MJP Publishers, Chennai

Unit-I Chapter 1 Unit-II Chapters 2,3 and 5 Unit-II

Books for Reference

- Ashutosh Kar, *Medicinal Chemistry*, Wiley Easterns limited 1993.
- Bahl and Arun Bahl, *A text book of Organic Chemistry* Edition, S. Chand Publishers, New Delhi, 2019.

COURSE OUTCOMES

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

Course Learning Outcomes: Students will be able	
CO 1	Apply the knowledge of nutrition and drugs in curing disease
CO 2	Discuss the significance of nutritional supplements and drugs
CO 3	Predict the causes for various diseases.
CO 4	Analyse the classifications of carbohydrates, proteins and vitamins.
CO 5	Identify the roles played by proteins, vitamins, enzymes and hormones.

COURSE MAPPING CO-PSO

CO / PSO	PSO1	PSO2	PSO3	PSO4
CO1	4	4	3	4
CO2	(6 Hours)	4	3	4
CO3	4	4	2	2
CO4	4	4	4	4
CO5	4	4	4	2

C. Ghosh

**SEMESTER-V
CORE COURSE-IX
ORGANIC CHEMISTRY - I** U23CHC509

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTERNAL	TOTAL
Theory	6				6	25	75	100

Objectives of the course

- This course aims to provide an understanding of
- stereoisomerism in chiral and geometric isomerism in olefins, conformations of ethane and butane
- preparation and properties of aromatic and aliphatic nitro compounds and amines
- preparation of different dyes, food colour and additives
- preparation and properties of five membered heterocycles like pyrrole, furan and thiophene
- preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline.

UNIT I--Stereochemistry

Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions;

Geometrical isomerism: cis-trans, syn-anti isomerism, E/Z notations.

Optical Isomerism: Optical activity, specific rotation, asymmetry, enantiomers, distereoisomers, meso structures - molecules with one and two chiral centres, racemisation- methods of racemisation; resolution- methods of resolution. C.I.P rules. R and S notations for one and two chirality (stereogenic) centres.

Molecules with no asymmetric carbon atoms – allenes and biphenyls. Conformational analysis of ethane and butane.

UNIT II Chemistry of Nitrogen Compounds – I

Nitroalkanes

Nomenclature, isomerism, preparation from alkyl halides, halo acids, alkanes; physical properties; reactions – reduction, halogenations, Grignard reagent, Pseudo acid character. Nitro - aci nitro tautomerism.

Aromatic nitro compounds

Nomenclature, preparation – nitration, from diazonium salts, physical properties; reactions - reduction of nitrobenzene in different medium, Electrophilic substitution reactions, TNT.

Amines: Aliphatic amines

Nomenclature, isomerism, preparation – Hofmanns' degradation reaction, Gabriel's phthalimide synthesis, Curtius Schmidt rearrangement.

Physical properties, reactions – alkylation, acylation, carbylamine reaction, Mannich reaction, oxidation, basicity of amines.

UNIT III-Chemistry of Nitrogen Compounds – II

Aromatic amines – Nomenclature, preparation – from nitro compounds, Hofmann's method; Schmidt reaction, properties - basic nature, ortho effect; reactions – alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, oxidation, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid - zwitter ion formation.

Distinction between primary, secondary and tertiary amines - aliphatic and aromatic

Diazonium compounds.

Diazomethane, Benzene diazonium chloride - preparations and synthetic applications.

Dyes

Theory of colour and constitution; classification based on structure and application; preparation – Martius yellow, aniline yellow, methy orange, alizarin, indigo, malachite green.

Industry oriented content

Dyes Industry, Food colour and additives

UNIT IV-Heterocyclic compounds

Nomenclature and classification. General characteristics - aromatic character and reactivity.

Five-membered heterocyclic compounds

Pyrrole – preparation - from succinimide, Paal Knorr synthesis; reactions – reduction, basic character, acidic character, electrophilic substitution reactions, ring opening.

Furan – preparation from mucic acid and pentosan; reactions – hydrogenation, reaction with oxygen, Diels Alder reactions, formation of thiophene and pyrrole; Electrophilic substitution reaction.

Thiophene synthesis - from acetylene; reactions –reduction; oxidation; electrophilic substitution reactions.

UNIT V- Six-membered heterocyclic compounds

Pyridine – synthesis - from acetylene, Physical properties; reactions - basic character, oxidation, reduction, electrophilic substitution reactions; nucleophilic substitution- uses .Condensed ring systems

Quinoline – preparation - Skraup synthesis and Friedlander's synthesis; reactions – basic nature, reduction, oxidation; electrophilic substitutions; nucleophilic substitutions – Chichibabin reaction.

Isoquinoline – preparation by the Bischler – Napieralski reaction, reduction, oxidation; electrophilic substitution.

Recommended Text

- 1.M.K. Jain, S.C.Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2009.
- 2.S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 2009.
3. ArunBahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand& Company Pvt. Ltd., Multicolour edition, 2012.
- 4.P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007.
- 5.C.N.Pillai, Text Book of Organic Chemistry, Universities Press (India) Private Ltd., 2009.

Reference Books

- 1.R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson

2. T. W. Graham, Organic Chemistry, eleventh edition, 2012.
3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Pvt. Ltd., New Delhi, seventh edition, 2009.
4. I. L. Finar, Organic Chemistry, Vol. (1& 2), Elsevier, Longman Ltd, sixth edition, 2006.
5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, fourth Edition, 2010.

Website and e-learning sources

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. <http://swayam.gov.in>
4. Virtual Textbook of Organic Chemistry

Course Learning Outcomes

Course Learning Outcomes: Students will be able to	
CO 1	Assign RS notations to chirals and EZ notation and explain conformations of ethane and ethane
CO 2	Explain preparation and properties of aromatic and aliphatic nitro compounds and amines
CO 3	Explain colour and constitution of dyes and pigments
CO 4	Discuss preparation and properties of five membered heterocycles like pyrrole, furan and thiophene
CO 5	Discuss preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline

COURSE MAPPING CO -PSO

CO / PSO	PSO1	PSO2	PSO3
CO1	4	4	4
CO2	4	4	4
CO3	4	4	4
CO4	4	4	4
CO5	3	2	2

**CORE COURSE -X
PHYSICAL CHEMISTRY -I** U28CHC510

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTER NAL	TOTAL
Theory	5				5	25	75	100

Objectives of the course

- The course aims at providing an overall view of
- Gibbs free energy, Helmholtz free energy, Ellingham's diagram and partial molar properties
- chemical kinetics and different types of chemical reactions
- adsorption, homogeneous and heterogeneous catalysis
- colloids and macromolecules
- photochemistry, fluorescence and phosphorescence

Course Outline

UNIT I- Thermodynamics - III

Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application.

Partial molar properties – chemical potential, Gibbs Duhem equation, variation of chemical potential with temperature and pressure, chemical potential of a system of ideal gases, Gibbs- Duhem-Margules equation.

UNIT II

Chemical Kinetics

Rate of reaction - Average and instantaneous rates, factors influencing rate of reaction - molecularity of a reaction - rate equation - order of

reaction. order and molecularity of simple and complex reactions, Rate laws - Rate constants – derivation of rate constants and characteristics for zero, first order, second (equal initial concentration).

Methods of determination of order of Volumetry, manometry and polarimetry.

Effect of temperature on reaction rate – temperature coefficient - concept of activation energy - Arrhenius equation. Theories of reaction rates – Collision theory – derivation of rate constant of bimolecular gaseous reaction – Failure of collision theory. Lindemann's theory of unimolecular reaction. Theory of absolute reaction rates – Derivation of rate constant for a bimolecular reaction – significance of entropy and free energy of activation. Comparison of collision theory and ARRT.

Complex reactions – reversible and parallel reactions (no derivation and only examples)

– kinetics of consecutive reactions – steady state approximation.

UNIT III

Adsorption – Chemical and physical adsorption and their general characteristics- distinction between them Different types of isotherms – Freundlich and Langmuir. Adsorption isotherms and their limitations – BET theory, kinetics of enzyme catalysed reaction –Michaelis- Menten – Lineweaver- Burk plot – inhibition – reversible – competitive, noncompetitive and uncompetitive (no derivation of rate equations)

Catalysis – general characteristics of catalytic reactions, auto catalysis promoters, negative catalysis, poisoning of a catalyst – theories of homogenous and heterogeneous catalysis – Kinetics of Acid – base and enzyme catalysis. Heterogeneous catalysis

UNIT IV

Colloids and Surface Chemistry

Colloids: Types of Colloids, Characteristics Colloids (Lyophilic and Lyophobic sols),

Preparation of Sols- Dispersion methods, aggregation methods, Properties of Sols- Optical properties, Electrical properties - Electrical double layer Electro Kinetic properties- Electro-osmosis, Electrophoresis,

Website and e-learning source

1. <https://nptel.ac.in>
2. <https://swayam.gov.in>
3. www.epgpathshala.nic.in

Course Learning Outcomes

Course Learning Outcomes: Students will be able	
CO 1	Explain Gibbs and Helmholtz free energy function, molar quantities and Ellingham's diagrams.
CO 2	Apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction, determine the effect of temperature on reaction rate, and the effect of free energy and entropy of activation.
CO 3	Compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogeneous and heterogeneous catalysis.
CO 4	Demonstrate the types and characteristics of sols and emulsions, and determine molecular weights of macromolecules.
CO 5	Utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and colorimetry.

