

B.Sc. CHEMISTRY

Course Structure and Syllabus

(For the candidates admitted from the academic year 2023-2024 onwards)

CHOICE BASED CREDIT SYSTEM- LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS-LOCF)



THANTHAI HANS ROEVER COLLEGE (AUTONOMOUS)

(Nationally Re-Accredited by NAAC with B⁺⁺)

(Affiliated to Bharathidasan University, Tiruchirappalli)

ELAMBALUR, PERAMBALUR – 621 220



Vision

To blossom as an institution of excellence, enabling, empowering and enlightening the youth and shaping them as fully developed human beings with the capacity to unfold their full mental potentiality resulting in the attainment of the wisdom to live constructively and meaningfully.

Mission

- To provide congenial and stress- free environment and opportunities for the enhancement of knowledge and acquisition skills through the best exposure and training possible.
- To offer multifaceted and need-based academic programmes and to promote extension activities.
- To adopt technology-enabled new methods, approaches and techniques so that the teaching-learning process becomes learner-centred and learner-friendly.
- To maximize the participation of all the stakeholders in the development of the institution and the region.
- To sensitize the youth towards inclusive growth for socio-economic change, sustainable development, gender equality, eco-friendliness, etc.
- To enable the youth to experience the effects of globalization and facilitate them to grow as responsible citizens and leaders.
- To inspire them, through value-based education, to embrace the entire humanity while firmly rooted in the Indian ethos.
- To provide regular placement training and placement opportunities.
- To kindle the spirit of creativity and enhance research activities and enable them to attain international standards.

Programme Outcomes (POs)

1. Students will possess basic subject knowledge required for higher studies, professional and applied courses
2. Students will acquire basic Practical skills & Technical knowledge along with domain knowledge of different subjects in the science & humanities stream.
3. Students will develop scientific aptitude Integrate skills of analysis, critiquing, application and creativity.
4. Students will employ appropriatedigitaltoolsandtechniquesnecessaryinanalysingdataandcreativdesign.
5. Studentswillgaincompetencetopursuehigherlearning,researchandcareersorwillbeabletooptfor entrepreneurship

Program Specific Outcomes (PSOs)

1. **PSO1:** Students acquirein-depthknowledgeofthefundamentalconceptsinalldisciplinesofchemistry.
2. **PSO2:** Students can disseminate the basics of chemistry and advanced topics and analytical skills inorganic, inorganic and physical chemistry.
3. **PSO3:** Students will be able develop creativity in academics and research.
4. **PSO4:** Students will be able apply digital tools to collect, analyse and interpret data and present scientific findings.
5. **PSO5:** Gain competence to pursue higher education and career opportunities in chemistry and allied fields.

Thanthai Hans Roever College (Autonomous), Elambalur, Perambalur - 621 220

B.Sc. CHEMISTRY

CHOICEBASEDCREDITSYSTEM–LEARNINGOUTCOMESBASEDCURRICULUMFRAMEWORK(CBCS- LOCF)

(For the candidates admitted from the academic year 2023 - 2024 onwards)

Semester	Part	Course Code	Title of the Course	Ins. Hours/ Weeks	Credits	Exam Hours	CIA (Max)	ESE (Max)	Total (Max)
1	I	23UT1/H1	General Tamil-I Tamil Ilakiya Varalaru-I	6	3	3	25	75	100
1	II	23UE1	English –I	6	3	3	25	75	100
1	III	23UCH1CC1	General Chemistry-I	6	5	3	25	75	100
1	III	23UCH1CC2P	Quantitative Inorganic Estimation And Inorganic Preparations Practical	3	3	3	40	60	100
1	III	23UPH1AC1	Allied Physics-I	4	4	3	25	75	100
1	III	23UPH2AP1	Allied Practical –I	3	–	–	–	–	–
I	IV	23UCH1SE1	Skill Enhancement Course-1 (NME-1)	2	2	3	25	75	100
			Value Added Course*		2*	2	50	50	100*
Total				30	20	–	–	–	600
2	I	23UT2/H2	General Tamil-II Tamil Ilakiya Varalaru-II	6	3	3	25	75	100
2	II	23UE2	English –II	6	3	3	25	75	100
2	III	23UCH2CC3	General Chemistry-II	5	5	3	25	75	100
2	III	23UCH2CC4P	Qualitative Organic Analysis Practical	3	3	3	40	60	100
2	III	23UPH2AC2	Allied Physics-II	3	3	3	25	75	100
2	III	23UPH2AP1	Allied Practical –I	3	2	3	40	60	100
2	IV	23UCH2SE2	Skill Enhancement Course-2 (NME-2)	2	2	3	25	75	100
2	IV	23UCH2SE3	Cosmetics And Personal Grooming	2	2	3	25	75	100
			Value Added Course*		2*	2	50	50	100*
TOTAL				30	23	–	–	–	800
3	I	23UT3/H3	General Tamil-III Tamilaga Varalarum Panpadum	6	3	3	25	75	100
3	II	23UE3	English –III	6	3	3	25	75	100
3	III	23UCH3CC5	General Chemistry –III	5	5	3	25	75	100
3	III	23UCH3CC6P	Qualitative Inorganic Analysis Practical	3	3	3	40	60	100
3	III	23UMA1AC3	Algebra and Calculus	3	3	3	25	75	100

