KUNTHAVAI NAACCHIYAAR GOVERNMENT ARTS COLLEGE FOR WOMEN
An Autonomous College Affiliated to Bharathidasan University

Re-Accredited by NAAC with 'B' Grade
Thanjavur – 613 007, Tamil Nadu, India.

CBCS & OBE
Scheme of Instruction and Syllabus for
B.Sc., Chemistry

(I to VI Semester)

Effective from 2023 – 2024 and onwards

DEPARTMENT OF CHEMISTRY

KUNTHAVAI NAACCHIYAAR GOVERNMENT ARTS COLLEGE FOR WOMEN

An Autonomous College Affiliated to Bharathidasan University

Re-Accredited by NAAC with 'B' Grade
Thanjavur – 613 007, Tamil Nadu, India.

KUNTHAVAI NAACCHIYAAR GOVT. ARTS COLLEGE FOR WOMEN (AUTONOMOUS)

DEPARTMENT OF CHEMISTRY

I. VISION

1. To impart higher education to women.
2. To transform and empower the women students through education by enhancing the qualities of competence, confidence and excellence.

II. MISSION

1. To educate the students from the rural area qualitatively.
2. To create social awareness.
3. To enable rational thinking and social responsibility.
4. To empower the students to face the challenges and hurdles in their upcoming life.

III. PROGRAM OUTCOME (PO)

After successful completion of the three year degree program, a student should be able to

PO 1: Acquire communicative skills, Scientific attitude and aptitude in learning chemistry.

PO 2 : Equip students as current industrial need.

PO 3 : Involve in deeper learning of principles and reactions of Inorganic, Organic and Physical chemistry

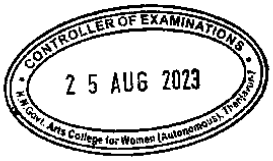
PO 4 : Use modern techniques, decent equipment's and chemistry software.

PO 5 : Get employability, Entrepreneurial skills to find out the jobs and start the own industry respectively.

PO 6 : Understand the role of chemistry in everyday life.

PO 7 : Equip students with different types of problem solving related to academic and industrial domain.

PO 8 : Employ critical thinking and the scientific knowledge to design carry out, record and analyse the result of chemical reactions.



PO 9 : Design and conduct the experiments as well as analyse the inorganic and Organic compounds.

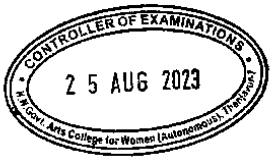
PO10: Create an awareness of the impact of chemistry on the environment, society and development outside of the scientific community.

Programme Structure

B.Sc Chemistry Course CBSE Structure with OBE

(for the candidates admitted 2023-24)

Sem	Part	Course	Existing Code	Title of the Paper	Inst. Hrs.	Credit	Exam Hrs.	Marks		Total
								Int.	Ext.	
I	I	LC 1	23K1T1	Tamil – I	6	3	3	25	75	100
	II	ELC 1	23K1E1	English – I	6	3	3	25	75	100
	III	CC 1	23K1CH01	General Chemistry – I	5	5	3	25	75	100
		CC 2(P)	23K1CH02P	Chemistry Practical - I (Volumetric Analysis)	3	3	3	25	75	100
		EC 1	23K1CH/P/CSECM1:1/23K1B/CHECZ1:1	Algebra and Calculus/ Elective Zoology I	4	4	3	25	75	100
			23K1CH/P/CSECM1:2/23K1B/CHECZ1:2	Numerical Methods with Applications/ Radiation Biology						
		EC2		Differential equations and Laplace Transforms/ Elective Zoology Lab	2	-	-	-	-	-
	IV	SEC – 1	23K1CHSEC1	Role of Chemistry in daily life	2	2	3	25	75	100
			23K1CHFC	Basic Chemistry	2	2	3	25	75	100
	Total				**30**	**22**				**700**
II	I	LC 2	23K2T2	Tamil – II	6	3	3	25	75	100
	II	ELC 2	23K2E2	English – II	6	3	3	25	75	100
	III	CC 3	23K2CH03	General Chemistry – II	5	5	3	25	75	100
		CC4(P)	23K2CH04P	Organic Analysis and Preparation of Organic Compounds	3	3	3	25	75	100
		EC 2	23K2CH/P/CSECM2:1/23K2CH/P/CSECM2:2/23K2B/CHECZ2P	Differential Equation and Laplace Transforms/Number Theory/ Elective Zoology Lab	2	2	3	25	75	100



		EC 3	23K2CH/P/CSEC M3:1/23K2B/CH ECZ3:1	Discrete Mathematics/ Elective Zoology II	4	3	3	25	75	100
			23K2CH/P/CSEC M3:2/23K2B/CH ECZ3:2	Mathematical Statistics/ Agricultural Entomology						
	IV	SEC-2	23K2CHSEC2	Dairy Chemistry	2	2	3	25	75	100
		SEC-3	23K2CHSEC3	Cosmetic and personal grooming	2	2	3	25	75	100
	Total				**30**	**23**				**800**
III	I	LC 3	23K3T3	Tamil – III	6	3	3	25	75	100
	II	ELC 3	23K3E3	English – III	6	3	3	25	75	100
	III	CC 5	23K3CH05	General Chemistry – III	5	5	3	25	75	100
		CC 6(P)	23K3CH06P	Qualitative Inorganic Analysis	3	3	3	25	75	100
		EC 4	23K3CHECP4:1	Allied Physics– I	4	4	3	25	75	100
			23K3CHECP4:2	Applied Physics – I						
		EC5		Allied Physics Practical	2	-	-	-	-	-
	IV	SEC-4	23K3CHSEC4	Entrepreneurial Skills in Chemistry	1	1	3	25	75	100
		SEC-5	23K3CHSEC5	Agro Chemistry	2	2	3	25	75	100
				EVS	1	-				
		ECC1	23K3CHECC1:1	Food Chemistry (Self Study)	-	3	3			100
			23K3CHECC1:2	MOOC						
		ECC2	23K3CHECC2	Hydrochemistry (Add on Course)	-	4				
	Total				**30**	**21**				**700**
IV	I	LC 4	23K4T4	Tamil – IV	6	3	3	25	75	100
	II	ELC 4	23K4E4	English – IV	6	3	3	25	75	100
	III	CC 7	23K4CH07	General Chemistry – IV	4	4	3	25	75	100
		CC 8(P)	23K4CH08P	Physical Chemistry Practical	3	3	3	25	75	100
		EC5	23K4CHECP5P	Allied physics practical	2	2	3	25	75	100
		EC 6	23K4CHECP6:1	Allied Physics – II	4	3	3	25	75	100
			23K4CHECP6:2	Applied Physics - II						
	IV	SEC – 6	23K4CHSEC6	Instrumental methods of Chemical Analysis	2	2	3	25	75	100
		SEC – 7	23K4CHSEC7	Forensic Science	2	2	3	25	75	100
			232K4EVS	EVS	1	2	3	25	75	100
		ECC3	23K4CHECC3:1	Pollution Control and its Measures (Self Study)	-	3	3			100
			23K4CHECC3:2	MOOC						
	Total				**30**	**24**				**900**
V	III	CC 9	23K5CH09	Organic Chemistry – I	6	5	3	25	75	100
		CC 10	23K5CH10	Inorganic Chemistry – I	6	5	3	25	75	100
		CC 11	23K5CH11	Physical Chemistry – I	6	5	3	25	75	100
		CC12(P)	23K5CH12P	Gravimetric analysis Practical	6	4	3	25	75	100
		EC7	23K5CHECCH7:1	Analytical Chemistry	4	3	3	25	75	100

			23K5CHECCH7:2	Bio Chemistry						
			23K5VE	Value Education	2	2	3	25	75	100
			23K5I	Summer Internship/Industrial Training	-	2				
	Total				**30**	**26**				**600**
		CC 13	23K6CH13	Organic Chemistry – II	7	6	3	25	75	100
		CC 14	23K6CH14	Inorganic Chemistry – II	7	6	3	25	75	100
		CC15	23K6CH15	Physical Chemistry – II	7	6	6	25	75	100
VI		EC8	23K6CHECCH8: 1	Molecular Spectroscopy	7	3	3	25	75	100
			23K6CHECCH8: 2	Polymer Science						
	V	SEC -8	23K6CHSEC8	Industrial Application of Chemistry	2	2	3	25	75	100
			23K6EA	Extension Activity	-	1				
	Total				**30**	**24**				**500**
	Grand Total				**180**	**140**				**4200**

23.8.2023

HOD of Chemistry,
Kunthavai Naachiyaar Government
Arts College for Women (Autonomous),
THANJAVUR - 613 007, TN.

CONTROLLER OF EXAMINATIONS
25 AUG 2023
H.W. Govt. Arts College for Women (Autonomous), Thanjavur

SEM I	CC1	GENERAL CHEMISTRY – I	23K1CH01	Ins.Hrs.5	Credit:5

Objective 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 thechemical behaviour • nature of chemical bonding, and fundamental concepts of organic chemistry • mathematical expression of a gas and know the Maxwell distribution of molecular velocities.
Course Outline	**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'exclusion principle and Aufbau principle; **Modern Periodic Table** **Cause of 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-II: 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 polarization – 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 AB_2, AB_3, AB_4, AB_5, AB_6 and AB_7 Partial ionic character of covalent bond-dipole moment, application to molecules of the type A_2, AB, AB_2, AB_3, AB_4; percentage ionic character-numerical problems based on calculation of percentage ionic character.
	UNIT-III: Structure and bonding – II **VB theory** – application to hydrogen molecule; concept of resonance - resonance structures of some inorganic species – CO_2, NO_2, CO_3^{2-}, NO_3^-; limitations of VBT; MO theory - bonding, antibonding and nonbonding orbitals, bond order; MO diagrams of H_2, C_2, O_2, O_2^+, O^{2-}, N_2, NO, HF, CO;magnetic characteristics, comparison of VB and MO theories. **Coordinate bond**: Definition, Formation of BF_3, NH_3, NH_4^+, H_3O^+ 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-IV: **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; inductomeric 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 andnitrobenzene, bond lengths; steric inhibition to resonance. Hyperconjugation - stability of alkenes, bond length, orienting effect of methylgroup, dipole moment of aldehydes and nitromethane Types of organic reactions-addition, substitution, elimination and rearrangements
	UNIT- V **Gaseous State:** Postulates of kinetic theory of gases, kinetic gas equation – derivation of Boyle's law, Charle's law and Avogadro's law from it, deviation from ideal behaviour, PV-P isotherms of real gases, relationship between critical constants and Vander Waals constants, the law of corresponding states, reduced equation of state, the value of `R` in different units. Maxwell's distribution of molecular velocities – average velocity, most probable velocity and root mean square velocity – collision diameter, collision number, collision frequency and mean free path.
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: NewDelhi, 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 PrasadK. J. R. *Essential Organic Chemistry,* PearsonEducation: 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: Newyork,1972. 2. Lee, J. D. *Concise Inorganic Chemistry,* 4th ed.; ELBS William Heinemann: London,1991. 3. Gurudeep Raj, *Advanced Inorganic Chemistry,* 26th ed.; Goel PublishingHouse: Meerut, 2001. 4. Atkins, P.W. & Paula, J. *Physical Chemistry,* 10th ed.; Oxford UniversityPress:New York, 2014. 5. Huheey, J. E. *Inorganic Chemistry: Principles of Structure and Reactivity,* 4th ed .; Addison, Wesley Publishing Company: India,1993.

Website and e-learning source	1. https://onlinecourses.nptel.ac.in 2. http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm 3. http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html 4. https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding 5. https://www.chemtube3d.com/

Course Learning Outcomes(for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.

CO2: 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.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

CONTROLLER OF EXAMINATIONS
25 AUG 2023
H.W. Govt. Arts College for Women (Autonomous), Thanjavur

23-8-2023
HOD of Chemistry,
Kunthavai Naachiyaar Government
Arts College for Women (Autonomous),
THANJAVUR - 613 007, TN.