COURSE MAPPING CO-PSO

CO / PSO	PSO1	PSO2	PSO3
CO1	4	4	4
CO2	4	4	4
CO3	4	4	4
CO4	4	4	4
CO5	3	2	2

Coagulation or precipitation, Stability of sols, associated colloids, Emulsions, Gels-preparation of Gels, Applications of colloids
Macromolecules: Molecular weight of Macromolecules-Number average molecular weight-average molecular weight, Determination of Molecular weight of molecules.

UNIT V

Photochemistry

Laws of photo chemistry – Lambert – Beer, Grotthus – Draper and Stark – Einstein. Quantum efficiency. Photochemical reactions – rate law – Kinetics of H_2-Cl_2 , H_2-Br_2 and H_2-I_2 reactions, comparison between thermal and photochemical reactions.

Fluorescence – applications including fluorimetry – sensitised fluorescence, phosphorescence – applications - chemiluminescence and photosensitisation – examples

Recommended Text

1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., forty eighth edition, 2021.
2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.
3. Arun Bahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co.
4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996.
5. J. Rajaram and J.C. Kuriacose, Thermodynamics, Shoban Lal Nagin Chand and CO., 1986.

Reference Books

1. J. Rajaram and J.C. Kuriacose, Chemical Thermodynamics, Pearson, 1st edition, 2013.
2. Keith J. Laidler, Chemical kinetics, third edition, Pearson, 2003.
3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002.
4. K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India

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CORE COURSE -XI
GRAVIMETRIC ANALYSIS -PRACTICAL

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTER NAL	TOTAL
Theory	6				3	40	60	100

OBJECTIVES

- ❖ To estimate Ca Mg, Ba, Pb and Ni as Chromate and sulphate by gravimetric method.

Gravimetric Analysis :

1. Estimation of Calcium as Calcium oxalate.
2. Estimation of Barium as Barium sulphate.
3. Estimation of Barium as Barium chromate.
4. Estimation of Lead as Lead sulphate.
5. Estimation of Lead as Lead chromate.
6. Estimation of Nickel Dimethylglyoxime.

COURSE OUTCOMES

At the end of the course the students will be able to

CO 1 : Gravimetrically estimate the inorganic salts

Course Learning Outcomes

Course Learning Outcomes: Students will be able to		Level
CO 1	Learn the procedure of Gravimetric Analysis	K1

COURSE MAPPING CO -PSO

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	4	4	4	4	4

C. John
HOD of Chem

SCHOOL OF CHEMISTRY
K. J. Somaiya Institute of Engineering & Technology
KUMHAR

**DSE-I (CHOICE-I)
INORGANIC CHEMISTRY -I**

U23CHQES:1

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTERNAL	TOTAL
Theory	4				4	25	75	100

Objectives of the course

The course aims to provide knowledge on

- Nomenclature, isomerism and theory of coordination compounds, and chelate complexes
- Crystal field theory, magnetic properties, stability of complexes and Jahn Teller effect
- Preparation and properties of metal carbonyls
- Lanthanoids and actinoids
- Preparation and properties of inorganic polymers

UNIT I-Co-ordination Chemistry - I

IUPAC Nomenclature of coordination compounds, Isomerism in coordination compounds.

Werner's coordination theory – effective atomic number – interpretation of geometry and magnetic properties by Pauling's theory – geometry of coordination compounds with co-ordination number 4 & 6.

Chelates – types of ligands forming chelates – stability of chelates, applications of chelates in qualitative and quantitative analysis – application of DMG and oxime in gravimetric analysis – estimation of hardness of water using EDTA, metal ion indicators.

Role of metal chelates in living systems – haemoglobin and chlorophyll

Unit II- Co-ordination Chemistry - II

Crystal field theory – Crystal field splitting of energy levels in octahedral and tetrahedral complexes, Crystal field stabilization energy (CFSE), spectrochemical series - calculation of CFSE in octahedral and tetrahedral

complexes, crystal field effect on ionic radii, heats of hydration, water as a ligand (heat of hydration), interpretation of magnetic spectra of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ - Jahn – Teller effect. Stability in aqueous solution, stability constants- factors affecting the complex ion, thermodynamic and kinetic stability (e.g. Comparison between VBT and CFT).

UNIT III-Organometallic compounds

Metal Carbonyls

Mono and polynuclear carbonyls, General methods of preparation, carbonyls – general properties of binary carbonyls – bonding in carbonyls of Ni, Fe, Cr, Co – structure and bonding in carbonyls of Ni, Fe, Cr, Co – EAN rule as applied to metal carbonyls.

Ferrocene-Methods of preparation, physical and chemical properties

UNIT IV-Inner transition elements (Lanthanoids and Actinoids)

General characteristics of f-block elements - Comparison of lanthanoids and actinoids - Occurrence, Oxidation states, properties, Colour and spectra - Lanthanoids and Actinoids - Ion-Exchange and Solvent extraction methods - Lanthanoid Chemistry of thorium and Uranium-Occurrence, properties and uses - Preparation, Properties and uses of thorium sulphate, thorium dioxide and uranyl acetate.

UNIT V- Inorganic polymers

General properties – classification of inorganic polymers in the backbone (Si, S, B and P) - preparation and properties of (polydimethylsiloxane and polymethylhydrosiloxane) linear polymer (polyphosphazenes and polyphosphonitrilic chloride) polymer (polysulfide and polymeric sulphur nitride), (borazine polymers) – industrial applications of inorganic polymers

Recommended Text

1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31th Edition, Milestone Publishers & Distributors, Meerut
2. Satya Prakash, Tuli G. D., Basu S. K., Madhava Murthy, Advanced Inorganic Chemistry, 18th Edition, S. Chand, Delhi
3. Lee J D, (1991), Concise Inorganic Chemistry, 4th Edition, Ellis Horwood, Chichester

- William Heinemann, London.
4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, S. Chand and Company Ltd.
5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992.

Reference Books

Reference Books

1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nd ed., S.Chand and Company, New Delhi.
2. Gopalan R, (2009) Inorganic Chemistry for Undergraduates, 1st Edition, University Press (India) Private Limited, Hyderabad
3. Sivasankar B, (2013) Inorganic Chemistry, 1st Edition, Pearson, Chennai
4. Alan G. Sharp (1992), Inorganic Chemistry, 3rd Edition, Addison-Wesley, England
5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.

Website and e-learning source

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. <http://swayam.gov.in>

Course Learning Outcomes

Learning Outcomes: Students will be able		Level
CO 1	Explain isomerism, Werner's Theory and stability of chelate complexes	K2
CO 2	Discuss crystal field theory, magnetic properties and spectral properties of complexes.	K3
CO 3	Explain preparation and properties of metal carbonyls	K2
CO 4	Give a comparative account of the characteristics of lanthanoids and actinoids	K4
CO 5	Explain properties and uses of inorganic polymers of silicon, sulphur, boron and phosphorous	K3

COURSE MAPPING CO -PSO

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	4	4	4	4	4
CO2	4	4	4	4	4
CO3	4	4	4	4	4
CO4	4	4	4	3	4
CO5	3	2	2	3	2

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**DSE-I (CHOICE-II)
BIOCHEMISTRY**

U23CH9E5:2

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTERNAL	TOTAL
Theory	4				4	25	75	100

Objectives of the course

The course aims at providing knowledge on

- Relationship between biochemistry and medicine, composition of blood
- Structure and properties of amino acids, peptides, enzyme, vitamins and proteins
- Biological functions of proteins, enzymes, vitamins and hormones
- Biochemistry of nucleic acids and lipids
- Metabolism of lipids

UNIT I

Logic of Living Organisms

Relationship of Biochemistry and Medicine

Blood - Composition of Blood, Blood Coagulation - Mechanism.

Hemophilia and Sickle Cell Anaemia

Maintenance of pH of Blood - Bicarbonate Buffer, Acidosis, Alkalosis.

UNIT II

Peptides and Proteins

Amino acids - nomenclature, classification - essential and Non-essential; Synthesis - Gabriel Phthalimide, Strecker; properties - zwitter ion and isoelectric point, electrophoresis and reactions.

Peptides - peptide bond - nomenclature - synthesis of simple peptides - solution and solid phase. Determination of structure of peptides, N-terminal analysis - Sanger's & Edmann method; C terminal analysis -

Proteins
properties and reactions
oxidation, denaturation, renaturation; colour tests for pro
of proteins - primary, secondary, tertiary and quaternary.
Metabolism of Amino acids - general aspects of meta
outline); urea cycle.

UNIT III Enzymes and Vitamins

Nomenclature and classification, characteristics, fac
enzyme activity - mechanism of enzyme action -
hypothesis, Koshland's induced fit model. Proenzyme
coenzymes

and isoenzymes; allosteric enzyme regulation. Vitami
functions of TPP, lipoic acid, NAD, NADP, FMN,
phosphate, CoA, folic acid, biotin, cyanocobal;

UNIT IV

Amino acids

Components of nucleic acids - nitrogenous bases a
structure of nucleosides and nucleotides, DNA- str
RNA -types- structure - functions; biosynthesis of p

Hormones

Adrenalin and thyroxine — chemistry, structure ar
structure elucidation).