3	III	23UBO1AC3	Plant Diversity, Physiology and Plant Biotechnology						
3	III	23UMA2AC5	Analytical Geometry (3D), Trigonometry and Fourier Series						
3	III	23UBO2AP2	Plant Diversity, Physiology and Plant Biotechnology & Morphology, Taxonomy, Anatomy, Empryology and Hortyculture	2	-	-	-	-	-
3	IV	23UCH3SE4	Entrepreneurial Skills In Chemistry	2	2	3	25	75	100
3	IV	23UCH3SE5	Skill Enhancement Course-5	2	2	3	25	75	100
3	IV	23UGGS	Gender Studies	1	1	3	25	75	100
			Value Added Course*		2*	2	50	50	100*
TOTAL				30	22	-	-	-	800
4	I	23UT4/H4	General Tamil-IVTamilum Ariviyalum	6	3	3	25	75	100
4	II	23UE4	English-IV	6	3	3	25	75	100
4	III	23UCH4CC7	General Chemistry-IV	5	5	3	25	75	100
4	III	23UCH4CC8P	Physical Chemistry Practical –I	3	3	3	40	60	100
4	III	23UMA2AC4	ODE, PDE and Laplace Transforms	3	3	3	25	75	100
4	III	23UBO2AC4	Morphology, Taxonomy, Anatomy, Empryology and Hortyculture						
4	III	23UBO2AP2	Plant Diversity, Physiology and Plant Biotechnology & Morphology, Taxonomy, Anatomy, Empryology and Hortyculture	3	2	3	40	60	100
4	III	23UMA2AC5	Analytical Geometry (3D), Trigonometry and Fourier Series				25	75	
4	IV	23UCH4SE6	Soft skill	2	2	3	25	75	100
4	IV	23UEVS	Environmental Studies	2	2	3	25	75	100
			Value Added Course*		2*	2	50	50	100*
TOTAL				30	23	-	-	-	800
5	III	23UCH5CC9	Organic Chemistry – I	6	5	3	25	75	100
5	III	23UCH5CC10	Inorganic Chemistry –I	5	5	3	25	75	100
5	III	23UCH5CC11	Physical Chemistry –I	6	5	3	25	75	100
5	III	23UCH5CC12 PW	Project With Viva Voce	3	3	3	Evaluation 80		100
							Viva-voce 20		
5	III	23UCH5DE1	Industrial Chemistry	4	4	3	25	75	100
5	III	23UCH5DE2	Agricultural chemistry	4	4	3	25	75	100
5	IV	23UVE	Value Education	2	2	3	25	75	100

			Summer Internship**	-	2*	-	-	-	-
			Value Added Course*		2*	2	50	50	100*
TOTAL				30	28	-	-	-	700
6	III	23UCH6CC13	Organic Chemistry –II	6	5	3	25	75	100
6	III	23UCH6CC14	Inorganic Chemistry –II	6	5	3	25	75	100
6	III	23UCH6CC15 P	Gravimetric Estimation and Organic Preparation Practical	6	5	3	40	60	100
6	III	23UCH6DE3	Fundamentals Of Spectroscopy	6	4	3	25	75	100
6	III	23UCH6DE4	Nanoscience	6	4	3	25	75	100
6	V		Extension Activity	-	1	-	-	-	-
			Value Added Course*		2*	2	50	50	100*
Total				30	24	-	-	-	500
Grand Total				180	140				4200

* **Extra Credit Courses which will not be included in the total CGPA**

- Summer Internship after 4th semester during summer vacation -30 Hours

-Value added course (Outside Instruction hours: 30 hours)

Course details:

No. of Courses & Credits Total Credits

Part I

Tamil 4 * 3 12

Part II

English 4 * 3 12

Part III

Core Course 10 * 5+4*3 62

Core Course: Project with Viva-Voce 1 * 3 3

Allied Course 1 * 4+ 3 * 3 2*2 17

Discipline Elective 4 * 4 16

Part IV

Skill Enhancement Courses 6 * 2 12

Gender Studies 1 * 1 1

Environmental Studies 1* 2 2

Value Education 1 * 2 2

Part V

Extension Activity 1 (Credit Only) 1

Note:

	Internal Marks	External Marks
1. Theory	25	75
2. Practical	40	60
3. Separate passing minimum is prescribed for Internal and External marks		

FOR THEORY

The passing minimum for CIA shall be 40% out of 25 marks [i.e. 10 marks]

The passing minimum for Semester Examinations shall be 40% out of 75 marks [i.e. 30 marks]

FOR PRACTICAL

The passing minimum for CIA shall be 40% out of 40 marks [i.e. 16 marks]

The passing minimum for Semester Examinations shall be 40% out of 60 marks [i.e. 24 marks]

- Project: 100 Marks (The Project will be evaluated by an Internal and an External Examiner)
Dissertation- 80 Marks
Viva Voce - 20 Marks

Skill Enhancement Courses offered to Other Department

23UCH1SE1	Skill Enhancement Course-1 (NME-1)
23UCH2SE2	Skill Enhancement Course-2 (NME-2)
23UCH2SE3	Cosmetics And Personal Grooming
23UCH3SE4	Entrepreneurial Skills In Chemistry
23UCH3SE5	Skill Enhancement Course-5
23UCH4SE6	Instrumental Methods Of Chemical Analysis (soft skill)

List of Value Added Courses

Course Code	Course Title
23UCHVA1	Uv-visible, IR spectroscopic Instrumentation and separation techniques
23UCHVA2	Reagents preparations and their validation
23UCHVA3	Soap production
23UCHVA4	Soil and water managements
23UCHVA5	Basic chemistry for competitive examinations
23UCHVA6	Chemistry of cosmetics