SEM I	CC2 (P)	CHEMISTRY PRACTICAL – I (VOLUMETRIC ANALYSIS)	23K1CH02P	Ins.Hrs. 3	Credit: 3

Objective of the Course	The course aims at giving an overall view of the • Prepare standard solutions • Understand the principles of Acidimetry, Alkalimetry, Permanganametry, Dichrometry, Iodometry, Iodimetry and complexometric titrations using EDTA • Analyze volumetric data systematically and estimate the amount of inorganic substance in a given solution. • Comprehends the advanced Titrimetric techniques. • Apply the techniques in Titrimetric analysis.
Course Outline	A double titration involving the making-up of solution to be estimated and the preparation of a primary standard (10% of the marks to be awarded for writing the procedure) 1. Acidimetry & Alkalimetry: a) Strong Acid Vs Weak Base b) Weak Acid Vs Strong Base. 2. Redox Titrations: a) Permanganimetry: i. Estimation of Ferrous Ion ii. Estimation of Oxalic Acid iii. Estimation of Calcium b) Dichrometry: i. Estimation of Ferrous Ion 3. Iodometry & Iodimetry: a) Estimation of Copper b) Estimation of Potassium Dichromate c) Estimation of Arseneous Oxide 4. Complexometric Titrations Using EDTA a) Estimation of Magnesium b) Estimation of Calcium c) Determination of Hardness of water.

Reference Books	1. Practical chemistry by A.O. Thomas scientific book centre, cinnarore, 2003. 2. Basic principles of practical chemistry, V. Venkateswaran, R. Veeraswamy, A.R. Kuladaivelu, S. Chand & Sons, New Delhi 2nd edition,2004. 3. Jeffery.G.H, Bassett J, mentham. J, Denney R.C(1989) Vogel's text book of quantitative chemical analysis, John wiley and sons.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: Prepare standard solutions

CO2: Understand the principles of Acidimetry, Alkalimetry, Permanganametry, Dichrometry, Iodometry, Iodimetry and complexometric titrations using EDTA.

CO3: Analyze volumetric data systematically and estimate the amount of inorganic substance in a given solution.

CO4: Comprehends the advanced Titrimetric techniques.

CO5: Apply the techniques in Titrimetric analysis.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

CONTROLLER OF EXAMINATIONS
25 AUG 2023
H.W. Govt. Arts College for Women (Autonomous), Thanjavur

23-8-2023
HOD of Chemistry,
Kunthavai Naachiyaar Government
Arts College for Women (Autonomous),
THANJAVUR - 613 007, TN.

SEM I	SEC 1	ROLE OF CHEMISTRY IN DAILY LIFE	23K1CHSEC1	Ins.Hrs. 2	Credit: 2

Objective 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
Course Outline	**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 Books	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 (for Mapping with POs and PSOs)

On completion of the course the students should be able to

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.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

23.8.2023

HOD of Chemistry,
Kunthavai Naachiyaar Government
Arts College for Women (Autonomous),
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CONTROLLER OF EXAMINATIONS
25 AUG 2023
H.W. Govt. Arts College for Women (Autonomous), Thanjavur

SEM I	FC	BASIC CHEMISTRY	23K1CHFC	Ins.Hrs.2	Credit:2

Objective of the Course	The course aims at giving an overall view of the • Atomic Structure • Chemical Bonding • Organic Reactions • Naming the Organic Compounds • Environmental Chemistry
Course Outline	**UNIT – I** **Atomic Structure :** Rutherford atomic model – Bohr theory of hydrogen atom – Dalton atomic model – de- Broglie's equation – Heisenberg's uncertainty principle – quantum numbers – Pauli's exclusion principle – orbits and orbitals.
	UNIT – II **Chemical Bonding:** Types of bonds – ionic, covalent, coordinate bond – concept of hybridization – hybridization involving s, p and d orbital- valance bond theory- VSEPER theory – molecular orbital theory – basic concept of resonance.
	UNIT – III **Organic Reactions :** Homolytic and Heterolytic bond fissions- types of reagents – electrphiles and nucleophiles – types of organic reactions, addition, elimination, substitution, rearrangement, oxidation, reduction, polymerization – Inductive, mesomeric, hyperconjugation and steric effect.
	UNIT – IV **Naming the Organic Compounds :** IUPAC Namonclature of organic compounds. E-Z Nomenclature – Elementary idea of cis-trans isomerism. **Concentration Units :** Molarity, Normality, Mole fraction, formality, percentage molality and parts per million – primary standard and secondary standard solutions.
	UNIT – V **Environmental Chemistry :** Air, water and soil pollution chemical reactions in atmosphere smog, major atmospheric pollutants, acid rain, ozone and its reactions. Effect of depletion of ozone layer – greenhouse effect and global warming – pollution due to industrial waste – strategy for control of environmental pollutions

Reference Books	1. Madan, R. D. and Sathya Prakash, *Modern Inorganic Chemistry*, 2nd ed.; S.Chand and Company: New Delhi, 2003. 2. Environmental Chemistry, A.K. De, 5th Edn., New Age International Publisher, 2005. 3. Environmental Chemistry, B.K. Sharma, 11th Edn., Krishna Prakashan Media Limited, 2007. *4.* Puri, B. R. and Sharma, L. R. *Principles of Physical Chemistry*,38th ed.;Vishal Publishing Company: Jalandhar, 2002.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: know the various theory of atomic structure

CO2: understand the types of chemical bonding and molecular orbital theory.

CO3: classify the basic concepts and types of organic reactions.

CO4: naming the organic compounds by IUPAC nomenclature and know the concentrations units.

CO5: aware the types of pollutions and strategies for control of environmental pollution.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

23.8.2023

HOD of Chemistry,
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SEM II	CC 3	GENERAL CHEMISTRY – II	23K2CH03	Ins.Hrs.5	Credit:5

Objective of the Course	This course aims at providing an overall view of the • properties of s and p-block elements • chemistry of hydrocarbons • compounds of main block elements and hydrocarbons • applications of acids and bases • chemistry of acids, bases and ionic equilibrium • concept involved in liquids, solids and liquid crystals
Course Outline	**Unit-I** **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, Na_2CO_3, KBr, $KClO_3$ 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-II **Hydrocarbon Chemistry-I** **Petroproducts:** Fractional distillation of petroleum; cracking, isomerisation, alkylation, reforming and uses **Alkenes**-Nomenclature, general methods of preparation – Mechanism of β-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 reactions – 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-III **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 α - 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.
	UNIT-IV **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 problems involving the core concepts**.**
	UNIT – V **Liquid State-** Intermolecular forces-Dipole-dipole attraction, London forces, Hydrogen bonding-nature,tyes and effects on properties.Structural differences between solids, liquids and gases. **Solid state-**Definition of space lattice, unit cell, laws of crystallography, symmetry elements in crystals, X-ray diffraction by crystals – derivation of Bragg equation, methods of crystal structure analysis – Laue's method and powder method, determination of crystal structure of NaCl, KCl, ZnS and CsCl. **Liquid crystals** – classification, structure, properties and applications.
Recommended Text	1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nd ed, 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. 5. 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, Newyork. 2. Barrow G M, (1992), Physical Chemistry, 5th ed., Tata McGraw Hill, NewDelhi. 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. 6. Agarwal O P, (1995), Reactions and Reagents in Organic Chemistry, 8thed., Goel Publishing House,Meerut.

Website and e-learning source	https://onlinecourses.nptel.ac.inhttp://cactus.dixie.edu/smblack/chem1010/lecture_notes/4B.html http://www.auburn.edu/~deruija/pdareson.pdfhttps://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 (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain the concept of acids, bases and ionic equilibria; periodic properties of s and pblock elements, preparation and properties of aliphatic and aromatic hydrocarbons

CO2: discuss the periodic properties of sand p- block elements, reactions of aliphatic andaromatic hydrocarbons and strength of acids

CO3: classify hydrocarbons, types of reactions, acids and bases, examine the properties s and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons

CO4: explain theories of acids, bases and indicators, buffer action and important compoundsof s-block elements

CO5: assess the application of hard and soft acids indicators, buffers, compounds of s and p- block elements and hydrocarbons

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

23.8.2023

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SEM II	CC 4	ORGANIC ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS	23K2CH04P	Ins.Hrs. 3	Credit: 3

Objective of the Course	This course aims at providing knowledge on • laboratory safety • handling glass wares • analysis of organic compounds • preparation of organic compounds
Course Outline	**Unit I 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
	UNIT II 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
Recommended Text	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),*Sultan 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.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

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.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M

CO-PO Mapping

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

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SEM II	SEC 2	DAIRY CHEMISTRY	23K2CHSEC2	Ins.Hrs.2	Credit:2

Objective of the Course	This course aims at providing an overall view of the • chemistry of milk and milk products • processing of milk • preservation and formation of milk products.
Course Outline	**UNIT – I** **Composition of Milk** Milk-definition-general composition of milk- constituents of milk - lipids, proteins, carbohydrates, vitamins and minerals - physical properties of milk - colour, odour, acidity, specific gravity, viscosity and conductivity -Factors affecting the composition of milk - adulterants, preservatives with neutralizer- examples and their detection- estimation of fat, acidity and total solids in milk.
	UNIT – II **Processing of Milk** Microbiology of milk - destruction of micro - organisms in milk, physico – chemical changes taking place in milk due to processing - boiling, pasteurization – types of pasteurization -Bottle, Batch and HTST (High Temperature Short Time) – Vacuum pasteurization – Ultra High Temperature Pasteurization.
	UNIT – III **Major Milk Products** Cream - definition - composition - chemistry of creaming process - gravitational and centrifugal methods of separation of cream - estimation of fat in cream. Butter - definition -composition - theory of churning – desi butter - salted butter, estimation of acidity and moisture content in butter. Ghee - major constituents - common adulterants added to ghee and their detection - rancidity- definition - prevention - antioxidants and synergists - natural and synthetic.
	UNIT – IV **Special Milk** Standardised milk - definition - merits - reconstituted milk - definition - flow diagram of manufacture - Homogenised milk - flavoured milk - vitaminised milk - toned milk -Incitation milk - Vegetable toned milk - humanized milk - condensed milk - definition, composition and nutritive value.

	UNIT – V **Fermented and other Milk Products** Fermented milk products – fermentation of milk - definition, conditions, cultured milk - definition of culture - example, conditions - cultured cream, butter milk - Bulgarious milk -acidophilous milk – Yoheer Indigeneous products- khoa and chhena definition - Ice cream -definition-percentage composition-types-ingredients-manufacture of ice–cream, stabilizers -emulsifiers and their role-milk powder-definition-need for making milk powder- drying process-types of drying.
Recommended Text	1. K. Bagavathi Sundari, Applied Chemistry, MJP Publishers, first edition, 2006. 2. K. S. Rangappa and K.T. Acharya, Indian Dairy Products, Asia Publishing House New Delhi, 1974. 3. Text book of dairy chemistry, M.P. Mathur, D. Datta Roy, P. Dinakar, Indian Council of Agricultural Research, 1 st edition, 2008. 4. A Text book of dairy chemistry, Saurav Singh, Daya Publishing house, 1 st edition, 2013. 5. Text book of dairy chemistry, P. L. Choudhary, Bio-Green book publishers, 2021.
Reference Books	1. Robert Jenness and S. Patom, Principles of Dairy Chemistry, S.Wiley, New York, 2005. 2. F.P.Wond, Fundamentals of Dairy Chemistry, Springer, Singapore, 2006. 3. Sukumar De, Outlines of Dairy Technology, Oxford University Press, New Delhi, 1980. 4. P.F.Fox and P.L.H. Mcsweeney, Dairy Chemistry and Biochemistry, Springer, Second edition, 2016. 5. Dairy chemistry and biochemistry, P. F. Fox, T. Uniacke-Lowe, P.L.H. McSweeney, J.A. OMahony, Springer, Second edition, 2015.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: understand about general composition of milk – constituents and its physical properties.

CO 2: acquire knowledge about pasteurization of Milk and various types of pasteurization - Bottle, Batch and HTST Ultra High Temperature Pasteurization.

CO 3: learn about Cream and Butter their composition and how to estimate fat in cream andGhee

CO 4: explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk.