UNIT V

Lipids

Occurrence, biological significance of fats, classific

Simple lipids - Oils and fats, chemical compositio
- hydrolysis, hydrogenation, trans-esterific
rancidity; analysis of oils and fats - saponific
number, acid value, R.M. value. Distinction
vegetable fats.

Compound lipids - Lipoproteins - VLDL, LDL
biological significance.

Cholesterol – occurrence, structure, test, physiological activity.
Metabolism of lipids: β -oxidation of fatty acids.

Recommended Text

1. Bahl, B. S.; Bhal, A. *Advanced Organic Chemistry*, 3rd ed.; S. Chand: New Delhi, 2003.
2. Jain, M.K.; Sharma, S.C. *Modern Organic Chemistry*, Vishal Publications: New Delhi, 2017.
3. Shanmugam, A. *Fundamentals of Biochemistry for Medical Students*, 6th ed.; Published by the author, 1999.
4. Veerakumari, L. *Biochemistry*, 1st ed.; MJP Publications: Chennai, 2004.
5. Jain, J. L.; *Fundamentals of Biochemistry*, 2nd ed.; S.Chand: New Delhi, 1983.

Reference Books

1. Conn, E. E.; Stumpf, P. K. *Outline of Biochemistry*, 5th ed.; Wiley Eastern: New Delhi, 2002.
2. West, E. S.; Todd, W. R.; Mason, H. S.; Van Bruggen, J. T. *Text Book of Biochemistry*, 4th ed.; Macmillan: New York, 1970.
3. Lehninger, A. L. *Principles of Biochemistry*, 2nd ed.; CBS Publisher: Delhi, 1993.
4. Rastogi, S. C. *Biochemistry*, 2nd ed.; Tata McGraw-Hill: New Delhi, 2003.
5. Chatterjea, M. N.; Shinde, R. *Textbook of Medical Biochemistry*, 5th ed.; Jaypee Brothers: New Delhi, 2002.

Website and e-learning source

- 1) <http://library.med.utah.edu/NetBiochem/nucacids.html>
- 2) <http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/EnzymeKinetics.html>
- 3) <https://swayam.gov.in/courses/4384-biochemistry> Biochemistry
- 4) https://onlinecourses.nptel.ac.in/noc19_cy07/preview Experimental Biochemistry.

Course Learning Outcomes

Course Learning Outcomes: Students will be able		Level
CO 1	Explain molecular logic of living organisms, composition of blood and bloodcoagulation	K2
CO 2	Explain synthesis and properties of amino acids, determination of structure of peptides and proteins	K3
CO 3	Explain factors influencing enzyme activity and vitamins as coenzymes	K2
CO 4	Explain RNA and DNA structure and functions	K2
CO 5	Explain biological significance of simple and compound lipids	K2

COURSE MAPPING CO -PSO

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	4	4	4	4	4
CO2	4	4	4	4	4
CO3	4	4	4	4	4
CO4	4	4	4	3	4
CO5	3	2	2	3	2

C. J. H.
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DEPT. OF CHEMISTRY
College for Women (A)
KUMBAKON

DSE-II (CHOICE -I)
PHARMACEUTICAL CHEMISTRY

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTERNAL	TOTAL
Theory	4				3	25	75	100

Objectives of the course

The course aims at providing an overall view of

- drugs design and drug metabolism
- important Indian medicinal plants, common diseases and antibiotics
- drugs for major diseases like cancer, diabetes and AIDS
- analgesics and antipyretic agents
- significance of clinical tests

UNIT I-Introduction

Important terminologies – drug, pharmacognosy, pharmacy, pharmacology, pharmacodynamics, pharmacokinetics, clinical pharmacology, pharmacotherapeutics, chemotherapy, toxicology, pharmacophore, antimetabolites, mutation, bacteria, virus, fungi, actinomycetes, vaccines, pharmacopeia, posology and therapeutic index.

Sources of drugs – dosage forms – bio availability – routes of administration – absorption, distribution and elimination of drugs – drug metabolism – prescription terms.

Structure and pharmacological activity

Effect of – unsaturation, chain length, isomerism; groups - halogens amino, nitro, nitrite, cyano, acidic, aldehydic, keto, hydroxyl and alkyl groups.

Development of Drugs

Development of a drug – classic steps- lead compounds- comparison of

by method of variation
Unit II-Indian medicinal plants
Some important Indian medicinal plants – mango, semparuthi, adadodai, turmeric and thooth

Common diseases and their treatment

Causes, prevention and treatment of the following
Insect borne diseases– malaria, filariasis, plague, diphtheria, whooping cough, influenza, measles, tuberculosis; Water borne diseases – cholera, typh
Digestive system – jaundice; Respiratory system – epilepsy.

Antibiotics

Definition – classification – structure and chloramphenicol, penicillins, structure and chloramphenicol ; therapeutic use streptomycin, erythromycin, tetracycline.

UNIT III-Drugs for major diseases

Cancer – common causes – chemotherapy - classification – adverse effects of cytotoxic agents chlorambucil ; anti metabolites – methotrexate. Vinca alkaloids – vincristine, vinblastine management of diabetes – insulin; oral hyp sulphonyl ureas – chlorpropamide ; biguanide thiazolidinediones .Cardiovascular drugs– anti arrhythmic agents – quinidine, propranolol hypertensive drugs - Aldomet, pentolinium tartrate hydrochloride, sodium nitroprusside. AIDS – causes and prevention – anti HIV drugs - AZT

UNIT IV-Analgesics and antipyretic agents

Classification – action of analgesics – narcotic synthetic analgesics – pethidine, antipyretic agents derivatives,

Anaesthetics

Definition, characteristics, classification - general anaesthetics - volatile anaesthetics - nitrous oxide, ethers, cyclopropane, chloroform, halothane, trichloro ethylene - storage, advantages and disadvantages ; non volatile anaesthetics - thiopental sodium ; local anaesthetics - requisites - advantages - esters - cocaine.

Blood and haematological agents

Blood - composition, grouping - physiological functions of plasma proteins - mechanism of clotting; Coagulants - vitamin K, dry thrombin; Anti coagulants - coumarins, antifibrinolytic agents - aminocaproic acid Anaemia - causes, types and control - anti anaemic drugs.

UNIT V-Clinical Chemistry

Blood tests - blood count - complete haemogram - Hb, RBC. Platelets, ESR; bleeding and clotting time - glucosetolerance test.

Significance of Clinical Tests

Serum electrolytes - blood Glucose - orthotoluidine method; Renal functions tests - blood urea, creatinine; liver function tests - serum proteins, albumin globulin ratio, HDL, LDL, coronary risk index. Urine examination - pH, tests for glucose, albumin.

Recommended Text

1. Jayashree Ghosh, (1999), A text book of pharmaceutical chemistry, 2nd ed., S.Chand & company, New Delhi.
2. Lakshmi S, (2004), Pharmaceutical chemistry, 3rd ed., Sultanchand & sons, Delhi.
3. Tripathi K D, (2018), Essentials of medical pharmacology, 8th ed., Jaypee brothers medical publishers (P) Limited, New Delhi.
4. Ashutosh Kar, (2018), Medicinal chemistry, 7th ed., New age international (P) Limited, Publishers, New Delhi.

Reference Books:

1. Chatwal G R, (2013), Pharmaceutical chemistry, inorganic (vol-I) 6th ed., Himalaya

publishing house, Bombay.

2. Chatwal G R, (1991), Pharmaceutical chemistry, organic Himalaya publishing house, Bombay.
3. Patrick G, (2002), Instant Notes Medicinal Chemistry, Private Limited, New Delhi.
4. Intellectual Property Rights. Neeraj Pandey, Khushd Publisher: PHI Learning Pvt. Ltd., 2014 ISBN: 9788120349896.

Website and e-learning source

1. http://www.pharmacy.umaryland.edu/faculty/amackere/col31_delete/lectures/qsar_1.pdf
2. <http://www.indianmedicinalplants.info/>
3. <https://www.wipo.int/about-ip/en/>



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Course Learning Outcomes		Level
Course Learning Outcomes: Students will be able		
CO 1	Define the pharmaceutical terminologies; describe the principles in pharmacological activity, drug development, clinical chemistry, hematology, therapeutic drugs and treatment of diseases; list the types of IPR and trademarks.	K2
CO 2	Discuss the development of drugs, structural activity, disease types, physio-chemical properties of therapeutic agents, significance of medicinal plants, clinical tests and factors for patentability.	K3
CO 3	Apply the principles involved in structural activity and drug designing, functions of haematological agents; estimation of clinical parameters and therapeutic application of drugs for major diseases.	K4
CO 4	Explain classification of analgesics and anesthetics, and physiological functions of plasma proteins	K2
CO 5	Explain the significance of clinical tests like blood urea, serum proteins and coronary risk index	K2

COURSE MAPPING CO-PSO

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	4	4	4	4	4
CO2	4	4	4	4	4
CO3	4	4	4	3	4
CO4	4	4	4	3	2
CO5	3	2	2	3	

C. J. M.
CHEMISTRY

**DSE-II (CHOICE -II)
NANOSCIENCE**

U23CHGE5:4

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTERNAL	TOTAL
Theory	4				3	25	75	100

Objectives of the Course

This course aims at providing knowledge on

- introduction to nanoparticles/clusters and nanocomposites
- properties of nanomaterials
- characterization of nanomaterials by different methods
- synthesis of carbon nanotubes, graphene, quantum dots, self-assembled nanomaterials
- applications of nanomaterials as sensors

UNIT I

Introduction to nanoscience

Definition of terms – nanoscience, nanoparticles, clusters, quantum dots, nanostructures and nanocomposites. Electron behaviour in free space, bulk material and nanomaterials.