Question Paper Pattern

UG Programme		
Maximum Marks : 75		Duration: 3 Hours
Section - A	i) a- (5 Questions for Multiple Choice) One question from each unit	5 x 1 = 5 Marks
	b- (5 Questions for Fill in the Blanks) One question from each unit	5 x 1 = 5 Marks
	ii) (5 short answer questions) One question from each unit	5 x 2 = 10 Marks
Section - B	5 Questions (Internal Choice: Either or) One set of questions from each unit	5 x 5 = 25 Marks
Section - C	3 Questions (Answer any 3 out of 5 Questions) One question from each unit	3 x 10 = 30 Marks

SEMESTER-I

Course Code	: 23UCH1CC1	Exam Hours	: 3
Instruction Hours	: 5	Internal Marks	: 25
Credits	: 5	External Marks	: 75

GENERAL CHEMISTRY-I

Objectives of the course:

The course aims at giving an overall view of the

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

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

1. CO1: explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.
2. CO2: classify the elements in the periodic table, types of bonds, reaction intermediates electronic effects in organic compounds, types of reagents.
3. CO3: apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, Δx , Δp electronegativity, percentage ionic character and bond order.
4. CO4: evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects
5. 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.

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;

Numerical problems involving the core concepts.

Unit II

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.

Problems involving the core concepts.

Unit-III: Structure and bonding - I

Ionic bond

Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle – lattice energies, Madelung constant; relative effect of lattice energy and solvation energy; Ion 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-IV: 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^- , O_2^{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-V:

Basic concepts in Organic Chemistry and Electronic effects

Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals; reaction intermediates – carbanions, carbocations, carbenes, arynes and nitrynes. Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; 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 and nitrobenzene, bond lengths; steric inhibition to resonance.

Hyperconjugation - stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitromethane.

Types of organic reactions- addition, substitution, elimination and rearrangements.

Recommended Text

1. Madan, R.D. and Sathya Prakash, *Modern Inorganic Chemistry*, 2nd ed.; S. Chand and Company: New Delhi, 2003.
2. Rao, C.N.R. *University General Chemistry*, Macmillan Publication: New Delhi, 2000.
3. Puri, B. R. and Sharma, L. R. *Principles of Physical Chemistry*, 38th ed.; Vishal Publishing Company: Jalandhar, 2002.
4. Bruce, P. Y. and Prasad K. J. R. *Essential Organic Chemistry*, Pearson Education: New Delhi, 2008.
5. Dash UN, Dharmarha OP, Soni P. L. *Textbook of Physical Chemistry*, Sultan Chand & Sons: New Delhi, 2016

Reference Books

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

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/>

Question Pattern			
Section :A	I. a	5 Multiple Chose Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice(One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five(One question from each Unit)	3x10=30
Total Marks			75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH1CC1	GENERAL CHEMISTRY-I					3	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓	✓			✓	✓	✓	✓		✓	
CO4	✓	✓	✓	✓	✓	✓	✓			✓	
CO5	✓		✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) = 42 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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SEMESTER-I

Course Code	: 23UCH1CC2P	Exam Hours	: 3
Instruction Hours	: 3	Internal Marks	: 40
Credits	: 3	External Marks	: 60

QUANTITATIVE INORGANIC ESTIMATION AND INORGANIC PREPARATIONS PRACTICAL

Objectives of the course

This course aims at providing knowledge on

1. laboratory safety
2. handling glass wares
3. Quantitative estimation
4. Preparation of inorganic compounds

Course Learning Outcomes (for Mapping with POs and PSOs)

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

1. CO1: explain the basic principles involved in titrimetric analysis and inorganic preparations.
2. CO2: compare the methodologies of different titrimetric analysis.
3. CO3: calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution.
4. CO4: assess the yield of different inorganic preparations and identify the end point of various titrations.

Unit I

Chemical Laboratory Safety in Academic Institutions

Introduction - importance of safety education for students, common laboratory hazards, assessment and minimization of the risk of the hazards, prepare for emergencies from uncontrolled hazards; concept of MSDS; importance and care of PPE; proper use and operation of chemical hoods and ventilation system; fire extinguishers-types and uses of fire extinguishers, demonstration of operation; chemical waste and safe disposal.

Common Apparatus Used in Quantitative Estimation (Volumetric)

Description and use of burette, pipette, standard flask, measuring cylinder, conical flask, beaker, funnel, dropper, clamp, stand, wash bottle, watch glass, wire gauge and tripod stand.

Principle of Quantitative Estimation (Volumetric)

Equivalent weight of an acid, base, salt, reducing agent, oxidizing agent; concept of mole,

molality, molarity, normality; primary and secondary standards, preparation of standard solutions; theories of acid-base, redox, complexometric, iodimetric and iodometric titrations; indicators – types, theory of acid–base, redox, metal ion and adsorption indicators, choice of indicators.

Unit II

Quantitative Estimation(Volumetric)

Preparation of standard solution, dilution from stock solution

Permanganometry

Estimation of sodium oxalate using standard ferrous ammonium sulphate

Dichrometry

Estimation of ferric alum using standard dichromate (external indicator) Estimation of ferric alum using standard dichromate (internal indicator)

Iodometry

Estimation of copper in copper sulphate using standard dichromate

Argentimetry

Estimation of chloride in barium chloride using standard sodium chloride/ Estimation of chloride in sodium chloride (Volhard's method)

Unit III

Complexometry

Estimation of hardness of water using EDTA

Estimations

Estimation of iron in iron tablets Estimation of ascorbic acid.