CO 5: have an idea about how to make milk powder and its drying process - types of dryingprocess

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

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SEM II	SEC 3	COSMETICS AND PERSONAL GROOMING	23K2CHSEC3	Ins.Hrs. 2	Credit: 2

Objective of the Course	This course aims at familiarizing the students with • formulations of various types of cosmetics and their significance • hair, skin and dental care • makeup preparations and personal grooming
Course Outline	**Unit I Skin care** Nutrition of the skin, skin care and cleansing of the skin; face powder – ingredients; creams and lotions – cleansing, moisturizing all purpose, shaving and sunscreen (formulation only); Gels – formulation and advantages; astringent and skin tonics – key ingredients, skin lightness, depilatories.
	Unit II Hair care Shampoos – types – powder, cream, liquid, gel – ingredients; conditioner – types – ingredients **Dental care** Tooth pastes – ingredients – mouth wash
	Unit III Make up Base – foundation – types – ingredients; lipstick, eyeliner, mascara, eye shadow, concealers, rouge
	Unit IV Perfumes Classification - Natural – plant origin – parts of the plant used, chief constituents; animal origin – amber gries from whale, civetone from civet cat, musk from musk deer; synthetic – classification emphasizing characteristics – esters – alcohols – aldehydes – ketones
	Unit V **Beauty treatments** Facials - types – advantages – disadvantages; face masks – types; bleach -types – advantages– disadvantages; shaping the brows; eyelash tinting; perming – types; hair colouring and dyeing ; permanent waving – hair straightening; wax types – waxing; pedicure, manicure - advantages – disadvantages
Recommended Text	1. Thankamma Jacob, (1997) Foods, drugs and cometics – A consumer guide,Macmillan publication, London.
Reference Books	1. Wilkinson J B E and Moore R J, (1997) Harry's cosmeticology, 7th ed., Chemical Publishers, London. 2. George Howard, (1987) Principles and practiceof perfumes and

	cosmetics, Stanley Therones, Chettenham
Website ande-learning source	1. http://www.khake.com/page75.html 2. Net.foxsm/list/284

Course Learning Outcomes (for Mapping with POs and PSOs)On

completion of the course the students should be able to

- **CO1:** know about the composition of various cosmetic products
- **CO2** understand chemical aspects and applications of hair care and dental care and skincare products.
- **CO3** understand chemical aspects and applications of perfumes and skin care products.
- **CO4** to understand the methods of beauty treatments their advantages and disadvantage
- **CO5** understand the hazards of cosmetic products.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

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SEM III	CC5	GENERAL CHEMISTRY – III	23K3CH05	Ins.Hrs.5	Credit:5

Objective of the Course	This course aims to provide a comprehensive knowledge on • Compounds of Nitrogen and Halogen family elements. • 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. • Colligative properties of solutions.
Course Outline	**UNIT – I** **Nitrogen Family** – Comparative study of Nitrogen family elements and their compounds - hydrides, halides, oxides and oxy acids. Chemistry of hydrazine – hydrazoic acid , hydroxyl amine and sodium bismuthate. **Halogen Family**- comparative study of halogens and their compounds, structures of oxides and oxyacids of halogens, estimation of available chlorine in bleaching powder, Interhalogen compounds- preparation, properties structure and uses. Pseudo halogens – preparation, properties and uses. Chemistry of Astatine.
	UNIT-II **Nuclear Chemistry** Natural radioactivity - α, β and γ rays; half-life period; Fajan–Soddy group displacement law; Geiger–Nattal rule; isotopes, isobars, isotones, mirror nuclei, iso diaphers; 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. (Problems to be worked out) Nuclear energy; nuclear fission and fusion – major nuclear reactors in India;radiation hazards, disposal of radioactive waste and safety measures.
	UNIT-III **Halogen derivatives Aliphatic halogen derivatives** Nomenclature and classes of alkyl halides – isomerism, physical properties,

	Chemical reactions. Nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with 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 **Alcohols:** Nomenclature, classification, preparation, properties, use; conversions – ascent and descent of series; test for hydroxyl groups. Oxidation of diols by periodic acid and lead tetraacetate.
	UNIT-IV **Phenols** Nomenclature; classification, Preparation from diazonium salts, cumene, Dow's process, Raching process; properties – acidic character and effect of substitution on acidity. Reactions – Fries, claisen rearrangement, Electrophilic substitution reactions, Reimer - Teimen, Kolbe, Schmidt, Gatermann synthesis, Libermann, nitro reaction, phthalein reaction. Resorcinol, quinol, picric acid – preparation, properties and uses. **Aromatic alcohols** Nomenclature, benzyl alcohol – methods of preparation – hydrolysis, reduction of benzaldehyde, Cannizzaro reaction, Grignard synthesis, physical properties, reactions – reaction with sodium, phosphorus pentachloride, thionyl chloride, acetic anhydride, hydrogen iodide, oxidation – substitution on the benzene nucleus, uses. Thiols: Nomenclature, structure, preparation and properties.
	UNIT –V **Dilute Solutions-** Colligative properties – Dilute solutions- colligative properties, Raoult' law, relative lowering of vapour pressure, molecular weight determination, Osmosis, law of osmotic pressure and its measurements, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point, Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

Recommended Text	1. B.R. Puri, L.R. Sharma, M.S. Pathania; *Principles of Physical Chemistry*, 46th 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. 4. P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, SultanChand & amp; Sons, twentieth edition, 2006. 4. M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, Vishal Publishing, fourth reprint, 2003. 5. S.M. Mukherji, and S.P. Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.
Reference Books	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.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain the kinetic properties of gases by using mathematical concepts.

CO2: describe the physical properties of liquid and solids; identify various types of crystalswith respect to its packing and apply the XRD method for crystal structure determinations.

CO3: investigate the radioactivity, nuclear energy and it's production, also the nuclear waste management.

CO4: write the nomenclature, physical & chemical properties and basic mechanisms of halo organic compounds and alcohols.

CO5: investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol including thiol.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

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SEM III	CC6 (P)	QUALITATIVE INORGANIC ANALYSIS	23K3CH06P	Ins.Hrs. 3	Credit: 3

Objective of the Course	• To develop the skill on systematic analysis of simple inorganic salts and mixture of salts.
Course Outline	**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 5. Analysis of a mixture - I to VIII containing two cations and two anions (of which one is interfering type)
Recommended Text	V. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, Basic Principles ofPractical Chemistry, Sultan Chand & Sons, New Delhi, second edition, 1997.
Website ande-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

CO 1: acquire knowledge on the systematic analysis of Mixture of salts.

CO 2: identify the cations and anions in the unknown substance.

CO 3: identify the cations and anions in the soil and water and to test the quality of water.

CO4: assess the role of common ion effect and solubility product

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M

CO-PO Mapping

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

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SEM III	EC 3	ELECTIVE CHEMISTRY - I	23K3PECCH4:1	Ins.Hrs. 4	Credit: 3

Objectives of thecourse	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. • Provide fundamentals of phytochemistry
	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 **Fundamental Concepts in Organic Chemistry** Hybridization: Orbital overlap hybridization and geometry of CH_4,C_2H_4, C_2H_2 and C_6H_6. Polar effects: Inductive effect and consequences on Ka 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 – III **Drugs and Speciality Chemicals** Definition, structure and uses: Antibioticsviz., 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 –IV **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.
	UNIT – V **Photochemistry** Grothus - Drapper'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.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 Books	1. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chandand 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;

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology.

CO 2: explain the preparation and property of carbohydrate.

CO 3: enlighten the biological role of transition metals, amino acids and nucleic acids.

CO 4: apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.

CO 5: outline the various type of photochemical process.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO- PO Mapping

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

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SEM III	EC3	CHEMISTRY FOR BIOLOGICAL AND PHYSICAL SCIENCES – I	23K3PECCH4:2	Ins.Hrs.4	Credit: 3

Objectives of thecourse	This course aims at providing knowledge on • Nanomaterials • Carbohydrates and proteins • Fossil fuels and fuel gases • Solid state • Electrochemistry
	UNIT I Nanomaterials Introduction of nanomaterials – definition, synthesis – Top down and Bottom up approaches – synthesis of carbon nanotubes, fullerenes, gold and silver nanoparticles. Characterization nanomaterials – electron microscopy techniques – scanning electron microscopy and transmission electron microscopy
	UNIT II **Carbohydrates:** Classification- Glucose and Fructose- preparation and properties-elucidation of structure of glucose. Sucrose- manufacture, properties andstructure(elucidation of structure not required). Starch and Cellulose- properties and uses only. **Proteins:** Proteins- classification based on physical properties andbiological functions-properties of proteins (Isoelectric point, Denaturation of Protein) - structure of proteins- primary and secondary structures (elementary treatmentonly).
	UNIT III **Fossil Fuels and Fuel gases** Fossil Fuels, Varieties of Coal, Petroleum – origin of Petroleum –Refining Chemistry of Cracking - Petroleum Refineries in India. **Fuel gases**- natural gas, water gas, semi water gas, carburetted water gas, producer gas, LPG and oil gas-composition, manufacture(elementary idea) and uses.

	UNIT IV **Solid State :** Typical crystal lattices- elements of symmetry- unit cell- types of cubic unit cells- Weiss and Miller indices- number of crystal units per unit cell- Avogadro number calculation- structure of NaCl crystal- Bragg equation.
	UNIT V **Electrochemistry :** Types of electrical conductors- conductance- specific and equivalent conductance- their determination- effect of dilution on conductance- weak and strong electrolytes- Ostwald's dilution law- Kohlrausch law- application of the law (determination of λ_∞ of weak electrolytes, solubility of sparingly soluble salts)- conductometric titrations- acid-base titrations- (SA Vs SB, SA Vs WB, WA Vs SB & WA Vs WB).
Reference Books	1. *Nano; The essentials;understanding nano science and nano technology,T. Pradeep, McGraw – Hill Professional publishing, New delhi, 2008* 2. *Text Book of Organic Chemistry,* P.L.Soni & H.M.Chawla, Sultan Chand. 3. *Principles of Physical Chemistry,* B.R.Puri & L.R.Sharma, Shoban Lal Nagin Chand & Co.

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

CO 1: know the different type of approaches in synthesizing nanomaterials and its characterization.

CO 2: describe the structure and function of bio-molecules like carbohydrates, amino acids and proteins.

CO 3: understand the fossil fuels, various types of fuels, manufacture and uses of fuels.

CO 4: learn the basic concepts of solid state chemistry.

CO 5: acquire the knowledge in the concepts of electrical conductance, conductors, strong and weak electrolytes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO- PO Mapping

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

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SEM III	SEC 4	ENTREPRENEURIAL SKILL	23K3CHSEC4	Ins.Hrs.1	Credit:1

Objective of the Course	The course aims at providing training to • develop entrepreneur skills in students • to provide hands on experience to prepare and develop products • develop start ups
Course Outline	**UNIT –I** **Food Chemistry** Food adulteration-contamination of food items with clay stones, water andtoxicchemicals -Common adulterants. Food additives, Natural and synthetic anti-oxidants, glazing agents (hazardous effect),food colourants, Preservatives, leavening agents, Baking powder and baking soda, yeast,MSG,vinegar. **Dyes** Classification – Natural, synthetic dyes and their characteristics – basic methods and principles of dyeing
	UNIT II **Hands on Experience (Students can choose any four)** Detection of adulterants in food items like coffee, tea, pepper, chilli powder, turmeric powder, butter, ghee, milk, honey etc., by simple techniques. Preparation of Jam, squash and Jelly, Gulkand, cottage cheese. Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, tooth paste/powde rand disinfectants in small scale. Extraction of oils from spices and flowers.Testing of water samples using testing kit. Dyeing – cotton fabrics with natural and synthetic dyes Printing – tie and dye, batik.
Recommended Text	1. George S &Muralidharan V, (2007) Fibre to Finished Fabric – A Simple Approach, Publication Division, University of Madras, Chennai. 2. Appaswamy G P, A Handbook on Printing and Dyeing of Textiles.
Reference Books	Shyam Jha, Rapid detection of food adulterants and contaminants (Theory and Practice),Elsevier, e Book ISBN 9087128004289, 1st Edition,2015

Website ande-learning source	https://www.vlab.co.in/broad-area-chemical-sciences

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: identify adulterated food items by doing simple chemical tests.