Synthesis and stabilization of nanomaterials Top down approach (physical methods), mechanical dispersion – ball milling, methods based on evaporation of a precursor-inert gas condensation, ion sputtering, spray pyrolysis, aerosol synthesis-nanolithography. Bottom-up approach (chemical methods) - solvothermal synthesis, photochemical method, gamma radiolysis, sonochemical synthesis, electro deposition, sol-gel method, nanomaterials via chemical routes- solvents reducing agents, capping agents-stabilization of nanoparticles -electrostatic and steric stabilization, common stabilizers, nanoparticle growth in solution, templated growth, Langmuir – Blodgett (L-B) method, reverse micelles-

emulsion method.

Unit II

Properties of materials on a nanoscale

Optical properties of metal and semiconductor nanomaterials- surface Plasmon resonance (SPR), surface enhanced Raman spectra (SERS), quantum confinement effect, tuning of optical spectrum. Magnetic properties - Fe₃O₄ particle, supra magnetic properties, electronic properties, Chemical properties- chemical process on the surface of nanoparticles, catalysis, mechanical properties.

UNIT III

Techniques employed for characterisation of nanomaterials

Spectroscopy – UV-visible, Photoelectron spectroscopy – Electron microscopy – Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning probe microscopy (SPM) – Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM), Optical microscopy – confocal microscopy, X-ray diffraction (XRD) [Principle and Block diagram only].

UNIT IV

Special nanomaterials

Carbon Nano Structures Carbon nanotubes: Introduction - types - zigzag, armchair, helical, synthesis by CVD, Functionalization of Carbon Nanotubes, Reactivity of Carbon Nanotubes, Field emission, Fuel Cells, Display devices .

Other Important Carbon based materials: Preparation and Characterization Fullerene, Graphene, properties, DLC and nanodiamonds and Applications

Semiconductor nanoparticles: Quantum dots, synthesis – chemical synthesis using clusters, properties, porous silicon – electrochemical etching, aerogel – types – silica aerogel, resorcinol formaldehyde (RF aerogels, zeolites – applications.

Self Assembled Nanomaterials: Self Assembled Monolayers (SAMS) - inorganic, organic molecules.

UNIT V

Application of nanomaterials

Biomedical Applications- drug, drug delivery, biolabelling, artificial implants, cancer treatment. Sensors – Natural nanoscale sensors: chemical sensors, biosensors, electronic noses.

Optics & Electronics – Nanomaterials in the next generation computer technology, high definition TV, flat panel displays, quantum dot laser

for water purification, nanofabric industry.
Impacts of Nanotechnology – human & environmental safety

Recommended Text

1. Sulabha K. Kulkarni. *Nanotechnology: Principles and Practices*, Capital Publishing Co., New Delhi.
2. Pradeep. T. *Nano: The Essentials. Understanding Nanoscience and Nanotechnology*: Tata McGraw-Hill Publishing Company Limited, New Delhi. 2007.
3. Shah. M.A.; Tokeer Ahmad, *Principles of Nanoscience and Nanotechnology*: Narosa Publishing House, New Delhi, 2010.
4. Murthy. B.S; Shankar. P, Baldev Raj.; Rath. B.B. James Murday, *Textbook of Nanoscience and Nanotechnology*; Universities press, India Ltd ,Hyderabad. 2012.

Reference Books

1. Sharma. P.K., *Understanding Nanotechnology*; Vista International Publishing House, Delhi. 2008.
2. Charles P. Poole Jr.; Frank J. Owens. *Introduction to Nanotechnology*: A John Wiley & Sons, INC., Publication, 2003.
3. Viswanathan B., *Nano Materials*; Narosa Publishing House, New Delhi, 2009.
4. Edited by C.N.R. Rao; Müller.A; Cheetham. A.K. *Nanomaterials Chemistry Recent Developments and New Directions*, WILEY-VCH Verlag GMBH & Co.,KGaA, Darmstad.
5. Jing Zhong Zhang, *Optical properties and spectroscopy of Nanomaterials*; World Scientific Publishing Pvt. Ltd., Singapore.

Website and e-learning source

- 1) <http://www.nanotechnology.com/docs/wtd015798.pdf>
- 2) <http://nccr.iitm.ac.in/Nanomaterials.pdf>

nanoscience.

CO 2	Describe the properties, synthesis, characterization of nanomaterials, special nanomaterials and their applications.
CO 3	Examine the structure, properties, applications and characterization of nanomaterials. CO4: various synthesis procedures, characterization of carbon nanotubes, fullerene and nanodiamonds.
CO 4	Discuss applications of nanomaterials in optics and electronics
CO 5	

COURSE MAPPING CO -PSO

CO /PSO	PSO1	PSO2	PSO3
CO1	4	4	4
CO2	4	4	4
CO3	4	4	4
CO4	4	4	4
CO5	3	2	2

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SEC VI-INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTERNAL	TOTAL
Theory	2				2	25	75	100

Objectives of the course

The course aims at providing an overall view of the

- operation and troubleshooting of chemical instruments
- fundamentals of analytical techniques and its application in the characterization of compounds
- theory of chromatographic separation and
- theory of thermo / electro analytical techniques
- stoichiometry and the related concentration terms

UNIT-I--Qualitative and Quantitative Aspects of Analysis

S.I Units, Distinction between Mass and Weight. Moles, Millimoles, Milli equivalence, Molality, Molarity, Normality, Percentage by Weight and Volume, ppm, ppb. Density and Specific Gravity of Liquids. Stoichiometry Calculations

Sampling, evaluation of analytical data, Errors – Types of Errors, Accuracy, Precision, Minimization of Errors. Significant Figures. Methods of Expressing Precision: Mean, Median, Average Deviation, Standard Deviation, Coefficient of Variation, Confidence Limits, Q- test, F-test, T- test. The Least Square Method for Deriving Calibration plots

UNIT II-Atomic Absorption Spectroscopy: Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

UNIT III- UV-Visible and IR Spectroscopy

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.

UV-Visible Spectrometry: Basic principles, instrumentation (choice of source, monochromator and detector) for single and double instrument; Basic principles of quantitative analysis: estimation of ions from aqueous solution, geometrical isomers, keto-enol tautomerism.

Infrared Spectroscopy: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double instrument; sampling techniques.

UNIT IV-Thermal and Electro-analytical Methods of Analysis

TGA and DTA- Principle, Instrumentation, methods of obtaining Thermograms, factors affecting TGA/DTA, Thermal analysis of nitrate, calcium oxalate and calcium acetate

DSC- Principle, Instrumentation and applications.

Electroanalytical methods: polarography - principle, instrumental applications. Derivative polarography- Cyclic Voltammetry - principle

UNIT V-Separation and purification techniques

Classification, principle, Factors affecting - Solvent Extraction – Liquid - Liquid Extraction,

Chromatography: Column, TLC, Paper, Gas, HPLC and Electrophoresis. Principle, Classification, Choice of Adsorbents, Solvents, Preparation of Column, Elution Mechanism of separation: adsorption, partition, ion exchange. Development of chromatograms and R_f value.

Recommended Text

1. Vogel, Arthur I: A Text book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed., The English Language Book Society of Longman.
2. R. Gopalan, P. S. Subramanian and K. Rengarajan, Elementary Analytical Chemistry, Sultan Chand, New Delhi, 2007
3. Skoog, Holler and Crouch, Principles of Instrumental Analysis, Cengage Learning, 6th Indian Reprint (2017).
4. R. Speyer, Thermal Analysis of Materials, CRC Press, 1993
5. R.A. Day and A.L. Underwood, Quantitative Analysis, 6th Edition, Prentice Hall of India Private Ltd., New Delhi, 1993

Reference Books

1. D. A. Skoog, D. M. West and F. J. Holler. Analytical Chemistry: An Introduction, 5th edn., Saunders college publishing, Philadelphia, 1998.
2. Dash U N. Analytical Chemistry: Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 2011.
3. Christian, Gary D; Analytical Chemistry, 6th Ed., John Wiley & Sons, New York, 2004.
4. Mike, O. & Chalmers, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elles Harwood Ltd. London
5. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, sixth edition Pearson Education, 2000

Website and e-learning sources

1. <http://www.epa.gov/rpdweb00/docs/marlap/402-b-04-001b-14-final.pdf>
2. <http://eric.ed.gov/?id=EJ386287>
3. <http://www.sjsu.edu/faculty/watkins/diamag.htm>
4. <http://www.britannica.com/EBchecked/topic/108875/separation-and-purification>
5. <http://www.chemistry.co.nz/stoichiometry.htm>

Course Learning Outcomes: Students will be able to	
CO 1	Apply error analysis in the calibration and use of analytical instruments, explain theory, instrumentation and application of flame photometry and Atomic Absorption spectrometry
CO 2	Explain theory, instrumentation and application of UV visible and Infrared spectroscopy.
CO 3	Able to discuss instrumentation, theory and applications of thermal and electrochemical techniques
CO 4	Explain the use of chromatographic techniques in separation and identification of mixtures
CO 5	Explain preparation of solutions, stoichiometric calculations

COURSE MAPPING CO -PSO

CO / PSO	PSO1	PSO2	PSO3	PSO4
CO1	4	4	4	4
CO2	4	4	4	4
CO3	4	4	4	4
CO4	4	4	4	4
CO5	3	2	2	4

U23CHC613

**SEMESTER VI
CORE COURSE-XIII
ORGANIC CHEMISTRY – II**

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTER NAL	TOTAL
Theory	5				5	25	75	100

Objectives of the course

This course aims at providing knowledge on

- classification, isolation and discussing the properties of alkaloids and terpenes
- preparation and properties of saccharides
- biomolecules
- different molecular rearrangement
- preparation and properties of organometallic compounds

UNIT I- Alkaloids

Classification, isolation, general properties- Hofmann Exhaustive Methylation; Structure elucidation – Coniine, piperine, nicotine.