Preparation of Inorganic compounds-

Potash alum

Tetraammine copper (II) sulphate

Hexamminecobalt (III) chloride

Mohr's Salt

Recommended Text

Reference Books:

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

Reference Books

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

Website and e-learning source

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

SCHEME OF VALUATION	
CRITERIA	MARKS
Record	5
Tabulation	10
Procedure writing	10
RESULTS	
< 1 %	35
1-2%	30
2-3%	25
3-4%	15
>4%	10

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH1CC2P	QUANTITATIVE INORGANIC ESTIMATION AND INORGANIC PREPARATIONS PRACTICAL					3	3			
Course	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓	✓	✓			✓	✓	
CO3	✓	✓			✓	✓	✓	✓		✓	
CO4	✓	✓	✓	✓	✓		✓			✓	
CO5	✓		✓	✓	✓		✓	✓	✓	✓	
Number of Matches(✓) = 38 Relationship: High											
Mapping	1-29%	30-59%		60-69%		70-89%		90-100%			
Matches	1-14	15-29		30-34		35-44		45-50			
Relationship	Very Poor	Poor		Moderate		High		Very High			

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SEMESTER-I

Course Code	: 23UCH1SE1	Exam Hours	: 3
Instruction Hours	: 2	Internal Marks	: 25
Credits	: 2	External Marks	: 75

NUTRITIONAL CHEMISTRY

Objectives of the course

This course aims at providing an overall view of the

1. importance of Nutritional Chemistry
2. chemistry of building materials and food
3. chemistry of Vitamins and minerals

UNIT-I CARBOHYDRATES:

Carbohydrates-Nutritional classification and functions (list), sources and requirements, digestion and absorption and utilization. Glycemic index of foods. Nutritional problems due to excess and deficit intake of carbohydrates. Dietary fibre-definition, classification and food sources. Role of fibre in human health.

UNIT: II PROTEINS:

Protein- Nutritional classification and functions, sources and requirements, digestion and absorption and utilization.4 Protein quality evaluation methods-NPU, BV, PER (Definition & formula).Nutritional problems due to excess and deficit intake of protein.Aminoacids-Essential and non- aminoacids.

UNIT-III LIPIDS:

Lipids- classification and functions, sources and requirements, digestion, absorption and utilization. Nutritional problems due to excess and deficit intake of lipids.Essential fatty acid- Definition and functions (list).

UNIT-IV VITAMINS:

Classification of vitamins-fat and water soluble vitamins. Fat soluble vitamins (A, D, E &K)- functions(list), requirements and food sources. Nutritional problems due to deficiency or excess intake of fat soluble vitamins. Water soluble vitamins (B1, B2, B3, B6, B12 , Vitamin C) - functions, requirements and food source

UNIT-V MINERALS, WATER AND ELECTROLYTE:

Minerals: Macrominerals- calcium, phosphorus, magnesium, sodium, potassium & chloride – Functions(list),requirements, food sources, deficiency and toxicity.Micro minerals& Trace minerals:

Iron, copper, zinc, manganese, iodine, fluoride, selenium, cobalt, chromium & nickel- Functions(list), requirements, food sources, deficiency and toxicity. Water-Distribution, functions of water & electrolytes. Water balance and water intoxication.

Website and e-learning source

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

1. CO1: Understand the role of nutrients in human health
2. CO2: Provide scientific knowledge on the signs and symptoms of nutrient deficiency and Toxicity
3. CO3: Acquire knowledge in energy determination and expenditure
4. CO4: Able to differentiate the functions and deficiency of vitamins.
5. CO5: Know the role of water and electrolyte balance in the human bod

Question Pattern			
Section :A	I. a	5 Multiple Chose Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice(One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five(One question from each Unit)	3x10=30
Total Marks			75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH1SE1	NUTRIONAL CHEMISTRY					3	2			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓		✓	✓	✓	✓			✓	✓	
CO3	✓	✓		✓	✓	✓	✓	✓	✓		
CO4	✓	✓	✓	✓	✓		✓			✓	
CO5	✓	✓			✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =38 Relationship: Moderate											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

PREPARED BY

VERIFIED BY

SEMESTER-II

Course Code	: 23UCH2CC3	Exam Hours	: 3
Instruction Hours	: 5	Internal Marks	: 25
Credits	: 5	External Marks	: 75

GENERAL CHEMISTRY-II

Objectives of the course

This course aims at providing an overall view of the

1. chemistry of acids, bases and ionic equilibrium, properties of s and p-block elements
2. chemistry of hydrocarbons, applications of acids and bases and compounds of main block elements and hydrocarbons

Unit-I

Acids, bases and Ionic equilibria

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

Salt hydrolysis - salts of weak acids and strong bases, weak bases and strong acids, weak acids and weak bases - hydrolysis constant, degree of hydrolysis and relation between hydrolysis constant and degree of hydrolysis; Solubility product - determination and applications; numerical problems involving the core concepts.

Unit-II

Chemistry of s - Block Elements

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

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

preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Alloys of Al. comparison of carbon with silicon. Carbon-di-sulphide – Preparation, properties, structure and uses. Percarbonates, per monocarbonates and per dicarbonates.