CO 2: prepare cleaning products and become entrepreneurs

CO 3: educate others about adulteration and motivate them to become entrepreneurs.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M

CO-PO Mapping

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
Weightage	6	6	6	6	6
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

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SEM III	SEC 5	AGRO CHEMISTRY	23K3CHSEC5	Ins.Hrs.2	Credit:2

Objective of the Course	This course aims to providing the students • Soil formation • knowledge about the various types of pesticides and their toxicity. • to understand the accumulation of pesticides in in the form of residues and its analysis. • knowledge on choice of alternate and eco-friendly pesticides.
Course Outline	**UNIT-I** **Soil formation** – factors influencing soil formation, Soil forming processes. Definition of soil. **Soil Physical properties** – Soil texture and structure – Bulk density, particle density, Porespace, soil air, soil temperature, soil water, soil consistence – significance of Physical properties to plant growth. **Fertilizers** Fertilizers- mixed fertilizers - role in plant life – methods of applying solid fertilizers and liquid fertilizers- economic value of fertilized crop. Nitrogenous, phosphatic and potash fertilizers. Urea, Super phosphate, Bone meal and potassium nitrate.
	Unit II **Pesticides residues:** Introduction- application of agrochemicals, dissemination pathways of pesticides, causes of pesticide residues, remedies. Pesticides residues in atmosphere- entry into atmosphere, action of pesticides, effects on environments. Pesticides residues in water - entry into water systems, action and effect in aquatic environment. Pesticides residues in soil. entry into soil, absorption, retention and transport in soil, effects on microorganism, soil condition and fertility, decomposition and degradation by climatic factors and microorganism. **Pesticide Residues effect and analysis:** Effects of pesticides residue on human life, birds and animals- routes for exposure to pesticides, action of pesticides on living system. Analysis of pesticides residues- sample preparation, extraction of pesticides residues (soil, water and vegetables/fruits) simple methods and schemes of analysis, multi-residue analysis.

	Unit III Biopesticides: Pheromones, attractants, repellents – Introduction, types and application (8- Dodecen-1-ol, 10-cis-12-hexadecadienoic, Trimedlure, Cue-lure, methyl eugenol, N,N- Diethyl-m-toluamide, Dimethyl phthalate, Icaridin). Baits- Metaldehyde, Iron (II) phosphate, Indoxacarb, Zinc Phosphide, Bromadiolone.
Recommended Text	2. Handa SK. Principles of pesticide chemistry. Agrobios (India); 2012. 3. Matolcsy G, Nádasy M, Andriska V. Pesticide chemistry. Elsevier; 1989. 4. J. Miyamoto and P. C. Kearney Pesticide Chemistry Human Welfare and the Environment vol. IV Pesticide Residue and Formulation Chemistry, Pergamon press,1985. 5. R. Cremlyn: Pesticides, John Wiley. *5. The nature and properties of soils*,.Brady N.C., Eurasia Publishing House, (P) Ltd. 9th Ed. 1984. 6. *Text book of soil science,* Biswas, T.D. and Mukherjee S.K. 1987 7. *Soil fertility and fertilizers*, Tisdale S.L., Nelson W.L., and Beaton J.D. Macmillan Publishing Company, NewYork , 1990. 6. 8. *Commercial fertilizers,* Colling G.H., McGraw Hill Publishing Co., New York, 1955.
Reference Books	1. Roy N. K., Chemistry of Pesticides. CBS Publisher & Distributors P Ltd; 1st Ed. (2010). 2. Nollet L.M., Rathore H.S., Handbook of pesticides: methods of pesticide residues analysis. CRC press; 2016. 3. Ellerbrock R.H., Pesticide Residues: Significance, Management and Analysis, 2005
Website ande-learning source	1. http://www.khake.com/page75.html 2. Net.foxsm/list/284

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: learn about the soil forming process their physical properties, structure and its significance.

CO 2: explain the preparation and property of pesticides

CO 3: investigate the pesticide residues, prevention and care

CO 4: demonstrate the extraction and analytical methods of pesticide residues

CO 5: make awareness to the public on bio-pesticides .

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO- PO Mapping

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

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SEM III	ECC 1	FOOD CHEMISTRY	23K3CHECC1:1	Ins.Hrs. -	Credit:3

Objective of the Course	This course aims to providing the students • Types of food • Food adulteration and poisons • Food additives and preservation
Course Outline	**UNIT-I** Food groups and nutritive values of Foods- cereals and millets- pulses, nuts and oilseeds, vegetables- Fruits, Milk and milk products, eggs, meat, fish and other animal foods, fats and oils, sugar and carbohydrate foods, spices. Nutritional classification of foods. Planning of balanced diets. Nutritive value of some food products. Recommended dietary allowances (RDA) calories, proteins, fat, calcium, Phosphorous, iron, vitamin A, Thiamine, Riboflavin, Nicotinic acid, folic acid, Vitamin B12, Vitamin D, Fortification of foods, food and its function. Deficiency diseases, Anaemia caused by dietary deficiencies, suggestion for a healthy diet (RDA).
	UNIT II Sources of water for the body, Mineral elements & Trace elements. Cooking and Diet - Methods of Cooking, effect of cooking (on vegetable foods, on animal foods) and heat processing on the nutritive values of foods. Food spoilage – Preservation and Hygiene, Microbiological food spoilage- Preservation and Nutritive Value- Food Poisoning- Food Hygiene. Food additives and contaminants - Classes of food additives, Risks and benefits of additives.
	UNIT III Therapeutic Nutrition and Diets - Needs for Modification of Diets in different diseases, peptic ulcer, Diarrhoea, Constipation, Diseases of liver- Jaundice, chronic renal failure, hyper & hypo tension-Diabetes Mellitus. Nutrition during pregnancy and lactation. Nutrition during infancy. Nutrition for children and teenagers. Nutrition in Later Maturity.

	UNIT IV Obesity – Occurrence, Complications due to obesity, Treatment, Prevention. Diet and Dental Health. Under nutrition and Malnutrition- causes, signs of under & malnutrition, Nutritional requirements. Milk and Milk Products - The Constituents of Milk, Physical properties of milk, Stability of milk- Denaturation & fermentation- Market Milk Pasteurization, Sterilization, Standardization, homogenization, toning, condensing and drying processes- nutritive values of dairy products (Cheese, ice cream, yoghurt, butter milk, whey water)
	UNIT V Food adulteration and detection -Definition of adulterated food, Food standards, Common food adulterants, contamination of foods with harmful Micro- Organisms, Chemical contaminants, detection of adulteration. Beverages – Coffee, Tea, Cocoa, Carbonated Non – alcoholic beverages, fruit beverages & miscellaneous beverages Fermented Foods – Fermented foods, Therapeutic value Food Standards.
Reference Books	1. *Fundamentals of Normal Nutrition*, Corinne H. Robinson, Macmillan Publishing Co., Inc. New York. 2. *Milk and Milk products*, Clarence Henry Eckles, Willes Barnes combs, Harold Macy, Tata McGraw Hill Publishing Company Ltd., New Delhi. 3. *Food Science and Experimental Foods*, M. Swaminathan, Ganesh and Company, Madras. 4. *Food Science- A Chemical Approach*, Brian A Fox, Allen G Cameron, Hodder and Stoughton. London Sydney, Auckland Toronto. 5. *Food and Nutrition Vol. II- Applied Aspects*, M. Swaminathan, D.Sc, F.N.A II edition BAPCO.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1 To learn about food groups and nutritive values of foods, nutritional classification of foods, balanced diets and its dietary deficiencies..

CO 2: To understand sources of water, minerals and trace elements. Methods and cooking, food spoilage, preservative and hygiene, food additives and its contaminants.

CO 3: To study the therapeutic nutrition and diets in pregnancy and lactation, infancy, children and teenagers, later maturity.

CO 4: To illustrate the occurrence and complications of obesity, diet and dental health, causes and signs of under and mal nutrition, milk and milk products such as physical properties, denaturation, fermentation and its process.

CO 5: To analyse the food adulteration and detection in beverages,

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping

CO /PO	PSO1	PSO2	PSO3	PSO 4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

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SEM III	ECC 2	HYDROCHEMISTRY	23K3CHECC2	Ins.Hrs. -	Credit:4

Course Outline	**UNIT-I** **Introduction** Sources of water- Surface sources and ground sources. Hydrology- precipitation, rain and snowfall water and runoff water. Water as universal solvent- classification of water- Soft water and hard water. Water pollution- Causes for water pollution (Natural and Anthropogenic processes). Effects of water pollution- prevention of pollution and water pollution control (Brief treatment Only).
	UNIT-II **Water Quality Parameters:** Physical parameters- Characteristics of water depending on source- colour, taste, odour, turbidity, Total Dissolved Solids (TDS) and Electrical conductivity. Chemical parameters- pH, Total Alkalinity, Total Hardness- permissible quantities and tests for sodium, potassium, chloride, chlorine, fluoride, calcium, maganesium, iron, manganese, ammonia, nitrite, nitrate, phosphate and sulphate. Biological Parameters- Bacteria, Algae, Fungi and Protozoa.
	UNIT-III **Quality of water:** Water quality Standards- WHO- standard of water quality for domestic and industrial purposes. Ground water quality and Surface water quality- Significance and Health effects of water quality. Impurities in water- suspended impurities, colloidal impurities and dissolved impurities. Water contaminants- organic, inorganic, microbiological and biological contaminants.

	UNIT-IV **Water Demand and Treatment of water:** Domestic water demand- Chemical and industrial demand- Factors affecting the water demand. Disadvantages of Hard water- indomestic use- in industrial use and in boilers, Removal of colour, odour and taste, reverse osmosis process and desalination of sea water. Disinfecting water- by boiling, by UV ray, with Iodine and Bromine, with ozone, by excess lime, by potassium permanganate and by chlorine.
	UNIT-V **Water Analysis** Physical test- Nephelometric Method of measurement of turbidity and tests for colour, taste and odour. Chemical test- COD and BOD. Biological test- Total count of Bacteria- Membrane Filter Technique- E.Coli test- MPN and Gram stain technique. **Infectious Diseases:** Water borne diseases- By Bacterial organisms, Bacteriophage andby Protozoa. Water washed diseases, water-based diseases, water-related diseases and preventive measures.
Reference Books	1. *Water pollution*, Tripathi A.K, Pandey S.N, Ashish Publishing House, New Delhi (1990). 2. *Water Pollution*, Goel P.K, New Age International Private Limited, New Delhi (1997). 3. *Environmental Chemistry*, Kudesia V.P, Pragati Prakashan Publication, Meerut, First Edition (2000) 4. *Pollution Convervation and Forestry*, Siddiqui K.A, Kitab Mahal Publication, Allahabad, Second Edition (2002). 5. *Environmental Chemistry*, De A.K, New Age International Private Ltd, New Delhi, Fourth Edition (2000). 6. *Water supply and Sanitary Engineering*, Birdie G.S, Birdie J.S, Dhanpat Rai Publishing Company, New Delhi. 7. *Chemtech I*, Venkateswarlu & Co., S. Chand and Company Ltd.

Course Learning Outcomes (for Mapping with Pos and PSOs)

On completion of the course the students should be able to

CO1: to study the source of water.
CO2: to learn about physical parameters and chemical parameter.
CO3: to analysis quality of water and impurities in water.
CO4: to understand in detail about water demand and treatment of water.
CO5: to know the infective diseases

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO – PO Mapping

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

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SEM IV	CC 7	GENERAL CHEMISTRY – IV	23K4CH07	Ins.Hrs.4	Credit:4

Objective of the Course	This course aims to provide a comprehensive knowledge on • transition elements with reference to periodic properties and group study of transition metals. • the organic chemistry of ethers, aldehydes and ketones • the organic chemistry of carboxylic acids • wave particle duality of matter • thermodynamic concepts on chemical processes and applied aspects.
Course Outline	**UNIT I** **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 II **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 LiAH4 Thioethers - nomenclature, structure, preparation, properties and uses. **Aldehydes and Ketones** Nomenclatue, 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 – Pondorf Verley reduction, reduction with LiAlH4 and NaBH4. Addition reactions of unsaturated carbonyl compounds: Michael addition.

	UNIT III **Carboxylic Acids**: Nomenclature, structure, preparation and reactions of aliphatic and aromatic monocarboxylic acids. Physical properties, acidic nature, effect of substituent on acidic strength. HVZ reaction, Claisen ester condensation, Bouveault Blanc reduction, decarboxylation, Hunsdieckerreaction.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. Schottan-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 and γ hydroxy acids.
	UNIT IV **Elementary Quantum Mechanics**- Wave particle dualism Heisenberg's uncertainty principle -wave character of electrons-Davisson and Germer experiment; Schrodinger wave equation for a particle wave-physical interpretation of Ψ and Ψ^2 .Operators, eigen function and eigen value. Postulates of Quantum Mechanics – application: Particle in one dimensional box – solution of Shrodinger's wave equation. **Magnetic Properties of matter:** Diamagnetism, Paramagnetism, ferro and anti-ferro magnetism-Curie Temperature (Determination not necessary)

	UNIT V **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 (Cp & Cv); 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; Measurement of heat of reaction – determination of calorific value of food and fuels Zeroth law of thermodynamics-Absolute Temperature scale.
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, thirdedition, 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. 5. 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*,4thed.; The Macmillan Company: Newyork,1972. 2. Gurudeep Raj, *Advanced Inorganic Chemistry*, 26thed.; Goel Publishing House: Meerut, 2001. 3. Elements of physical chemistry, Samuel Glasstone, David Lewis, London Macmillan & Co Ltd., 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.