Terpenes: Classification, Isoprene rule, isolation and structural elucidation of Citral, alpha terpineol, Menthol, Geraniol and Camphor.

UNIT II- Carbohydrates

Definition and Classification of Carbohydrates with examples. Relative configuration of sugars. Determination of configuration (Fischer's Proof). Definition of enantiomers, diastereomers, epimers and anomers with suitable examples.

Monosaccharides – configuration – D and L hexoses – aldohexoses and ketohexoses.

Glucose, Fructose – Occurrence, preparation, properties, reactions, structural elucidation, uses.

Interconversions of sugar series – ascending, descending, aldose to

ketose and ketose to aldose.

Disaccharides – sucrose, lactose, maltose - preparation, properties and uses (no structural elucidation).

Polysaccharides – Source, constituents and biological importance of homopolysaccharides- starch and cellulose, heteropolysaccharides – hyaluronic acid, heparin.

UNIT III - Molecular rearrangements:

Molecular Rearrangement: Type of rearrangements, Mechanism for Benzidine, Favorskii, Claisen, Fries, Hofmann, Curtius, Schmidt and Beckmann, Pinacol-pinacolone rearrangement

UNIT IV - Special reagents in organic synthesis

AIBN, 9BBN, BINAP/BINOL, BOC, DABCO, DCC, DIBAL, DMAP, NBS/NCS, NMP, PCC,

TBHP, TEMPO

Organometallic compounds in Organic Synthesis

Preparation, Properties and applications:

Grignard Reagents, Organo Lithium Compounds, Ziegler – Natta, Wilkinson, Metal Carbonyl, Zeiss's Salt

UNIT V -Green Chemistry: Principles, chemistry behind each principle and applications in chemical synthesis. Green reaction media – green solvents, green reagents and catalysts; tools used like microwave and ultrasound in chemical synthesis.

Recommended Text

1. M.K.Jain, S. C.Sharma, Modern Organic Chemistry, Vis Publishing, 4th reprint, 2009.
2. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., 3rd edition, 2009
3. Arun Bahl and B.S. Bahl, Advanced organic chemistry, New Delhi: S.Chand & Company Pvt. Ltd., Multicolour edition, 2012.
4. P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, 29th edition, 2007.
5. C Bandyopadhyay; An Insight into Green Chemistry; Published by

Reference Books

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia, 6th edition, 2012.
2. T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons, 11th edition, 2012.
3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 7th edition, 2009.
4. I. L. Finar, Organic Chemistry, Vol. (1 & 2), England, Wesley Longman Ltd, 6th edition, 2006.
5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, 5th Edition, 2010.

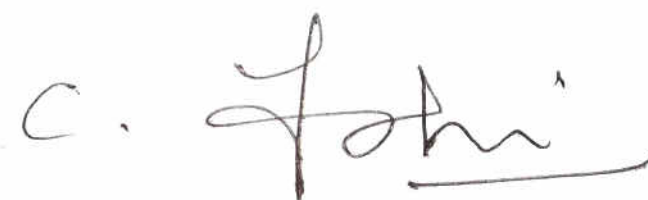
Website and e-learning source

1. www.epgpathshala.nic.in
2. www.nptel.ac.in 3. <http://swayam.gov.in>
4. Virtual Textbook of Organic Chemistry
5. <https://vlab.amrita.edu/>

1	
CO 2	Explain preparation and reactions of mono and disachharides
CO 3	Classify biomolecules and natural products based on their structure, properties, reactions and uses.
CO 4	explain molecular rearrangements like benzidine, Hoffmann etc.,
CO 5	preparation and properties of organolithium compounds.

COURSE MAPPING CO -PSO

CO / PSO	PSO1	PSO2	PSO3	PSO4
CO1	4	4	4	4
CO2	4	4	4	4
CO3	4	4	4	4
CO4	4	4	4	3
CO5	3	2	2	3



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CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTER NAL	TOTAL
Theory	5				5	25	75	100

Objectives of the course

The course aims at providing an overall view of the

- phase diagram of one and two component systems
- chemical equilibrium,
- separation techniques for binary liquid mixtures.
- electrical conductance and transport number.
- galvanic cells, EMF and significance of electrochemical series.

UNIT-I - Phase rule

Definition of terms; derivation of phase rule ; application to one component systems – water and sulphur - super cooling, sublimation ; two component systems – solid liquid equilibria- simple eutectic (lead - silver and bismuth - cadmium), freezing mixtures (potassium iodide- water), compound formation with- congruent melting points (magnesium – zinc and ferric chloride – water system), peritectic change (sodium – potassium), solid solution (gold-silver); copper sulphate – water system.

UNIT II - Chemical equilibrium

Law of mass action – thermodynamic derivation – relationship between K_p and K_c – application to the homogeneous equilibria – dissociation of PCl_5 gas, N_2O_4 gas – equilibrium constant and degree of dissociation – formation of HI , NH_3 , and SO_3 – heterogeneous equilibrium – decomposition of solid calcium carbonate – Lechatelier principle – van't Hoff reaction isotherm – temperature dependence of equilibrium constant – van't Hoff reaction isochore – Clayperon equation – ClausiusClayperon equation and its applications.

UNIT III- Binary liquid mixtures

Ideal liquid mixtures – non ideal solutions – azeotropic mixture fractional distillation – partially miscible mixtures – phenol-water, triethylamine-water, nicotine-water – effect of impurities on solution temperature; immiscible liquids- steam distillation; Nernst distribution law – applications.

UNIT IV- Electrical Conductance and Transference

Arrhenius theory of electrolytic dissociation – Ostwald's dilution limitations of Arrhenius theory; behavior of strong electrolytes; interionic effects – Debye Huckel theory – Onsager equation (derivation), significance of Onsager equation, Debye Falkenhagen: Wien effect. Ionic mobility – Discharge of ions on electrolysis (Hittorf's method, moving boundary method – factors affecting transport number – determination of ionic mobility; Kohlrausch's law applications; molar ionic conductance and viscosity (Walden's rule) applications of conductance measurements – determination of degree of dissociation of weak electrolyte, dissociation constant of weak acid and weak base, ionic product of water, solubility product of sparingly soluble salts - conductometric titrations – acid base titrations.

UNIT V- Galvanic Cells and Applications

Galvanic cell, representation, reversible and irreversible cells, EMF and its measurement – standard cell; relationship between electrical energy and chemical energy; sign of spontaneity of a reaction, reversible electrodes, electrode potential, standard electrode potential, primary and secondary reference electrodes, Nernst equation for potential and cell EMF; types of electrodes – metal/metal ion, amalgam/metal ion, redox electrode; electrochemical series applications of electrochemical series. Chemical cells with and without transport, concentration cells with and without transport;

Applications of EMF measurements

applications of EMF measurements – determination of equilibrium constant, coefficient of electrolytes, transport number, valency of ions, solubility product, pH using hydrogen gas electrode, quinhydrone electrode

electrode, potentiometric titrations – acid base titrations, redox titrations, precipitation titrations, redox indicators - use of diphenylamine indicator in the titration of ferrous iron against dichromate.

Industrial component

Galvanic cells- lead storage, Ni-Cd, Li and Zn-air, Fuel cells – H_2 - O_2 cell.

Recommended Text

1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, ShobanLalNagin Chand and Co., forty eighth edition, 2021.
2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.
3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co.
4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996.
5. J. Rajaram and J.C. Kuriacose, Thermodynamics, ShobanLalNagin Chand and CO., 1986.

Reference Books

1. K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition, 2009.
2. Gilbert. W. Castellen, Physical Chemistry, Narosa Publishing House, third edition, 1985.
3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002.
4. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001
5. D.N.Bajpai, Advanced Physical Chemistry, S.Chand&Co., 2001

Website and e-learning source

<https://nptel.ac.in> <https://swayam.gov.in>

<https://archive.nptel.ac.in/content/storage2/courses/112108150/pdf/PPT>

<https://nptel.ac.in> Introduction to chemical equilibrium

ware

Course Learning Outcomes

Course Learning Outcomes: Students will be able to	
CO 1	Construct the phase diagram for one component and two component systems, explain the properties of freezing mixture, component with congruent melting points and solid solutions.
CO 2	Apply the concepts of chemical equilibrium in dissolution of PCl_5 , N_2O_4 and formation of HI , NH_3 , SCl_2 decomposition of calcium carbonate. Demonstrate important principles such as Le chatelier principle, Hoff reaction isotherm and Clausius-Clayperon equation.
CO 3	Identify an appropriate distillation method for the separation of binary liquid mixtures such as azeotropic mixtures, partially miscible mixtures and immiscible liquids.
CO 4	Explain the significance of Arrhenius theory, Debye-Huckel theory, Onsager equation and Kohlrausch's conductance.
CO 5	Construct electrochemical cell with the help of electrochemical series and calculate cell EMF. Discuss the applications of EMF and significance of potentiometric titrations.