Unit-III

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

General characteristics of elements of Group 15; chemistry of $\text{H}_2\text{N}-\text{NH}_2$, NH_2OH , HN_3 and HNO_3 . Chemistry of PH_3 , PCl_3 , PCl_5 , POCl_3 , P_2O_5 and oxy acids of phosphorous (H_3PO_3 and H_3PO_4). General properties of elements of group 16 - Structure and allotropy of elements - chemistry of ozone - Classification and properties of oxides - oxides of sulphur and selenium – Oxy acids of sulphur (Caro's and Marshall's acids).

Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF , HCl , HBr and HI), oxides and oxy acids (HClO_4). Inter-halogen compounds (ICl , ClF_3 , BrF_5 and IF_7), pseudo halogens [$(\text{CN})_2$ and $(\text{SCN})_2$] and basic nature of Iodine. Noble gases: Position in the periodic table. Preparation, properties and structure of XeF_2 , XeF_4 , XeF_6 and XeOF_4 ; uses of noble gases - clathrate compounds.

Unit-IV

Hydrocarbon Chemistry-I

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

Alkenes-Nomenclature, general methods of preparation – Mechanism of 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-V

Hydrocarbon Chemistry - II

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

orientation and reactivity.

Polynuclear Aromatic hydrocarbons: Naphthalene – nomenclature, Haworth synthesis; physical properties, reactions – electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation & alkylation, preferential substitution at \square - position – reduction, oxidation – uses.

Anthracene – synthesis by Elbs reaction, Diels – Alder reaction and Haworth synthesis; physical properties; reactions - Diels-Alder reaction, preferential substitution at C-9 and C-10; uses.

Recommended Text

1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 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, Mehrotra 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, New York.
2. Barrow G M, (1992), Physical Chemistry, 5th ed., Tata McGraw Hill, New Delhi.
3. Lee J D, (1991), Concise Inorganic Chemistry, 4th ed., 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, 8th ed., Goel Publishing House, Meerut.

Website and e-learning source

1. <https://onlinecourses.nptel.ac.in>
2. http://cactus.dixie.edu/smlblack/chem1010/lecture_notes/4B.html
3. <http://www.auburn.edu/~deruija/pdareson.pdf> <https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding>
4. <http://nptel.ac.in/courses/104101090/>

Lecture 1: Classification of elements and periodic properties

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

Question Pattern			
Section :A	I. a	5 Multiple Chose Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice(One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five(One question from each Unit)	3x10=30
Total Marks			75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH2CC3	GENERAL CHEMISTRY-II					3	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓	✓	✓		✓	✓	✓	
CO3	✓	✓			✓	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓		✓		✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =43 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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SEMESTER-II

Course Code	: 23UCH2CC4P	Exam Hours	: 3
Instruction Hours	: 3	Internal Marks	: 40
Credits	: 3	External Marks	: 60

QUALITATIVE ORGANIC ANALYSIS PRACTICAL

Objectives of the course

This course aims at providing knowledge on

1. laboratory safety and handling glass wares
2. analysis of organic compounds and preparation of organic compounds.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

1. CO1: observe the physical state, odour, colour and solubility of the given organic compound.
2. CO2: identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.
3. 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.
4. CO4: exhibit a solid derivative with respect to the identified functional group.

Unit- I

Safety rules, symbols and first-aid in chemistry laboratory Basic ideas about Bunsen burner, its operation and parts of the flame. Chemistry laboratory glassware –basis information and uses.

Unit -II

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

- i. monocarboxylic acid, dicarboxylic acid
- ii. monohydric phenol, polyhydric phenol
- iii. aldehyde, ketone, ester
- iv. carbohydrate (reducing and non-reducing sugars)
- v. primary, secondary, tertiary amine
- vi. monoamide, diamide, thioamide

- vii. anilide, nitro compound
- viii. Preparation of derivatives for functional groups

Unit -III

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

Separation and Purification Techniques (Not for Examination)

- 1. Purification of organic compounds by crystallization (from water / alcohol) and distillation
- 2. Determination of melting and boiling points of organic compounds.
- 3. **Steam distillation** - Extraction of essential oil from citrus fruits/eucalyptus leaves.
- 4. Chromatography (any one) (Group experiment)
 - a. Separation of amino acids by Paper Chromatography
 - b. Thin Layer Chromatography - mixture of sugars / plant pigments/permanganate dichromate.
 - c. Column Chromatography - extraction of carotene, chlorophyll and xanthophyll from leaves / separation of anthracene - anthracene picrate.
- 5. Electrophoresis – Separation of amino acids and proteins.
(Demonstration)
- 6. Isolation of casein from milk/Determination of saponification value of oil or fat/Estimation of acetic acid from commercial vinegar. (Any one Group experiment) (4,5& 6–not for ESE)

Reference Books

- 1. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. Basic Principles of Practical Chemistry, 2nd ed.; Sultan Chand: New Delhi, 2012.
- 2. Manna, A.K. Practical Organic Chemistry, Books and Allied: India, 2018.
- 3. Gurtu, J. N; Kapoor, R. Advanced Experimental Chemistry (Organic), 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.