Website ande-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

CO1: explain the terms and processes in thermodynamics; discuss the various laws of thermodynamics and thermo chemical calculations.

CO2: discuss the second law of thermodynamics and its application to heat engine; discuss third law and its application on heat capacity measurement.

CO3: investigate the chemistry of transition elements with respect to various periodic properties and group wise discussions.

CO4: discuss the fundamental organic chemistry of ethers, epoxides and carbonyl compoundsincluding named organic reactions.

CO5: discuss the chemistry and named reactions related to carboxylic acids and their derivatives; discuss chemistry of active methylene compounds, halogen substituted acidsand hydroxyl acids.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping

CO /PO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

23.8.2023

HOD of Chemistry,
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25 AUG 2023
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SEM IV	CC 8	PHYSICAL CHEMISTRY PRACTICAL	23K4CH08P	Ins.Hrs.3	Credit:3

Objective of the Course	The course aims at providing an understanding of • the laboratory experiments in order to understand the concepts of physical changes in chemistry • the rates of chemical reactions
Course Outline	1. **Kinetics:** Determination of rate constant of acid catalyzed hydrolysis of an ester. 2. **Phase equilibria:** a) Construction of phase diagram of a simple eutectic system b) Determination of Critical Solution Temperature of phenol-water system 3. **Transition Temperature:** Determination of transition temperature of a salt hydrate by thermometric method 4. **Rast's Method:** a) Determination of K_f of a solvent by Rast's macro method b) Determination of molecular weight of a solute by Rast's macro method 5. **Conductivity Measurements:** a) Conductometric titration of a strong acid Vs a strong base b) Estimation of Fe^{2+} ion by potentiometric method.
Reference Books	1. Basic principles of practical chemistry, V. Venkateswaran, R. Veeraswamy, A.R. Kuladaivelu, S. Chand & Sons, New Delhi 2nd edition,2004.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: describe the principles and methodology for the practical work

CO2: explain the procedure, data and methodology for the practical work.

CO3: apply the principles of electrochemistry, kinetics for carrying out the practical work.

CO4: demonstrate laboratory skills for safe handling of the equipment and chemicals

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

23.8.2023

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SEM IV	EC 5	VOLUMETRIC AND ORGANIC ANALYSIS PRACTICAL	23K4PECCH5P	Ins.Hrs.3	Credit:3

Objective of the Course	The course aims at providing an understanding of • Understand the principles of Acidimetry, Alkalimetry, Permanganametry and Iodometry. • Analyze volumetric data systematically and estimate the amount of inorganic substance in a given solution • .Comprehends the advanced Titrimetric techniques. • Apply the techniques in Titrimetric analysis. • Analyse the organic compounds for the purpose of finding functional group.
Course Outline	**I.VOLUMETRIC ANALYSIS** 1. Acidimetry and Alkalimetry a. Strong acid versus strong base b. Weak acid versus strong base c. Determination of hardness of water 2. Permanganimetry a. Estimation of ferrous sulphate using $KMnO_4$ b. Estimation of Oxalic acid using $KMnO_4$ 3. Iodometry a. Estimation of copper using thiosulphate b. Estimation of $K_2Cr_2O_7$ using thiosulphate c. Estimation of $KMnO_4$ using thiosulphate **II. ORGANIC ANALYSIS** A study of reactions of the following organic compounds 1. Carbohydrate 2.Amide 3.Aldehyde 4.Ketone 5. Acid 6.Amine 7.Phenol The students may be trained to perform the specific reactions like – Test for element (nitrogen only), Aliphatic or aromatic. Saturated or Unsaturated and functional group present and record their observation as and when they proceed.
Reference Books	1.Practical chemistry by A.O. Thomas scientific book centre, cinnarore, 2003. 2.Basic principles of practical chemistry, V. Venkateswaran, R. Veeraswamy, A.R. Kuladaivelu, S. Chand & Sons, New Delhi 2nd edition,2004.

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 /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution toPSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

23.8.2023

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SEM IV	EC 6	ELECTIVE CHEMISTRY - II	23K4PEC CH6:1	Ins.Hrs.4	Credit:4

Objective of the Course	This course aims to provide knowledge on • nomenclature of coordination compounds and carbohydrates. • Industrial Chemistry • Amino Acids and Essential elements of biosystem • understand the concepts of kinetics and catalysis • provide fundamentals of electrochemistry
Course Outline	**UNIT I** **Co-ordination Chemistry and Water Technology** Co-ordination Chemistry**:** Definition of terms - IUPAC Nomenclature - Werner'stheory - EAN rule - Pauling's theory – Postulates - Applications to $[Ni(CO)4]$, $[Ni(CN)4]^{2-}$,$[Co(CN)6]^{3-}$ 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 **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 **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.

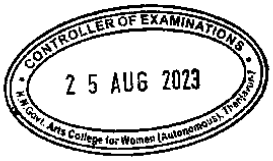
	UNIT IV **Amino Acids and Essential elements of biosystem** Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method - Proteins- classification – structure - Colour reactions – Biological functions – nucleosides -nucleotides – RNA and DNA – structure. Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg.
	UNIT V **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.
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.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 Books	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. 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.

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

CO 1: write the IUPAC name for complex, different theories to explain the bonding incoordination compounds and water technology.
CO 2: evaluate the effiencies and uses of various fuels and fertilizers.
CO 3: : explain the preparation and property of carbohydrate.
CO 4: enlighten the biological role of transition metals, amino acids and nucleic acids.
CO 5: apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S



CO- PO Mapping

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

23.8.2023

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SEM IV	EC 6	CHEMISTRY FOR PHYSICAL AND BIOLOGICAL SCIENCES - II	23K4PEC CH6:2	Ins.Hrs.4	Credit:4

Objective of the Course	This course aims to provide knowledge on • Nuclear Chemistry • Molecular Orbital Theory • Polar Effects and Isomerism • Photo Chemistry, Chemical Kinetics and Catalysis • Synthetic Polymers, Pharmaceuticals and Fertilizers
Course Outline	**UNIT –I Nuclear Chemistry** Composition of the nucleus- nuclear forces- mass defect- binding energy- nuclear stability. Natural Radioactivity- comparison of properties of α, β and γ rays- Soddy's group displacement law- law of radioactive disintegration- disintegration constant- half-life period- radioactive series. Nuclear fission and fusion- definition - chain reaction- energy released during fission and fusion- stellar energy- principles of atom bomb and hydrogen bomb (elementary treatment only)- comparison of fission and fusion.
	UNIT- II Molecular Orbital Theory Important basic concepts of Molecular Orbital Theory – LCAO – bonding and anti-bonding molecular orbitals – bond order- application of Molecular Orbital theory to H_2, He_2, Li_2, Be_2, N_2, O_2, NO and CO molecules.
	UNIT- III Polar Effects and Isomerism Inductive effect- relative strengths of aliphatic mono carboxylic acids- aliphatic amines- electromeric effect- mesomeric effect and resonance- conditions for resonance- consequences of resonance- basic property of aniline and acidic property of phenol. Optical isomerism- cause of optical isomerism- examples- Recemic mixtures- diastereo isomers- (lactic acid and tartaric acid). Geometrical isomerism- examples- (maleic and fumaric acids only in detail).

	UNIT- IV Photo Chemistry, Chemical Kinetics and Catalysis Laws of photo chemistry- Lambert- Beer's law- Grothus- Draper law- Einstein's law- quantum yield- definition- comparison between thermal and photo chemical reactions- photosensitization- photosynthesis- chemiluminescence. Definition of order and Molecularity of First, second, third and zero order reactions (Derivation not necessary). Catalysis Homogeneous and heterogeneous catalysis and industrial application – Enzyme catalysis examples and applications.
	UNIT- V Synthetic Polymers, Pharmaceuticals and Fertilizers Preparation and uses of Teflon, alkyd and epoxy resins, polyester and bakelite. Sulpha drugs- sulpha pyridine, sulpha thiazole and sulpha diazine- preparation, therapeutic uses - Antibiotics- penicillin G and chloromycetin - uses only. Fertilizers: Nitrogenous, phosphate and potash fertilizers. Urea, Super phosphate, Bone meal and potassium nitrate.
Reference Books	1. *Text Book of Inorganic Chemistry*, P.L.Soni, Mohan Katyal, Sultan Chand. 2. *Text Book of Organic Chemistry*, P.L.Soni & H.M.Chawla, Sultan Chand. 3. *Principles of Physical Chemistry*, B.R.Puri & L.R.Sharma, Shoban Lal Nagin Chand & Co.

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

CO 1: understand the composition of nucleus, types of nuclear reactions and decay reactions.

CO 2: acquire knowledge in the basic concepts of Molecular orbital theory.

CO 3: know the basic concepts of electronic effects and isomerism of molecules.

CO 4: Discuss the basic concepts of photochemical reaction, uses of catalyst in industry and interpret the chemical reaction rates.

CO 5: acquire knowledge of polymers in various fields and understand the uses of an antibiotics and Fertilizers.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO- PO Mapping

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

23.8.2023

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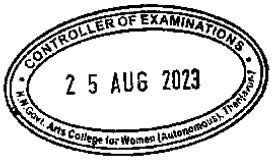
SEM IV	SEC 6	INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS	23K4CHSEC6	Ins.Hrs.2	Credit:2

Objective 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
Course Outline	**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 **Electroanalytical methods** Classification of electroanalytical methods, basic principle of pH metric, Polarography, Stropping Voltametry and Amperometric techniques, diffusion current, Half way potentials, Construction and characterization of DME – Coulometry –principles – applications.

	UNIT –IV **Solvent extraction :** Classification, principle and efficiency of the technique. **Mechanism of extraction :** extraction by solvation and chelation, Technique of extraction, batch, continuous and counter current extractions, Qualitative and quantitative aspects of solvent extraction. Extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and non-aqueous media. **Chromatography :** Classification, principle and efficiency of the technique, Mechanism of separation, adsorption, partition and ion-exchange, development of chromatograms : frontal, elution and displacement methods.
	UNIT V **Conductometer –** conductometric titration – types – potentiometer-types of potentiometric titrations – cyclic voltammetry – instrumentation and its application. Adsorption of oxalic acid on charcoal by oxalic acid as freundlich adsorption isotherm verification and its applications.
Recommended Text	1. Vogel, Arthur I: A Test 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, Elements of 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. R.A. Day and A.L. Underwood, Quantitative Analysis, 6thedn., Prentice Hall of India Private Ltd., New Delhi, 1993



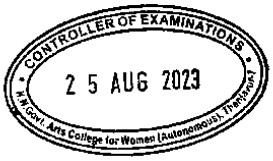
Reference Books	1. D. A. Skoog, D. M. West and F. J. Holler, Analytical Chemistry: An Introduction, 5thedn., Saunders college publishing, Philadelphia, 1998. 2. Dash U N, Analytical Chemistry; Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 2011. 3. Christian, Gary D; Analytical Chemistry, 6th Ed., John Wiley & Sons, New York, 2004. 4. Mikes, O. &Chalmes, 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 ande-learning source	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 (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: handle the analytical data.
CO2: know the theory and instrumentation techniques of atomic adsorption spectroscopy.
CO3: examine the electroanalytical methods , polarography and coulometry.
CO4: learn separation techniques like chromatography.
CO5: knoe theory and titrations of conductometric, potentiometric and cyclic voltammetry.,

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S



CO- PO Mapping

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

23.8.2023

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SEM IV	SEC 7	FORENSIC SCIENCE	23K4CHSEC7	Ins.Hrs.2	Credit:2

Objective of the Course	This course aims at giving an overall view of • crime detection through analytical instruments • forgery and its detection • medical aspects involved
Course Outline	**UNIT I** **Poisons** Poisons - types and classification - diagnosis of poisons in the living and the dead -clinical symptoms - postmortem appearances. Heavy metal contamination (Hg, Pb, Cd) of sea foods - use of neutron activation analysis in detecting arsenic in human hair. Treatment in cases of poisoning – use of antidotes for common poisons.
	Unit-II **Crime Detection** Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Human bombs - possible explosives (gelatin sticks and RDX) - metal detector devices andother security measures for VVIP-composition of bullets and detecting powder burns.
	UNIT-III **Forgery and Counterfeiting** Documents - different types of forged signatures - simulated and traced forgeries -inherent signs of forgery methods - writing deliberately modified - uses of ultraviolet rays -comparison of type written letters – checking silver line water mark in currency notes – alloy analysis using AAS to detect counterfeit coins – detection of gold purity in 22 carat ornaments – detecting gold plated jewels -authenticity of diamond.
	UNIT-IV **Tracks and Traces** Tracks and traces - small tracks and police dogs - foot prints - costing of foot prints -residue prints, walking pattern or tyre marks – miscellaneous traces and tracks – glass fracture - tool marks - paints - fibres - Analysis of biological substances - blood, semen, saliva, urine and hair - Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies - detecting steroid consumption in athletes and racehorses.