COURSE MAPPING CO -PSO

CO / PSO	PSO1	PSO2	PSO3
CO1	4	4	4
CO2	4	4	4
CO3	4	4	4
CO4	4	4	4
CO5	3	2	2

U23CHC 615P

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTER NAL	TOTAL
Theory	6				3	40	60	100

Objectives of the course

This course aims at providing

- Basic principles of physical chemistry experiments
- Hands on experience in carrying out the experiments

UNIT I- Phase diagrams

1. Simple eutectic - determination of eutectic temperature and composition of naphthalene-diphenyl amine or naphthalene-diphenyl system
2. Determination of Transition Temperature of a salt hydrate.
3. Determination of upper critical solution temperature of phenol –water system
4. Effect of an electrolyte on miscibility temperature of phenol – water system
5. Determination of concentration of sodium chloride using phenol- sodium chloride system.

UNIT II - Distribution law

6. Determination of the distribution coefficient of iodine between carbon tetrachloride and water.
7. Determination of equilibrium constant of the reaction



8. Determination of concentration of the given potassium iodide solution using the above equilibrium constant.

UNIT III

Electrochemistry

9. Conductometric titration of Hydrochloric acid against Sodium hydroxide
10. Potentiometric titration of Ferrous ion against Potassium dichromate using quinhydrone electrode.

REFERENCE BOOKS

1. Sindhu, P.S. *Practicals in Physical Chemistry*, Macmillan New Delhi, 2005.
2. Khosla, B. D. Garg, V. C.; Gulati, A. *Senior Practical Physical Chemistry*, R. Chand : New Delhi, 2011.

Gupta, Renu, *Practical Physical Chemistry*, 1st Ed.; International : New Delhi, 2017.

Website and e-learning source : <https://www.vlab.co.in/broad-chemical-sciences>

Course Learning Outcomes

Course Learning Outcomes: Students will be able	
CO 1	Describe the principles and methodology for the practical work.
CO 2	Explain the procedure, data and methodology for the practical work
CO 3	Apply the principles of phase rule and electrochemistry for carrying out the practical work
CO 4	Demonstrate laboratory skills for safe handling of the equipment and chemicals

COURSE MAPPING CO-PSO

CO / PSO	PSO1	PSO2	PSO3	PSO4
CO1	4	4	4	4
CO2	4	4	4	4
CO3	4	4	4	4
CO4	4	4	4	3

U23CHGE6:1

DSE-III (CHOICE-I)
INORGANIC CHEMISTRY -II

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTER NAL	TOTAL
Theory	5				4	25	75	100

Objectives of the course

The course aims to provide knowledge on

- Tracer elements and their role in the biological system.
- Iron transport and storage
- Metallo enzymes, oxygen transport.
- Silicates and their applications
- Industrial applications of refractories, alloys, paints and pigments

UNIT I -Bio- inorganic Chemistry

Essential and trace elements: Role of Na^+ , K^+ , Mg^{2+} , Ca^{2+} , Fe^{3+} , Cu^{2+} and Zn^{2+} in biological systems. Effect of excess intake (Toxicity) of Metal ions – trace elements - As, Cd, Pb, Hg

UNIT II - Metal ion transport and storage

Iron – storage, transport - Transferrin and Ferritin; Iron-porphyrins – myoglobin, haemoglobin – oxygen transport - Bohr effect; Sodium/potassium pump, calcium pump; transport and storage - copper and zinc.

UNIT III - Metallo enzymes

Isomerase and synthetases, structure of cyanocobalamin (Vitamin B12), nature of Co-C bond; Metalloenzymes - functions of carboxypeptidase A, zinc metalloenzyme – mechanism and uses, Zn-Cu structure and function, carbonic anhydrase, Vitamin B-12 as and isomerase - Iron-sulphur proteins - $2\text{Fe}-2\text{S}$ – rubredoxin, ferridoxin, Iron sulphur cluster enzymes. Invivo and Invitro nitrogen fixation – biological functions of and molybdo enzymes.

UNIT IV - Silicates

Introduction – general properties of silicates, structure – types – ortho silicates(zircon), pyrosilicates (thortveitite), silicates(pyroxenes), ring silicates(beryl), sheet silicates(asbestos), silicates having three dimensional structure (zeolites, ultramarines)

UNIT V- Industrial Applications of Inorganic Compound

Refractories, pyrochemical, explosives. Alloys, Paints and requirements of a good paint; classification, constituents pigments, vehicles, thinners, driers, extenders, anti-knocking skinning agents, plasticizers, binders-application; varnishes enamels.

Nanocomposite Hydrogels: synthesis, characterization and use. Industrial visits and internship mandatory.

Recommended Text

1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Chemistry, 31th ed., Milestone Publishers & Distributors
2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2000), Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi
3. Lee J D, (1991), Concise Inorganic Chemistry, 4th Edition, WilliamHeinemann, London.
4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, Schand and Company Ltd.

5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992.

Reference Books

1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nded., S.Chand and Company, New Delhi.
2. Gopalan R, (2009) Inorganic Chemistry for Undergraduates, 1st Edition, University Press (India) Private Limited, Hyderabad
3. Sivasankar B, (2013) Inorganic Chemistry. 1st Edition, Pearson, Chennai
4. Alan G. Sharp (1992), Inorganic Chemistry, 3rd Edition, Addison-Wesley, England
5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.

Website and e-learning source

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. <http://swayam.gov.in>

Course Learning Outcomes

Course Learning Outcomes: Students will be able		Level
CO 1	Ability to explain the importance of tracer elements on biological system.	K2
CO 2	Explain the metal ion transport, Bohr effect, Na, K, Ca pump.	K3
CO 3	Explain the function of Vitamin B12, Zn-Cu enzyme, ferredoxin, cluster enzymes.	K4
CO 4	Classification and structure of silicates.	K3
CO 5	Explain the manufacture of refractories, explosives, paints and pigments	K 2

COURSE MAPPING CO -PSO

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	4	4	4	4	4
CO2	4	4	4	4	4
CO3	4	4	4	4	4
CO4	4	4	4	3	4
CO 5	4	4	4	3	4


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**DSE-III (CHOICE-II)
POLYMER SCIENCE**

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTER NAL	TOTAL
Theory	5				4	25	75	100

Objectives of the course

- The course aims at providing an overall view of
 - classification of polymers, preparation of polymers
 - kinetics of polymerization and characterization of polymers
 - analytical techniques used to characterize polymers
 - reactions of polymers
 - speciality polymers like PVC, PMMA

UNIT I- Introduction

Difference between polymer and macromolecule – classification – synthetic and natural, organic and inorganic, thermoplastic and thermosetting. Plastics, elastomers, fibres and liquid resins.

Techniques of polymerization

Bulk, solution, emulsion and suspension polymerization

Unit – II- Kinetics of polymerization

Kinetics of condensation and addition polymerisation; ionic, freeradical, copolymerisation and coordination polymerisation – reactivity ratios – block and graft copolymers.

Characterisation of polymers

Appearance, feel and hardness, density, effect of heat, solubility, combustion, tensile strength, shear, stress, impact strength, mechanical, thermomechanical and rheological properties of polymers in viscoelastic state.

UNIT III - Molecular Weight and Properties of Polymers

Molecular Weight of Polymers-Number Average and Weight Average,

Weight index – membrane and vapour pressure osmometry – sedimentation velocity and plot, ultracentrifuge – gel permeation chromatography – equilibrium – viscometry – Glass Transition Temperature – Thermal properties of polymers – Aggregation and State of Phase Transitions, Factors Affecting Glass Transition Temperature, Importance of Glass Transition Temperature, Heat Distortion Temperature, DTA, Crystallinity of Polymers: Crystalline Behaviour, Crystallinity

UNIT IV

Reactions of Polymers-Hydrolysis, Acidolysis, Aminolysis, Substitution Reactions (One Example Each) Cyclisation, Cross-Linking and Reactions of Specific Functional Groups in the Polymer

Polymer technology

Processing of polymers – casting, thermoforming, extrusion, compression, blow moulding – foaming, reinforcing – processing of fibres – melt, wet and dry spinning

UNIT V - Speciality polymers

Polyelectrolytes, conducting polymers, polymeric liquid crystals, phase synthesis, biomedical polymers, liquid crystalline, electroluminescent polymers – two examples of each. Polyethylene, PVC, PMMA, polyester; rubber – synthesis and vulcanisation of rubber.

Polymer Degradation

Types of Degradation - Thermal, Mechanical, Ultraviolet Radiation and Chemical Degradation Methods. Rubber-Natural and Synthetic-Structure, Mechanism of Biodegradable and Non-Biodegradable Polymers.

Recommended Text

1. Gowariker V.R, N.V. Viswanathan and Jayadev Science.
2. New Delhi: New Age International, 2015

3. Misra G.S. Introductory Polymer Chemistry. New Delhi: Wiley Eastern, 2010.
4. Bahadur P and Sastry N V. Principles of Polymer Science. New Delhi: Narosa Publishing House, 2005
5. Ahluwalia, V.K. Anuradha Mishra, *Polymer Science A Text Book*, Ane Books India: New Delhi, 2008.
6. Morrison, R. R.; Boyd, R. N.; Bhattacharjee, S. K. *Organic Chemistry*, 7th ed.; Pearson: New Delhi, 2011.