Website and e-learning source

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

Scheme of valuation

Criteria	Marks		
Record	5		
Procedure writing	5		
Physical constant	5		
Organic preparation	10		
Organic analysis {15}	Gravimetry{20}		
Aliphatic/aromatic	2	error	Marks
Saturated/unsaturated	2		
Element test	4	< 1 %	20
Functional group	4	1-2%	15
Derivative	3	2-3%	10
		>3%	5

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH2CC4P	QUALITATIVE ORGANIC ANALYSIS PRACTICAL					6	5			
Course	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓		✓	✓	✓	✓	✓	
CO3	✓	✓			✓			✓	✓		
CO4		✓	✓	✓	✓	✓	✓			✓	
CO5	✓	✓	✓	✓		✓	✓	✓	✓	✓	
Number of Matches(✓) =38 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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SEMESTER-II

Course Code	: 23UCH2SE2	Exam Hours	: 3
Instruction Hours	: 2	Internal Marks	: 25
Credits	: 2	External Marks	: 75

DAIRY CHEMISTRY

Objectives of the course

This course aims at providing an overall view of the

1. chemistry of milk and milk products
2. processing of milk and preservation and formation of milk products.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

1. CO 1: understand about general composition of milk – constituents and its physical properties.
2. CO 2: acquire knowledge about pasteurization of Milk and various types of pasteurization - Bottle, Batch and HTST Ultra High Temperature Pasteurization.
3. CO 3: learn about Cream and Butter their composition and how to estimate fat in cream and Ghee
4. CO 4: explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk.
5. CO 5: have an idea about how to make milk powder and its drying process - types of drying process

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 - Bulgarian milk - acidophilus milk – Yoheer Indigenous 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.

Website and learning source

1. <https://dairyprocessinghandbook.tetrapak.com/chapter/chemistry-milk>

Question Pattern			
Section :A	I. a	5 Multiple Chose Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice(One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five(One question from each Unit)	3x10=30
Total Marks			75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH2SE2	DAIRY CHEMISTRY					3	3			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓	✓	✓		✓	✓	✓	
CO3	✓	✓			✓	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓		✓		✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =43 Relationship: High											
Mapping	1-29%		30-59%		60-69%		70-89%		90-100%		
Matches	1-14		15-29		30-34		35-44		45-50		
Relationship	Very Poor		Poor		Moderate		High		Very High		

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SEMESTER-I

Course Code	: 23UCH2SE3	Exam Hours	: 3
Instruction Hours	: 2	Internal Marks	: 25
Credits	: 2	External Marks	: 75

COSMETICS AND PERSONAL GROOMING

Objectives of the course

This course aims at familiarizing the students with

1. formulations of various types of cosmetics and their significance
2. hair, skin and dental care and makeup preparations and personal grooming

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

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

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 cosmetics – 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 practice of perfumes and cosmetics, Stanley Therones, Chettenham

Website and e-learning source

1. <http://www.khake.com/page75.html>
2. Net.foxsm/list/284

Question Pattern			
Section :A	I. a	5 Multiple Chose Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice(One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five(One question from each Unit)	3x10=30
Total Marks			75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH2SE3	COSMETICS AND PERSONAL GROOMING					3	2			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓		✓	✓	✓	✓			✓	✓	
CO3	✓	✓		✓	✓	✓	✓	✓	✓		
CO4	✓	✓	✓	✓	✓		✓			✓	
CO5	✓	✓			✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =38 Relationship: Moderate											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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SEMESTER-III

Course Code	: 23UCH3CC5	Exam Hours	: 3
Instruction Hours	: 5	Internal Marks	: 25
Credits	: 5	External Marks	: 75

GENERAL CHEMISTRY -III

Objectives of the course

This course aims to provide a comprehensive knowledge on

1. the physical properties of gases, liquids, solids and X-ray diffraction of solids fundamentals of nuclear chemistry and nuclear waste management.
2. applications of nuclear energy, basic chemistry of halo-organic compounds, phenol and other aromatic alcohols and preparation and properties of phenols and alcohols.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

1. CO1: explain the kinetic properties of gases by using mathematical concepts.
2. CO2: describe the physical properties of liquid and solids; identify various types of crystals with respect to its packing and apply the XRD method for crystal structure determinations.
3. CO3: investigate the radioactivity, nuclear energy and its production, also the nuclear waste management.
4. CO4: write the nomenclature, physical & chemical properties and basic mechanisms of halo organic compounds and alcohols.
5. CO5: investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol including thiol.

UNIT I

Gaseous state

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

Real gases: Deviations from ideal gas behaviour, (Andrew's and Amagat's plots); compressibility factor, Z, and its variation with pressure for different gases. equations of states for real gases-van der Waal's

equation; Virial equation; Boyle temperature; Numerical problems based on equations of states for real gases, isotherms of real gases – critical phenomena – isotherms of CO₂

- continuity of state–Van der waal's equation and the critical state; law of corresponding states–liquefaction of gases; numerical problems involving the core concepts.

Unit-II

Liquid and Solid State

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

Crystals –size and shape; laws of crystallography; symmetry elements – plane, centre and axis; Miller indices, Unit cells and space lattices; classification of crystal systems; Bravais lattices; X – ray diffraction – Bragg's equation.Packing in atomic solids – simple cubic, body centered cubic, face centered and hexagonal close packing; Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO₂; comparison of structure and properties of diamond and graphite;.numerical problems involving core concepts Defects in solids - stoichiometric and nonstoichiometric defects.

Liquid crystals – classification and applications.

UNIT-III

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-IV

Halogen derivatives Aliphatic halogen derivatives

Nomenclature and classes of alkyl halides – isomerism, physical properties, Chemical reactions. Nucleophilic substitution reactions – SN₁, SN₂ and SN_i 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-V

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.