	UNIT-V **Medical Aspects** Aids - causes and prevention - misuse of scheduled drugs - burns and their treatment by plastic surgery. Metabolite analysis using mass spectrum - Gas chromatography-Arson -natural fires and arson - burning characteristics and chemistry of combustible materials -nature of combustion. Ballistics - classification - internal and terminal ballistics - small arms -laboratory examination of barrel washing and detection of powder residue by chemical tests.
Recommended Text	1. SA Iqbal, M Liviu, Textbook of forensic chemistry, Discovery publishing house private limited, 2011. 2. Kelly M. Elkins, Introduction to Forensic Chemistry, CRC Press,Taylor & Francis Group, 2019. 3. Javed I. Khan, Thomas J. Kennedy, Donnell R. Christian, Jr., Basicprinciples of Forensic chemistry, Humana Press, first edition, 2012. 4. Bapuly AK, (2006) Forensic Science – Its application in crime investigation, Paras Medical Publisher, Hyderabad. 5. Sharma B.R., (2006) Scientific Criminal Investigation, Universal Law Publishing Co. Pvt. Ltd, New Delhi.
Reference Books	1. Richard Saferst in and Criminalistics-An Introduction to Forensic Science (College Version), Sopfestein, Printice hall, eighth edition,2003 2. Suzanne Bell, Forensic Chemistry, Pearson, second international edition, 2014. 3. Jay Siegel, Forensic chemistry: Fundamentals and applications, Wiley-Blackwell, first edition, 2015. 4. Max M. Houck & Jay A. Segal, (2006) Fundamentals of Forensic Science, Elsevier Academic press. 5. Henry C. Lee, Timothy Palmbach, Marilyn T. Miller, (2006) Henry Lee's Crime Scene Book Elsevier Academic press.
Website ande-learning source	1. http://www.library.ucsb.edu/ist/03-spring/internet.html 2. http://www.wonder howto.com/topic/forensic-science/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: learn about the Poisons - types and classification of poisons in the living and the dead organisms and also get information about Postmortem.

CO 2: get awareness on Human bombs, possible explosives (gelatin sticks and RDX) and metal defector devices and other security measures for VVIP - composition of bullets and detecting powder burns

CO 3: detect the forgery documents, different types of forged signatures

CO4: have an idea about how to tracks and trace using police dogs, foot prints identification and gain the knowledge in analyzing biological substances - blood, semen, saliva, urine and hair - DNA Finger printing for tissue identification in dismembered bodies

CO 5: get the awareness on Aids - causes and prevention and also have an exposure on handling fire explodes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO-PO Mapping

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation betwee

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SEM IV	ECC 3	POLLUTION CONTROL AND ITS MEASURES	23K4CHE CC3:1	Ins.Hrs. -	Credit:3

Course Outline	**Unit - I Air Pollution** Major regions of the atmosphere – composition of air – specific air pollutants and their effects – CO, CO_2, SO_2, SO_3, NO and NO_2 – ozone depletion – acid rain – photochemical smog and degradation of metals present in industrial water.
	Unit – II Water Pollution Criteria for potable water – major water pollutants – organic, inorganic, heavy metals – (As, Cr, Fe, Pb, Cd, Hg) oil spills – sources –effects.
	Unit – III Soil and Pesticide Pollution Sources, effects of various oil pollutants – pesticides – classification. Toxicity of DDT, BHC, malathion, parathion, carbamates. Alternative sources for pesticides, types of soil pollution.
	Unit – IV Noise and Nuclear Pollution Noise pollution – sources and effects – nuclear pollution – genetic and somatic effects – nuclear disasters and major accidents.
	Unit – V Analysis and Control methods Sampling of air and water pollutants – analysis of DO, BOD, COD, and TOC in water- Analysis of CO by GC, NO by chemiluminescence and CO_2 by spectrometry. Treatment of water for domestic and industrial purpose – primary, secondary and tertiary treatment methods.
Reference Books	1. Environmental Chemistry, A.K. De, 5thEdn., New Age International Publisher, 2005. 2. Environmental Chemistry, B.K. Sharma, 11thEdn., Krishna Prakashan Media Limited, 2007.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1**:** to know the manufacturing process of cements and its materials.

CO 2: learn the applications of ceramics and its product.

CO 3: examine the refractories and its applications.

CO4: illustrate the adhesive types of items.

CO 5: understand the abrasives, pulp and paper materials.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO – PO Mapping

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

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SEM V	CC 9	ORGANIC CHEMISTRY - I	23K5CH09	Ins.Hrs.6	Credit:5

Objective of the Course	This course aims to provide an understanding of • stereoisomerism in chirals 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.
Course Outline	**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, carbylaminereaction, 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 andsynthetic applications. **Dyes** Theory of colour and constitution; classification based onstructure and application; preparation –Martius yellow, aniline yellow, methyl 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 Education, Asia, sixth edition, 2012. 2.T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons, eleventh edition, 2012. 3.A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, seventh edition,2009. 4.I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, sixth edition, 2006. 5.J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, Fifth 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

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: assign RS notations to chirals and EZ notations to olefins and explain conformations of ethane and butane.

CO2: explain preparation and properties of aromatic and aliphatic nitro compounds and amines

CO3: explain colour and constitution of dyes and food additives

CO4: discuss preparation and properties of five membered heterocycles like pyrrole, furan and thiophene

CO5: discuss preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO- PO Mapping

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

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SEM V	CC 10	INORGANIC CHEMISTRY - I	23K5CH10	Ins.Hrs.6	Credit:5

Objective 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
Course Outline	**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 co-ordination 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 oxine in gravimetric analysis –estimation ofhardness 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 - factors influencing the magnitude of crystal field splitting, crystal field effect on ionic radii, lattice energies, heats of ligation with water as a ligand (heat of hydration), interpretation of magnetic properties, spectra of $[Ti(H2O)6]^{3+}$ - Jahn – Teller effect. Stability of complexes in aqueous solution, stability constants- factors affecting the stability of a complex ion, thermodynamic and kinetic stability (elementary idea). Comparison of VBT and CFT.

	UNIT III **Organometallic compounds** **Metal Carbonyls** Mono and polynuclear carbonyls, General methods of preparation of carbonyls – general properties of binary carbonyls – bonding in carbonyls – structure and bonding in carbonyls of Ni, Fe, Cr, Co, Mn, Ru and Os. 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 - Comparative account of lanthanoids and actinoids - Occurrence, Oxidation states, Magnetic properties, Colour and spectra - Lanthanoids and Actinoids, Separation by ion-Exchange and Solvent extraction methods - Lanthanoids contraction-Chemistry of thorium and Uranium-Occurrence, Ores, Extraction, properties and uses - Preparation, Properties and uses of ceric ammonium sulphate, thorium dioxide and uranyl acetate.
	UNIT V Inorganic polymers General properties – classification of inorganic polymers based on element in the backbone (Si, S, B and P) - preparation and properties of silicones (polydimethylsiloxane and polymethylhydrosiloxane) phosphorous based polymer (polyphosphazines and polyphophonitrilic chloride), sulphur based polymer (polysulfide and polymeric sulphur nitride), boron based polymers (borazine polymers) – industrial applications of inorganic polymers.
Recommended Text	1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31thEdition, Milestone Publishers & Distributors, Delhi. 2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advanced Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi 3. Lee J D, (1991), Concise Inorganic Chemistry, 4th Edition, ELBS William Heinemann, London. 4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics inInorganic Chemistry, S. Chand 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, 2nd ed ., S.Chand and Company, New Delhi. 2. Gopalan R, (2009) Inorganic Chemistry for Undergraduates, IstEdition, University Press (India) Private Limited,Hyderabad 3. Sivasankar B, (2013) Inorganic Chemistry.Ist Edition, Pearson,Chennai 4. Alan G. Sharp (1992), Inorganic Chemistry, 3rd Edition, Addition-Wesley, England 5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.
Website ande-learning source	1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http:/swayam.gov.in

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain isomerism, Werner's Theory and stability of chelate complexes

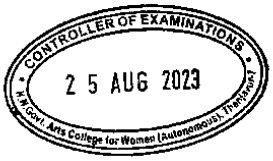
CO2: discuss crystal field theory, magnetic properties and spectral properties of complexes.

CO3: explain preparation and properties of metal carbonyls

CO4: give a comparative account of the characteristics of lanthanoids and actinoids

CO5: explain properties and uses of inorganic polymers of silicon, sulphur, boron and Phosphorous

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S



CO – PO Mapping

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO'

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SEM V	CC 11	PHYSICAL CHEMISTRY - I	23K5CH11	Ins.Hrs.6	Credit:5

Objective of the Course	The course aims at providing an overall view of • Gibbs free energy, Helmholtz free energy, Ellingham's diagramand partial molar properties • Thermochemical calculations • chemical kinetics and different types of chemical reactions • adsorption, homogeneous and heterogeneous catalysis • photochemistry, fluorescence and phosphorescence
Course Outline	**Unit I** **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 –II **Thermodynamics - III:** Equilibrium constants and free energy change, Thermodynamic Derivation of Law of Mass Action-Thermodynamic interpretation of Le-Chatelier's principle (concentration, temperature, pressure and addition of inert gases). Equilibrium between different phases- System of variable composition- Partial molar quantities –Chemical Potential of component in an ideal mixture – Gibbs-Duhem equation - Variation of chemical potential with T, P and X (mole fraction) Clapeyron equation and Clausius - Clapeyron equation –Application.

	UNIT III **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 and third order (equal initial concentration) – Derivation of time for half change with examples. 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 IV **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 and Briggs- Haldene equation – 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. Heterogenous catalysis

	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 Chemistry of Vision – 11 cis retinal – vitamin A as a precursor - colour perception of vision
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 eleventhedition, 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. 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 Ltd, third edition, 2009. 5. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001
Website ande-learning source	1. https://nptel.ac.in 2. https://swayam.gov.in 3. www.epgpathshala.nic.in

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain Gibbs and Helmholtz free energy functions, partial molar quantities and Ellinghams

CO2: apply the concepts of chemical kinetics to predict the rate of the reaction and order ofthe reaction, demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation.

CO3: compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogenous and heterogeneous catalysis.

CO4: demonstrate the types and characteristics of colloids, preparation of sols and emulsions, and determine the molecular weights of macromolecules.

CO5: utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and color perception of vision.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO – PO Mapping

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

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SEM V	CC 12P	GRAVIMETRIC ANALYSIS	23K5CH12P	Ins.Hrs.6	Credit:4

Objective of the Course	This course aims to provide an understanding of • Demonstrate the principles of inorganic quantitative estimation methods. • Plan, excute and experiment to prepare metal complexes and gravimetrically analyse certain metal complexes.
Course Outline	**Gravimetric Analysis:** 1. Determination of percentage of water of hydration in Barium Chloride 2. Estimation of Barium as Barium Sulphate 3. Estimation of Sulphate as Barium Sulphate 4. Estimation of Barium as Barium Chromate 5. Estimation of Lead as Lead Chromate 6. Estimation of Calcium as Calcium Oxalate Monohydrate. 7. Estimation of Lead as Lead Sulphate
Reference Books	2. Basic principles of practical chemistry, V. Venkateswaran, R. Veeraswamy, A.R. Kuladaivelu, S. Chand & Sons, New Delhi 2nd edition,2004.