Reference Books

- Billmeyer, F.W. *Polymer Science*. India: Wiley-Interscience, 2007.
- Seymour, R. B.; Carraher Jr. C.E. *Polymer Chemistry: An Introduction*, Marcel Dckker Inc : New York, 1981.
- Sinha, R. *Outlines of Polymer Technology*, Prentice Hall of India: New Delhi, 2000.
- Joel R. Fried, *Polymer Science and Technology*, 3rd ed.; Prentice Hall of India: New Delhi, 2014.

Website and e-learning source

- <https://polymerdatabase.com>
- <http://amrita.vlab.co.in/?sub=2&brch=190&sim=603&cnt=1>
3. <http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/polymers.htm>
4. <http://nsdl.niscair.res.in/bitstream/123456789/406/2/Molecular+weights+of+polymers.pdf>

Course Learning Outcomes

Course Learning Outcomes: Students will be able		Level
CO 1	Explain classification of polymers, elastomers, fibres and liquid resins	K2
CO 2	Explain addition and condensation polymerization, mechanical properties of polymers	K3
CO 3	Determine the molecular weight of polymers, and explain the thermal properties of polymers	K4
CO 4	Explain reactions of polymers and polymer processing	K3
CO 5	Discuss speciality polymers like PVC, PMMA, rubbers, biodegradable polymers	K2

COURSE MAPPING CO -PSO

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	4	4	4	4	4
CO2	4	4	4	4	4
CO3	4	4	4	4	4
CO4	4	4	4	3	4
CO 5	4	4	4	3	4


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DSE-IV- AGRICULTURAL CHEMISTRY (CHOICE-I)

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTER NAL	TOTAL
Theory	4				3	25	75	100

OBJECTIVES

- To learn about physical and chemical properties of soils
- To study about fertilizers, micro nutrients and bio-fertilizers
- To create an awareness about organic and green manures
- To apply the controlling measures of pests.

UNIT-I

- 1.1. Soil physical properties-soil separates and particle size distribution-soil texture and structure-bulk density, particle density, pore space, soil air, soil temperature, soil water, soil consistence-significance of physical properties to plant growth.
- 1.2. Soil chemical properties- soil colloids-inorganic colloids –clay minerals-amorphous-organic colloids-soil organic matter-decomposition-humus formation-significance on soil fertility, soil reaction-biological properties of soil-nutrient availability.

UNIT II

- 1.1. Fertilizer-definition-fertilizer recommendation based on soil testing-fertility index-nitrogenous fertilizers (preparation and structure is not necessary)-effect of nitrogen on plant growth and development. Phosphate fertilizers (preparation and structure is not necessary)-effect of phosphorous on plant growth and development.
- 1.2. Secondary and micro nutrient fertilizers-complex fertilizers-complex and mixed fertilizers-sources, manufacture, properties and reactions in soils.

UNIT III

- 1.1. Biofertilizer-nitrogen fixing biofertilizer-rhizobium, azospirillum, phosphate mobilizing biofertilizer-bacteria bacillus, pseudomonas, fungi aspergillus, penicillium.
- 1.2. Preparation of slow release fertilizers – compatibility of fertilizer blending-preparation of different fertilizer mixtures-fertilizer prescription for different soils and crops.

UNIT IV

- 4.1. Nutrient potential of different organic manures- agricultural, industrial and urban wastes.
- 4.2. Green manures-green leaf manure-bulky organic and concentrated organic manures-compost-enriched farm yard manures, composting of coir sugarcane trash, leaf litters and farm wastes-oil cakes, bone meal, poultry manures-fertilizers use efficiency-integrated nutrition management

UNIT V

- 5.1. Pest management and control: Pesticides-characteristics-uses-fate of pesticides in soil and plants-impact of pesticides on environment-safety measures in the analysis and handling of pesticides.
- 5.2. Insecticides, Fungicides, Herbicides and Acaricides-definition –examples and uses Structure and formula only.

REFERENCE BOOKS:

1. N.C. Brady The nature and properties of soils, Eurasia publishing house, (P) Ltd 9th edition 1984.
2. Biswas, T.D. and Mukerherjee S. K. 1987 The text book of soil science.
3. A.J. Daji (1970) A text book of soil science, Asia publishing house, Madras.
4. Donhue, R.L. Miller and Shickluna, J.C., 1987. Soils-An introduction to soils and plant growth, Prentice hall of India (P) Ltd., New Delhi.
5. Colling. G.H. 1955, Commercial fertilizers, McGraw Hill publishing Co., Newyork.
6. Tisdale, S.L. Nelson, W.L. and Beaton, J.D, 1990, Soil fertility and fertilizers, Macmillan publishing company, Newyork.

7. Hesse. P.R. 1971 A text book of soil chemical analysis John Murray, Newyork.
8. JAckon. M.L.1958, Soil chemical analysis, Prentice hall of Indian (P) Ltd., NewDelhi.
9. Buchel. K.H 1983, Chemistry of pesticides –John Willey & Sons, Newyork.
10. Melnikov.N.N. 1971, Chemistry of pesticides vol.36 of residue review – springer verlae, Newyork.
11. Sree Ramula, U.S 1971, Chemistry of insecticides and fungicides – Oxford and IBH publishing Co., NewDelhi.

COURSE OUTCOMES

Course Learning Outcomes

Course Learning Outcomes: Students will be able		
CO 1	Learn about physical and chemical properties of soils	Lev K2
CO 2	Study about fertilizers, micro nutrients and bio-fertilizers	K3
CO 3	Create an awareness about the usage of organic and green manures	K4
CO 4	Apply the controlling measures of pests.	K

COURSE MAPPING CO -PSO

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO
CO1	4	4	4	4	4
CO2	4	4	4	4	4
CO3	4	4	4	4	4
CO4	4	4	4	3	4



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DSE-IV FUNDAMENTALS OF SPECTROSCOPY (CHOICE-II)

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTER NAL	TOTAL
Theory	4				3	25	75	100

Objectives of the course

This course is designed to provide knowledge on

- electrical and magnetic properties of organic and inorganic compounds
- basic principles of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry
- instrumentation of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry
- applications of various spectral techniques in structural elucidation
- solving combined spectral problems

UNIT I

Electrical and Magnetic properties of molecules

Dipole moment – polar and nonpolar molecules – polarisability of molecules.

Application of dipole moments in the study of organic and inorganic molecules.

Magnetic permeability, volume susceptibility, mass susceptibility and molar susceptibility; diamagnetism, paramagnetism – determination of magnetic susceptibility using Guoy balance, ferromagnetism, anti ferromagnetism

Microwave spectroscopy

Rotation spectra - diatomic molecules (rigid rotator approximation) selection rules – determination of bond length, effect of isotopic substitution – instrumentation and applications

UNIT II

Ultraviolet and Visible spectroscopy

Electronic spectra of diatomic molecules (Born Oppenheimer approximation) - vibrational coarse structure – rotational fine structure of electronic vibration

transitions – Frank Condon principle
Birge-Spencer method of evaluation of dissociation energy – pre-
transition - $\sigma-\sigma^*$, $\pi-\pi^*$, $n-\sigma^*$, $n-\pi^*$ transitions.
Applications of UV-Woodward – Fieser rules as applied to conjugated
and α , β - unsaturated ketones. Elementary Problems.

Colorimetry - principle and applications (estimation of Fe^{3+})
UNIT III Infrared spectroscopy Vibration spectra – diatomic
harmonic oscillator and anharmonic oscillator; Vibration – rota-
diatomic molecule as rigid rotator and anharmonic oscil-
Oppenheimer approximation oscillator) - selection rules,
polyatomic molecules – stretching and bending vibrations -
–determination of force constant, moment of inertia and inter-
distance – isotopic shift – application of IR spectra to simp-
inorganic molecules – (group frequencies)

Raman Spectroscopy

Rayleigh scattering and Raman scattering of light – Raman
theory of Raman effect – quantum theory of Raman effect
Raman spectrum – selection rules – mutual exclusi-
instrumentation (block diagram) – applications.

UNIT IV

Nuclear magnetic resonance spectroscopy:

PMR – theory of PMR – instrumentation - number of signals – c-
shift – peak areas and proton counting – spin-spin coup-
applications. J values – geminal and vicinal protons. Problems rel-
and deshielding of protons,
chemical shifts of protons in hydrocarbons, and in
monofunctional organic compounds; spin-spin splitting of neigh-
protons in vinyl and allyl systems.

UNIT V

Mass spectrometry

Principle – different kinds of ionisation – instrumentation –
spectrum – types of ions – determination of molecular
fragmentation and structural elucidation – McLafferty rearran-
Retro Diels Alder reaction - illustrations with simple organic m-
Solving structure elucidation problems using multiple spec-

data (NMR, MS, IR and UV-Vis).