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

Website and e-learning source

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

Question Pattern			
Section :A	I. a	5 Multiple Chose Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice(One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five(One question from each Unit)	3x10=30
Total Marks			75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH3CC5	GENERAL CHEMISTRY - III					3	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓	✓	✓	
CO2	✓		✓	✓	✓	✓			✓	✓	
CO3	✓	✓		✓	✓	✓	✓	✓	✓		
CO4	✓	✓	✓	✓	✓	✓	✓		✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =43 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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SEMESTER-III

Course Code	: 23UCH3CC6P	Exam Hours	: 3
Instruction Hours	: 3	Internal Marks	: 40
Credits	: 3	External Marks	: 60

QUALITATIVE INORGANIC ANALYSIS PRACTICAL

Objectives of the course

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

Course Learning Outcomes (for Mapping with POs and PSOs)

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

1. CO 1: acquire knowledge on the systematic analysis of Mixture of salts.
2. CO 2: identify the cations and anions in the unknown substance.
3. CO 3: identify the cations and anions in the soil and water and to test the quality of water.
4. CO4: assess the role of common ion effect and solubility product

Semi - Micro Qualitative Analysis

1. Analysis of simple acid radicals: Carbonate, sulphide, sulphate, thiosulphite, chloride, bromide,
2. iodide, nitrate
3. Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate, arsenate, arsenite.
4. Elimination of interfering acid radicals and Identifying the group of basic radicals
5. Analysis of basic radicals (group wise): Lead, copper, bismuth, cadmium, tin, antimony, iron, aluminium, arsenic, zinc, manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium
6. Analysis of a mixture - I to VIII containing two cations and two anions (of which one is interfering type)

Recommended Text

Reference Books:

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

Website and learning source

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

SCHEME OF VALUATION	
CRITERIA	MARKS
Record	5
Aim and tabulation	5
4- radicals with correct procedure	50
3- radicals with correct procedure	35
2- radicals with correct procedure	25
1- radical with correct procedure	15
Spotting	10

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH3CC6P	QUALITATIVE INORGANIC ANALYSIS PRACTICAL					3	3			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓	✓		✓	✓	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓	✓	✓			✓	

CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches(✓) =45 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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SEMESTER-III

Course Code	: 23UCH3SE4	Exam Hours	: 3
Instruction Hours	: 2	Internal Marks	: 25
Credits	: 2	External Marks	: 75

ENTREPRENEURIAL SKILLS IN CHEMISTRY

Objectives of the course

The course aims at providing training to

1. develop entrepreneur skills in students
2. to provide hands on experience to prepare and develop products and develop start ups

UNIT -I

Food Chemistry

Food adulteration-contamination of food items with clay stones, water and toxic chemicals -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/powder and 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

1. Shyam Jha, Rapid detection of food adulterants and contaminants (Theory and Practice), Elsevier, e Book ISBN 9087128004289, 1st Edition, 2015

Website and e-learning source

2. <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

1. CO 1: identify adulterated food items by doing simple chemical tests.
2. CO 2: prepare cleaning products and become entrepreneurs
3. CO 3: educate others about adulteration and motivate them to become entrepreneurs.

Question Pattern			
Section :A	I. a	5 Multiple Chose Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice(One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five(One question from each Unit)	3x10=30
Total Marks			75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH3SE4	ENTREPRENEURIAL SKILLS IN CHEMISTRY					3	2			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓		✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓	✓		✓	✓	✓	✓	✓			
CO4	✓	✓	✓	✓	✓	✓	✓			✓	
CO5			✓	✓		✓	✓	✓	✓	✓	
Number of Matches(✓) =39 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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SEMESTER-III

Course Code	: 23UCH3SE5	Exam Hours	: 3
Instruction Hours	: 2	Internal Marks	: 25
Credits	: 2	External Marks	: 75

PESTICIDE CHEMISTRY

Objectives of the course

This course aims to providing the students

1. Knowledge about the various types of pesticides and their toxicity.
2. To understand the accumulation of pesticides in in the form of residues and its analysis and knowledge on choice of alternate and eco-friendly pesticides.

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

1. CO 1: teach about the pesticides and their toxicity with respect to structure and category.
2. CO 2: explain the preparation and property of pesticides
3. CO 3: investigate the pesticide residues, prevention and care
4. CO 4: demonstrate the extraction and analytical methods of pesticide residues
5. CO 5: make awareness to the public on bio-pesticides

Unit I

Introduction: History of pesticides. Chemistry of Pesticides: Brief introduction to classes of pesticides (Chemical class, targets), structures, chemical names, physical and chemical properties.

Toxicity of pesticides: Acute and chronic toxicity in mammals, birds, aquatic species etc. Methods of analysis of pesticides.

Insecticides: Classification and study of following insecticides with respect to structure, chemical name, physical properties, chemical properties, synthesis, degradation, metabolism, formulations, Mode of action, uses, toxicity.

Organophosphates and Phosphothionates: Acephate, Chlorpyrifos, Monocrotophos, and parathion-methyl. Organochlorine – Endosulfan, heptachlor; Carbamate: Cartap hydrochloride, Methomyl, Propoxur.

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

1. Handa SK. Principles of pesticide chemistry. Agrobios (India); 2012.
2. Matolcsy G, Nádas M, Andriská V. Pesticide chemistry. Elsevier; 1989.
3. J. Miyamoto and P. C. Kearney Pesticide Chemistry Human Welfare and the Environment vol. IV Pesticide Residue and Formulation Chemistry, Pergamon press, 1985.
4. R. Cremllyn: Pesticides, John Wiley.