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SEM V	EC7	ANALYTICAL CHEMISTRY	23K5CHECCH7:1	Ins.Hrs.4	Credit:3

Objective of the Course	After successful completion of the course, the students will be able to • .Error analysis • Separation and Purification techniques • Analytical Electrochemistry • Colorimetric analysis
Course Outline	**UNIT – I** **Error analysis** Errors in chemical Analysis, classification of errors - Determinate errors, Instrumental errors, personal errors, constant errors and proportional errors- Correction of determinate errors and random errors- Precision, accuracy and Rejection of data questioned- Significant figures, mean deviation and standard deviation- Curve fitting- Method of least squares. **Laboratory Hygiene** Storage and handling of corrosive-flammable, explosive, toxic, carcinogenic and poisonous chemicals. **Simple First-Aid Procedures** Acid in eye, alkali in eye, acid burns, alkali burns, bromine burns, poisoning, inhalation of gases, cut by glasses and heat burns.
	UNIT II **Separation and Purification techniques** Principles of separation by precipitation and solvent extraction. **Chromatography** Principles involved in adsorption, partition and ion exchange, paper, thin layer, column, gas liquid chromatography. Electrophoresis - Applications.
	UNIT III **Analytical Electrochemistry** Redox potential – Measurement and application.Interpretation of chemical behaviour, Electrolytic separations, principles of electrodeposition.Electrogravimetry - estimation of Cu and Ag. **Electro analytical Techniques:** coulometry – coulometric titration – different types of coulometer: Principle and application. **Polarography** Principles – residual current , migration current, diffusion current- Half wave Potential- Concentration polarisation- Instrumentation- Determination of Cd by direct comparison method- Amperometric titrations.

	Thermoanalytical and Radiometric Methods Principles involved in thermogravimetric analysis and differential thermal analysis. Instrumentation. Characteristics of TGA curves of Calcium oxalate monohydrate & Copper sulphate penta hydrate and DTA curves of Calcium acetate monohydrate. Radiometric titration – types, complex formation and precipitation formation – activation analysis – absolute and comparative methods and applications
	Colorimetric analysis Laws of colorimetry, Nessler's and photo electric colorimetric method, Instrumentation, operation and applications, Estimation of Ni, Cu and Fe. **Principles and applications** of atomic adsorption, Flame emission, Nephlometry &Turbidometry analysis .
Reference Books	1. R. Gopalan, P.S. Subramanian and K. Rengarajan, *Elements of AnalyticalChemistry*, Sultan Chand & Sons, New Delhi (1995) 2. B.K. Sharma, *Instrumental Methods of Chemical Analysis*, Goel Publishing House, Meerut (1999) 3. S.M. Khoptar, *Basic concepts of Analytical Chemistry*, New Age International (P) Limited, New Delhi (1998) 4. A.I. Vogel, *Text Book of Quantitative Inorganic Analysis*, Longmass (1984) 5. D.A. Skoog & D.M.West, *Fundamentals of Analytical Chemistry*, W.B. Saunders, New York, (1982) 6. Gurdeep Chatwal, Sham Anand, *Instrumental Methods of Chemical Analysis*, Himalaya Publishing House, Mumbai (1998) 7. Instrumental methods of analysis Milard merit.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: Learn chemistry of different types of errors, precision and accuracy, laboratory hygiene and first aid procedure.

CO2: Know the process of separation, purification and chromatography techniques.

CO3: Interpret the importance of electro analytical techniques in analysis of chemical compounds and solutions

CO4.Analyse the various types of thermal methods of analysis including TGA, DTA and Radiometric Methods.

CO5: Explain the principles and methods of colorimetric, nephlometry and turbidometry analysis.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

23.8.2023

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SEM V	MBE	BIO CHEMISTRY	23K5CHECCH7:2	Ins.Hrs.4	Credit:3

Objective 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
Course Outline	**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 - Enzymic method. **Proteins** – classification based on composition, functions and structure; properties and reactions – colloidal nature, coagulation, hydrolysis, oxidation, denaturation, renaturation; colour tests for proteins; structure of proteins – primary, secondary, tertiary and quaternary. Metabolism of Amino acids – general aspects of metabolism (a brief outline); urea cycle.

	UNIT III **Enzymes and Vitamins** Nomenclature and classification, characteristics, factors influencing enzyme activity – mechanism of enzyme action – Lock and key hypothesis, Koshland's induced fit model. Proenzymes, antienzymes, coenzymes and isoenzymes; allosteric enzyme regulation. Vitamins as coenzymes – functions of TPP, lipoic acid, NAD, NADP, FMN, FAD, pyridoxal phosphate, CoA, folic acid, biotin, cyanocobalamin.
	UNIT IV **Amino acids** Components of nucleic acids - nitrogenous bases and pentose sugars, structure of nucleosides and nucleotides, DNA- structure & functions; RNA –types– structure - functions; biosynthesis of proteins **Hormones** Adrenalin and thyroxine — chemistry, structure and functions (No structure elucidation).
	UNIT V **Lipids** Occurrence, biological significance of fats, classification of lipids. **Simple lipids** – Oils and fats, chemical composition, properties, reactions – hydrolysis, hydrogenation, trans-esterification, saponification, rancidity; analysis of oils and fats – saponification number, iodine number, acid value, R.M. value. Distinction between animal and vegetable fats. **Compound lipids** – Lipoproteins - VLDL, LDL, HDL, chylomicrons – 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: 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 Bookof 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 ande-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 (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO1: explain molecular logic of living organisms, composition of blood and blood coagulation

CO2: explain synthesis and properties of amino acids, determination of structure of peptides and proteins

CO3: explain factors influencing enzyme activity and vitamins as coenzymes

CO4: explain RNA and DNA structure and functions

CO5: explain biological significance of simple and compound lipids

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO – PO Mapping

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

23.6.2023

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SEM V	VE	VALUE EDUCATION	23K5VE	Ins.Hrs.2	Credit:2

CO	STATEMENT	
	After successful completion of the course, the students will be able to	
1	Know the value education by various religions.	K1
2	Learn and practice social value and responsibilities.	K2
3	Understand and start applying the essential steps to become good leaders.	K2
4	Analyse the personal value, mind culture value personal health.	K4
5	Collecting news details about value education and to encourage writing skills highlight moral value.	K6
K1 – Remember; **K2** - Understand; **K3** – Apply; **K4** – Analyse; **K5** – Evaluate; **K6** – Create		

UNIT - I

1. Introduction: Definition of Value Education – Need for Value Education – Teachings of values by various religions like Hinduism, Buddhism, Christianity, Jainism, Islam etc.

UNIT - II

2 **Living & Social Values**

2.1 Living Values: Peace, respect, co-operation, freedom, happiness, honesty, humility, love, responsibility, simplicity, tolerance, optimism and positive thinking

2.2 Social values: Love and Compassion, Sharing and Generosity, Politeness and Courtesy, Gratitude, Duty and Responsibilities towards Society, Tolerance and Unity.

UNIT - III

3.1 **Role of Visionaries and Leaders in Social Reforms**: Rajaram Mohan Roy, Mahatma Gandhi, Swami Vivekananda, EVR Periyar, Mother Therasa.

3.2 **Value Crisis**: Religious Fundamentalism and Terrorism – Corruption in Society–

commerce without Ethics – Education without Character – Wealth without efforts

3.3 Time Management

UNIT - IV

4. **Yoga**: Teaching yoga – Manavalakkalai- by Qualified Yoga Teachers – The aim is to acquire Physical Health – Mental Acuteness- Strength of Life Forces and Wisdom – to achieve a holistic way of life- to take up and get involved in Social Welfare Activities – to learn their commitment to society.

UNIT - V

5.1 **Human Rights** : Child Labour – Womens Rights – Bonded Labour – Problems of Refuges.

5.2 **Role of State Public service Commission:**Constitution provisions and formation-methods of recruitment – rules and notification , syllabi for different exams – written and oral – placement.

References

1. Radhakrinshnaan, "Religion and Culture"(1968), Orient paperbacks, New delhi.
2. Das,M.S.&Guptha,V.K.(1995),"Social Values among Youth Adults: A Changing Scenario", New Delhi.
3. Venkataiah. M(ed.), (1998), "value Education New Delhi, A PH Publishing Corporation.
4. Sharma.O.P.,(1997),"value Education in Action" New Delhi, University Book House.
5. Chakraborti, Mohit.,(1997)"value Education:Changing Perspectives", New Delhi,kanishka Publishers, Distributors.
6. C.S.Devnoth(1996) "Adipodai manitha urimaigal" Narmadha Publishers. D.Kulanthaiyaya "Evai manitha urimaigal " Narmadha Publishers.

23-8-2023

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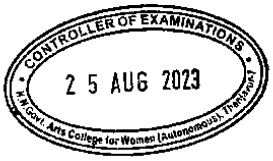
SEM VI	CC13	ORGANIC CHEMISTRY - II	23K6CH13	Ins.Hrs.7	Credit:6

Objective of the Course	This course aims at providing knowledge on • classification, isolation and discussing the properties ofalkaloids and terpenes • preparation and properties of saccharides • biomolecules • different molecular rearrangement • preparation and properties of organometallic compounds
Course Outline	**UNIT I** **Alkaloids** Classification, isolation, general properties- Hofmann Exhaustive Methylation; Structure elucidation – Coniine, piperine, nicotine. **Terpenes:** Classification, Isoprene rule, isolation and structuralelucidation 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 toketose and ketose to aldose. **Disaccharides** – sucrose, lactose, maltose - preparation, properties anduses (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, Clasien, 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 ultra-sound in chemical synthesis.
Recommended Text	1. M.K.Jain, S. C.Sharma, Modern Organic Chemistry, Vishal 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 Bandyopadhya; An Insight into Green Chemistry; Published on 2020
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 ande-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/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain isolation and properties of alkaloids and terpenes
CO2: explain preparation and reactions of mono and disachharides
CO3: classify biomolecules and natural products based on their structure, properties, reactions and uses.
CO4: explain molecular rearrangements like benzidine, Hoffmann etc.,
CO5: preparation and properties of organolithium compounds

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO- PO Mapping

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

23.8.2023

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SEM VI	CC14	INORGANIC CHEMISTRY – II	23K6CH14	Ins.Hrs. 6	Credit:4

Objective 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
Course Outline	**UNIT I** **Bioinorganic 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 Ferretin; 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 carboxy peptidase A, zinc metalloenzyme – mechanism and uses, Zn-Cu enzyme - structure and function, carbonic anhydrase, Vitamin B-12 as transferase and isomerase - Iron-sulphur proteins - 2Fe-2S – rubredoxin, 4Fe-2S – ferridoxin, Iron sulphur cluster enzymes. Invivo and Invitro nitrogen fixation – biological functions of nitrogenase and molybdo enzymes.
	UNIT IV **Silicates** Introduction – general properties of silicates, structure – types of silicates – ortho silicates(zircon), pyrosilicates (thortveitite), chain silicates(pyroxenes), ring silicates(beryl), sheet silicates(talc, mica, asbestos), silicates having three dimensional structure (feldspars, zeolites, ultramarines)
	UNIT V **Industrial Applications of Inorganic Compounds** Refractories, pyrochemical, explosives. Alloys, Paints and pigments -

	requirements of a good paint; classification, constituents of paints – pigments, vehicles, thinners, driers, extenders, anti-knocking agents, anti-skinning agents, plasticizers, binders-application; varnishes- oils, spirit; enamels. Nanocomposite Hydrogels: synthesis, characterization and uses. Industrial visits and internship mandatory.
Recommended Text	1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31th ed., Milestone Publishers & Distributors, Delhi.. 2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advancd Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi 3. Lee J D, (1991), Concise Inorganic Chemistry, 4th ed., ELBS William Heinemann, London. 4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics inInorganic 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, Ist Edition, University Press (India) Private Limited, Hyderabad 3. Sivasankar B, (2013) Inorganic Chemistry. Ist Edition, Pearson, Chennai 4. Alan G. Sharp (1992), Inorganic Chemistry, 3rd Edition, Addition-Wesley, England 5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.
Website ande-learning source	1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http:/swayam.gov.in

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

CO1: ability to explain the importance of tracer elements on biological system.