Recommended Text

Gopalan, R.; Subramaniam, P. S.; Rengarajan, K. *Elements of Analytical Chemistry*; S Chand: New Delhi, 2003.
 Usharani, S. *Analytical Chemistry*, 1st ed.; Macmillan: India, 2002.
 Banwell, C.N.; Mc Cash, E. M. *Fundamentals of Molecular Spectroscopy*, 4th ed.; Tata McGraw Hill, New Delhi, 2017.
 U.N.Dash, *Analytical Chemistry Theory and Practice*, Sultan Chand & Sons, 2nd Ed., 2005

K.Sharma, *Spectroscopy*, 22nd ed., Goel Publishing House, 2011.

Reference Books

Srivastava, A. K.; Jain, P. C. *Chemical Analysis an Instrumental Approach*, 3rd ed.; S.Chand, New Delhi, 1997.
 Robert D Braun. *Introduction to Instrumental Analysis*; Mc.Graw Hill: New York, 1987.
 Skoog, D. A.; Crouch, S. R.; Holler, F.J.; West, D. M. *Fundamentals of Analytical Chemistry*, 9th ed.; Harcourt college Publishers: USA, 2013.
 Madan, R. L.; Tuli, G. D. *Physical Chemistry*, 2nd ed.; S.Chand: New Delhi, 2005.
 Suri, B. R.; Sharma, L. R.; Pathania, M.S. *Principles of Physical Chemistry*, 3rd ed.; Vishal Publishing: Delhi, 2008.

Website and e-learning source

<http://vallance.chem.ox.ac.uk/pdfs/SymmetryLectureNotes2004.pdf>
<http://chemistry.rutgers.edu/undergrad/chem207/SymmetryGroupTheory.html>
www.epgpathshala.nic.in
www.nptel.ac.in
<http://swayam.gov.in>

COURSE OUTCOMES

Course Learning Outcomes

Course Learning Outcomes: Students will be able			Level
CO 1	Explain electrical and magnetic properties of materials and microwave spectroscopy		K2
CO 2	Explain theory, instrumentation and applications of Infrared and Raman spectroscopy		K3
CO 3	Apply selection rules to understand spectral transitions, explain Woodward – Fieser's rule for the calculation of wavelength maximum of conjugated dienes		K4
CO 4	Explain theory, instrumentation and applications of NMR spectroscopy		K3
CO 5	Explain theory, instrumentation and applications of Mass spectrometry		

COURSE MAPPING CO -PSO

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	4	4	4	4	4
CO2	4	4	4	4	4
CO3	4	4	4	4	4
CO4	4	4	4	3	4
CO5	4	4	4	3	4


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SEC-VII-BUSINESS SKILLS IN CHEMISTRY

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTER NAL	TOTAL
Theory	2				2	25	75	100

Objectives:

Cements, Ceramics, Refractories, Adhesives, abrasives, Pulp and Paper - Introduction - classification - preparation - Manufacture - properties - Requirements - Composition - Mechanism - applications.

UNIT – I PREPARATION OF DOMESTICALLY USEFUL PRODUCTS:

Preparation of washing powder, cleaning powder, phenoyls (white, black, yellow and rose coloured phenoyls). Liquid blue and soap oil.

UNIT – II COSMETICS:

Preparation of shampoo, Face powder, soap-manufacturing of soap (kettle process and hydrolysis process).

UNIT-III

1.1. INORGANIC CEMENTING MATERIALS- Introduction-Lime and its manufacture-Gypsum-Plaster-Cement-Types of Cement.

1.2 Manufacture of Portland cement - Chemical Composition of Portland Cement - Setting and Hardening of Portland Cement. Heat of Hydration of Cement - Special Cement – Concrete and RCC - Decay of Concrete.

UNIT-IV

2.1 GLASS AND CERAMICS - Introduction - Manufacture of Glass - Varieties of Glasses.

2.2 Plasticity of Clay - White wares - Glazing - applications - Earthenware and stoneware's – Optical Fibers.

UNIT-V

5.1 Abrasives - introduction - Natural Abrasives - Artificial Abrasives - Grinding Wheels.

5.2 Pulp and paper - Introduction - Manufacture of pulp - Sulphate pulp - Soda pulp - Rag pulp - Beating, refining, filling, sizing and coloring - manufacture of paper.

Course Learning Outcomes

Course Learning Outcomes: Students will be able		Level
CO 1	Learn about the preparation methods of cosmetics, cement,	K2
CO 2	Apply the preparation methods to real time applications	K6

COURSE MAPPING CO -PSO

CO /PSO	PSO1	PSO2	PSO3	PSO4	PS
CO1	4	4	4	4	
CO2	4	4	4	4	

C. 

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AEC-II CHEMISTRY FOR COMPETITIVE EXAMINATIONS

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTER NAL	TOTAL
Theory	2				2	25	75	100

UNIT I

Structure of atoms, chemical reactions, periodic classification, acids and bases, metals and non-metals, and carbon compounds.

UNIT II

Elements and compounds, acids, bases, salts, petroleum products, fertilizers, pesticides, metallurgy, and food adulterants.

UNIT III

Co-ordination Chemistry: (10 Questions) Nomenclature – theories of co-ordination compounds. Werner, valence bond, crystal field theories - Effective atomic number – isomerism.

UNIT IV

Carbohydrates: Classification, sources, preparation and reactions - Glucose, Fructose, Sucrose and lactose- structure of glucose and fructose.

UNIT V

Pharmaceutical Chemistry: Terminology-pharmacology, pharmacotherapies, toxicology, chemotherapy, Different types of drugs like analgesics, antibiotics, antiseptics, disinfectants, anaesthetics, antacids, antimalarial antidepressants, antipsychotic and sedatives.

types of nano materials-Applications of nano

Course Learning Outcomes

Course Learning Outcomes: Students will be able	
CO 1	Understand the basics concepts of Chemistry.
CO 2	Apply the Ideas into Real time Ideas.

COURSE MAPPING CO -PSO

CO / PSO	PSO1	PSO2	PSO3	PSO4
CO1	4	4	4	4
CO2	4	4	4	4

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PART-IV
GENDER STUDIES

பாலின சமத்துவம்

CATEGORY	HOURS				CREDITS	MARKS		
	L	T	P	O		CIA	INTER NAL	TOTAL
theory	1				1	25	75	100

லகு-I

பாலின தொடர்பான கோட்பாடுகள்-பாலியல்-பாலினம்-உடற்கூறு ரீதியாக
பெணியித்தல்-ஆணாதிக்கம்-பெண்ணியம்- பாலின பாகுபாடு - பாலின
வேலைப் பாகுபாடு-பாலின ஒரு படித்தானவைகள்-பாலின உணர்வூட்டல்-
பாலின சமவாய்ப்பு - பாலின சமத்துவம்-பாலின மைய நீரோட்டமாக்கள் -
திகாரப்படுத்துதல்

லகு-II

மகளிரியல் Vs பாலினசமத்துவக்கல்வி-பல்கலைகழக மானியக்குழுவின்
மூலக்கருவிகள்-ஏழாவது ஐந்தாண்டு திட்டம் முதல் பதினோராவது
ஐந்தாண்டு திட்டம்-பாலினசமத்துவக்கல்வி-பெய்ஜி மாநாடு மற்றும்
பெண்களுக்கு எதிரான அனைத்து வன்முறைகளையும் ஒழிப்பதற்கு சர்வதேச
உடன்படிக்கைகள் - இணைத்தல்-உட்படுத்துதல்

லகு-III

பாலியல் பாகுபாட்டிற்கு தளங்கள்:குடும்பம் பாலின விகிதச்சாரம்-கல்வி-
வேலைவாய்ப்பு-சந்தை-
ரோக்கியம்-ஆளுமை-மதம்-வேலை Vs

ஊடகங்கள்-அரசியல்-சட்டம் குடும்ப வன்மை-பாலியல் துன்புறுத்தல்-அரசு
கொள்கைகள் மற்றும் திட்டங்கள்

அலகு-IV

பெண்கள் மேம்பாடு மற்றும் பாலினசமத்துவ மேம்பாடு முயற்சிகள் சர்வதேச
பெண்களுக்கான தசாப்தம்-சர்வதேச பெண்கள் ஆண்டு-பெண்களின்
மேம்பாட்டிற்கான தேசிய கொள்கைகள்-பெண்கள் அதிகார ஆண்டு 2001-
சர்வதேச கொள்கைகளை மைய நீரோட்டமாக்கள்

அலகு-V

பெண்கள் இயக்கங்கள் மற்றும் பாதுகாப்பு நிறுவன ஏற்பாடுகள் - தேசிய
மற்றும் மாநில மகளிர் ஆணையம்-அனைத்து மகளிர் காவல் நிலையங்கள் -
குடும்ப நீதி மன்றங்கள்-குடும்ப வன்முறையிலிருந்து பெண்களை
பாதுகாக்கும் சட்டம் 2005-பணியிடங்களில் பெண்கள் மீதான பாலியல்
துன்புறுத்தல்களை தடுப்பதற்கான உச்ச நீதிமன்ற வழிகாட்டுதல்கள்
தாய்சேய் திட்டம்-பெண்களை கருவிலேயே கண்டறியும் தொழில் நுட்ப
(முறைப்படுத்துதல் மற்றும் தவறாக பயன்படுத்துதலை தடை செய்திடு
சட்டம்-ஈவ்டிசிங்(பெண்களை தொல்லை செய்தல்) தடுப்பு சட்டம்-சுய உதவி
குழுக்கள்-பஞ்சாயத்து அமைப்புகளுக்கான 73வது மற்றும் 74வது சட்
திருத்தம்.

C. John

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