CO2: explain the metal ion transport, Bohr effect, Na, K, Ca pump.

CO3: explain the function of Vitamin B_{12}, Zn-Cu enzyme, ferredoxin, cluster enzymes.

CO4: classification and structure of silicates.

CO5: explain the manufacture of refractories, explosives, paints and pigments

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

23.8.2023

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SEM VI	CC15	PHYSICAL CHEMISTRY - II	23K6CH15	Ins.Hrs.7	Credit:6

Objective 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 electrochemicalseries.
Course Outline	**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.
	UNIT III **Binary liquid mixtures** Ideal liquid mixtures – non ideal solutions – azeotropic mixtures – fractional distillation – partially miscible mixtures – phenol-water, triethylamine-water, nicotine-water – effect of impurities on criticalsolution temperature; immiscible liquids- steam distillation; Nernst distribution law – applications.
	UNIT IV **Electrical Conductance and Transference** Arrhenius theory of electrolytic dissociation – Ostwald's dilution law, limitations of Arrhenius theory; behavior of strong electrolytes – interionic effects – Debye Huckel theory –Onsager equation (no derivation), significance of Onsager equation, Debye Falkenhagen effect, Wien effect.

	Ionic mobility – Discharge of ions on electrolysis (Hittorf's theoretical device), transport number –determination – 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 - degreeof dissociation of weak electrolyte, dissociation constant of weak acidand weak base, ionic product of water, solubility and solubility productof 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 EMF and spontaneity of a reaction, thermodynamics and EMF – calculation of ΔG, ΔH, and ΔS from EMF data; reversible electrodes, electrode potential, standard electrode potential, primary and secondary reference electrodes, Nernst equation for electrode potential and cell EMF; types of electrodes – metal/metal ion, metal amalgam/metal ion, metal, insoluble salt/anion, gas electrode, 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 activity coefficient of electrolytes, transport number, valency of ions, solubility product, pH using hydrogen gas electrode, quinhydrone electrode and glass electrode, potentiometric titrations – acid base titrations, redox titrations, precipitation titrations, ionic product of water and degree of hydrolysis; 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, Al-air batteries Fuel cells – H_2-O_2 cell – efficiency of fuel cells. corrosion –mechanism, types and methods of prevention.
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 eleventhedition, 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, MacmillanIndia Ltd, third edition,2009. 2. Gilbert. W. Castellen, Physical Chemistry, Narosa PublishingHouse, 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 ofPhysical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001 5. D.N.Bajpai, Advanced Physical Chemistry, S.Chand&Co.,2001
Website ande-learning source	https://nptel.ac.in https://swayam.gov.in https://archive.nptel.ac.in/content/storage2/courses/112108150/pdf/PPTs/MTS_07_m.pdf Thermodynamics - NPTEL https://www.youtube.com/watch?v=f0udxGcoztE Introduction to chemical equilibrium – MIT opencourse ware

Course Learning Outcomes (for Mapping with POs and PSOs)On

completion of the course the students should be able to

CO1: 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.

CO2: apply the concepts of chemical equilibrium in dissociation of PCl_5, N_2O_4 and formation of HI, NH_3, SO_3 and decomposition of calcium carbonate. Demonstrate important principles such as Le chatelier principle, van't Hoff reaction isotherm and Clausius-Clayperon equation.

CO3: Identify an appropriate distillation method for the separation of binary liquid mixtures such as azeotropic mixtures, partially miscible mixtures and immiscible liquids.

CO4: Explain the significance of Arrhenius theory, Debye-Huckel theory, Onsager equation and Kohlrausch's law in conductance.

CO5: Construct electrochemical cell with the help of electrochemical series and calculate cell EMF. Demonstrate the applications of EMF and significance of potentiometric titrations.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

23.8.2023

HOD of Chemistry,
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SEM VI	EC8	MOLECULAR SPECTROSCOPY	23K6CHE ECCH8:1	Ins.Hrs.7	Credit:3

Objective 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
Course Outline	**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 – dissociation in electronic transitions – BirgeSponer method of evaluation of dissociation energy – pre-dissociation transition - σ -σ *, π-π*, n-σ*, n-π* transitions. Applications of UV-Woodward – Fieser rules as applied to conjugated dienes and α, β - unsaturated ketones. Elementary Problems. Colorimetry - principle and applications (estimation of Fe^{3+})

	UNIT - III **Infrared spectroscopy** Vibration spectra –diatomic molecules – harmonic oscillator and anharmonic oscillator; Vibration – rotation spectra – diatomic molecule as rigid rotator and anharmonic oscillator (Born-Oppenheimer approximation oscillator) - selection rules, vibrations of polyatomic molecules – stretching and bending vibrations – applications – determination of force constant, moment of inertia and internuclear distance – isotopic shift – application of IR spectra to simple organic and inorganic molecules – (group frequencies) **Raman Spectroscopy** Rayleigh scattering and Raman scattering of light – Raman shift – classical theory of Raman effect – quantum theory of Raman effect – Vibrational Raman spectrum – selection rules – mutual exclusion principle – instrumentation (block diagram) – applications.
	UNIT IV **Nuclear magnetic resonance spectroscopy:** PMR – theory of PMR – instrumentation - number of signals – chemical shift – peak areas and proton counting – spin-spin coupling – applications. Problems related to shielding and deshielding of protons, chemical shifts of protons in hydrocarbons, and in simple monofunctional organic compounds; spin-spin splitting of neighbouring protons in vinyl and allyl systems.
	UNIT V **Mass spectrometry** Principle – different kinds of ionisation – instrumentation – the mass spectrum – types of ions – determination of molecular formula- fragmentation and structural elucidation – McLafferty rearrangement; Retro Diels Alder reaction - illustrations with simple organic molecules. Solving structure elucidation problems using multiple spectroscopic data (NMR, MS, IR and UV-Vis).
Recommended Text	1.Gopalan, R.; Subramaniam, P. S.; Rengarajan, K. *Elements of Analytical Chemistry*; S Chand: New Delhi, 2003. 2.Usharani, S. *Analytical Chemistry*, 1st ed.; Macmillan: India, 2002. 3.Banwell, C.N.; Mc Cash, E. M. *Fundamentals of Molecular Spectroscopy*, 4th ed.; Tata McGraw Hill, New Delhi, 2017. 4.U.N.Dash, Analytical Chemistry Theory and Practice, Sultan Chand &Sons,2nd Ed., 2005 5. B.K.Sharma, Spectroscopy,22nd ed., Goel Publishing House, 2011.
Reference	1.Srivastava, A. K.; Jain, P. C. *Chemical Analysis an Instrumental*

Books	*Approach*, 3rded.; S.Chand, New Delhi, 1997. 2.Robert D Braun. *Introduction to Instrumental Analysis*; Mc.Graw Hill: New York, 1987. 3.Skoog, D. A.; Crouch, S. R.; Holler, F.J.; West, D. M. *Fundamentals of Analytical Chemistry*, 9thed.; Harcourt college Publishers: USA, 2013. 4.Madan, R. L.; Tuli, G. D. *Physical Chemistry*, 2nded.; S.Chand: New Delhi, 2005. 5. Puri, B. R.; Sharma, L. R.; Pathania, M.S. *Principles of Physical Chemistry*, 43rd ed.; Vishal Publishing: Delhi, 2008.
Website and e-learning source	1. http://vallance.chem.ox.ac.uk/pdfs/SymmetryLectureNotes2004.pdf 2.http://chemistry.rutgers.edu/undergrad/chem207/SymmetryGroupTheory.html 3. www.epgpathshala.nic.in 4. www.nptel.ac.in 5.. http:/swayam.gov.in

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain electrical and magnetic properties of materials and microwave spectroscopy

CO2: explain theory, instrumentation and applications of Infrared and Raman spectroscopy

CO3: apply selection rules to understand spectral transitions, explain Woodward – Fieser's rule for the calculation of wavelength maximum of conjugated dienes

CO4: explain theory, instrumentation and applications of NMR spectroscopy

CO5: explain theory, instrumentation and applications of Mass spectrometry

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO- PO Mapping

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

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SEM VI	EC8	POLYMER SCIENCE	23K6CHE ECCH8:2	Ins.Hrs.7	Credit:3

Objective 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
Course Outline	**UNIT I** **Introduction** Difference between polymer and macromolecule – classification – synthetic and natural, organic and inorganic, thermoplastic and **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, Molecular Weight Distribution, Determination of Molecular Weight polydispersity index – membrane and vapour phase osmometry, light scattering - Zimm plot, ultracentrifuge – sedimentation velocity and sedimentation equilibrium – viscometry – gel permeation chromatography Thermal properties of polymers – Glass Transition Temperature-State of Aggregation and State of Phase Transitions, Factors Influencing Glass Transition Temperature, Importance of Glass Transition Temperature, Heat Distortion Temperature, TGA / DTA,Crystallinity of Polymers: Crystalline Behaviour, Degree of Crystallinity
	UNIT IV Reactions of Polymers-Hydrolysis, Acidolysis, Aminolysis, Additionand

	Substitution Reactions (One Example Each) Cyclisation, Cross-Linking and Reactions of Specific FunctionalGroups in the Polymer **Polymer technology** Processing of polymers – casting, thermoforming, moulding – extrusion, compression, blow moulding – foaming, amination,reinforcing – processing of fibres – melt, wet and dry spinning.
	UNIT V **Speciality polymers** Polyelectrolytes, conducting polymers, polymeric supports for solid phase synthesis, biomedical polymers, liquid crystalline polymers, electroluminescent polymers – two examples of each of these polymers. Polyethylene, PVC, PMMA, polyester; rubber – synthetic and natural, vulcanisation of rubber. **Polymer Degradation** Types of Degradation - Thermal, Mechanical, Ultra Sound, Photo Radiation and Chemical Degradation Methods. Rubber-Natural and Synthetic-Structure, Mechanism of Vulcanisation Biodegradable and Non-Biodegradable Polymers.
Recommended Text	1. Gowariker V.R, N.V. Viswanthan and Jayadev Sreedhar. Polymer 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	1. Billmeyer, F.W. Polymer Science. India: Wiley-Interscience, 2007. 2. Seymour,R. B.; CarraherJr.C.E. *Polymer Chemistry: An Introduction,* Marcel Dckker Inc : New York, 1981. 3. Sinha, R. *Outlines of Polymer Technology*, Prentice Hall of India:New Delhi, 2000. 4. Joel R. Fried, *Polymer Science and Technology*, 3rd ed.; Prentice 5. Hall of India: New Delhi, 2014.

Website and e-learning source	1. https://polymerdatabase.com 2. 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+weigh ts+of+polymers.pdf

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

CO1: explain classification of polymers, elastomers, fibres and liquid resins

CO2: explain addition and condensation polymerization, mechanical properties of polymers

CO3: determine the molecular weight of polymers, and explain the thermal properties of polymers

CO4: explain reactions of polymers and polymer processing

CO5: discuss speciality polymers like PVC, PMMA, rubbers, biodegradable polymers

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

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SEM VI	SEC8	INDUSTRIAL APPLICATION OF CHEMISTRY	23K6CHSEC8	Ins.Hrs.2	Credit:2

Objectives of thecourse	This course aims at providing knowledge on • Lime manufacture • Manufacture of glasses • Refractories • Adhesive • Abrasives
	UNIT I Lime and its manufacture, Gypsum – plaster – Cement – Types of Cements, manufacture of Portland cement and its applications.
	UNIT II Glass – Ceramics- manufacture of Glasses, Ceramics and its applications.
	UNIT III Refractories – classification, manufacture of refractories, cermets - Insulating refractories – Regvivement of a refractory – Applications.
	UNIT IV Adhesive: Classification of adhesives – adhesive ackor – development of Adhesive strength – chemically reactive adhesives preparations of adhesives – applications of adhesives.
	UNIT V Abrasives – natural abrasives, artificial abrasives – grinding wheels – pulp and paper – manufacture of pulp and paper – applications of abrasives, paper and pulp.
Reference Books	1. Industrial Chemistry, B.K Sharma.

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

CO1: to know the manufacturing process of cements and its materials.
CO2: learn the applications of ceramics and its products.
CO3: examine the refractories and its applications.
CO4: illustrate the adhesive types of items.
CO5: understand the abrasives, pulp and paper materials

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

Level of Correlation between PSO's and CO's

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

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