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

Question Pattern			
Section :A	I. a	5 Multiple Chose Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice(One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five(One question from each Unit)	3x10=30
Total Marks			75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH3SE5	PESTICIDE CHEMISTRY					3	2			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓			✓	✓	✓	✓	
CO3		✓		✓	✓		✓	✓			
CO4	✓	✓	✓	✓	✓		✓			✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =38 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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SEMESTER-IV

Course Code	: 23UCH4CC7	Exam Hours	: 3
Instruction Hours	: 5	Internal Marks	: 25
Credits	: 5	External Marks	: 75

GENERAL CHEMISTRY-IV

Objectives of the course

1. This course aims to provide a comprehensive knowledge on thermodynamic concepts on chemical processes and applied aspects and thermo chemical calculations
2. transition elements with reference to periodic properties and group study of transition metals, the organic chemistry of ethers, aldehydes and ketones and the organic chemistry of carboxylic acids

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

1. CO1: explain the terms and processes in thermodynamics; discuss the various laws of thermodynamics and thermo chemical calculations.
2. CO2: discuss the second law of thermodynamics and its application to heat engine; discuss third law and its application on heat capacity measurement.
3. CO3: investigate the chemistry of transition elements with respect to various periodic properties and group wise discussions.
4. CO4: discuss the fundamental organic chemistry of ethers, epoxides and carbonyl compounds including named organic reactions.
5. CO5: discuss the chemistry and named reactions related to carboxylic acids and their

UNIT I

Thermodynamics I

Terminology – Intensive, extensive variables, state, path functions; isolated, closed and open systems; isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible processes; First law of thermodynamics – Concept and significance of heat (q), work (w), internal energy (E), enthalpy (H); calculations of q, w, E and H for reversible, irreversible expansion of ideal and real gases under isothermal and adiabatic conditions; relation between heat capacities (C_p & C_v); Joule Thomson effect-inversion temperature. Thermo chemistry - 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.

Unit II

Thermodynamics II

Second Law of thermodynamics - Limitations of first law, spontaneity and randomness; Carnot's cycle; Concept of entropy, entropy change for reversible and irreversible processes, entropy of mixing, calculation of entropy changes of an ideal gas and a van-der Waals gas with changes in temperature, volume and pressure, entropy and disorder.

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

Third law of thermodynamics - Nernst heat theorem; Applications of third law - evaluation of absolute entropies from heat capacity measurements, exceptions to third law.

UNIT III

General Characteristics of d-block elements

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

UNIT IV

Ethers, Thio ethers and Epoxides

Nomenclature, isomerism, general methods of preparations, reactions involving cleavage of C-O linkages, alkyl group and ethereal oxygen. Zeisel's method of estimation of methoxy group. Reactions of epoxides with alcohols, ammonia derivatives and LiAlH_4 Thioethers - nomenclature, structure, preparation, properties and uses.

Aldehydes and Ketones

Nomenclature, structure and reactivity of aliphatic and aromatic aldehydes and ketones; general methods of preparation and physical properties. Nucleophilic addition reactions, base catalysed reactions with

mechanism- Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. Oxidation of aldehydes. Baeyer - Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf - Kishner reduction, Meerwein – Ponder Verley reduction, reduction with LiAlH_4 and NaBH_4 . Addition reactions of unsaturated carbonyl compounds: Michael addition.

UNIT V

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, Hunsdiecker reaction. Formic acid-reducing property. Reactions of dicarboxylic acids, hydroxy acids and unsaturated acids. Carboxylic acid Derivatives: Preparations of aliphatic and aromatic acid chlorides, esters, amides and anhydrides. Nucleophilic substitution reaction at the acyl carbon of acyl halide, anhydride, ester, amide. 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 $\alpha\beta$ hydroxyacids.

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),
3. Macmillan, India Ltd, third edition, 2009.
4. P.L. Soni and Mohan Katyal, Textbook of Inorganic Chemistry, Sultan Chand & Sons, twentieth edition, 2006.
5. M. K. Jain, S. C. Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2003.
6. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 1994.

Reference Books

1. Maron, S. H. and Prutton C. P. Principles of Physical Chemistry, 4th ed.; The Macmillan Company: 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 Publishing House: Meerut, 2001.
4. Atkins, P.W. & Paula, J. Physical Chemistry, 10th ed.; Oxford University Press: New York, 2014.

5. Huheey, J. E. Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed; Addison Wesley Publishing Company: India,1993.

Website and e-learning source

MO OC components

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

Question Pattern			
Section :A	I. a	5 Multiple Chose Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice(One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five(One question from each Unit)	3x10=30
Total Marks			75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH4CC7	GENERAL CHEMISTRY-IV					3	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3		✓		✓	✓	✓	✓	✓			
CO4	✓	✓	✓	✓	✓	✓	✓			✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =42 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50

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SEMESTER-IV

Course Code	: 23UCH4CC8P	Exam Hours	: 3
Instruction Hours	: 3	Internal Marks	: 40
Credits	: 3	External Marks	: 60

PHYSICAL CHEMISTRY PRACTICAL – I

Objectives of the course

The course aims at providing an understanding of

1. the laboratory experiments in order to understand the concepts of physical changes in chemistry
2. the rates of chemical reactions and colligative properties and adsorption isotherm

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

1. CO1: describe the principles and methodology for the practical work
2. CO2: explain the procedure, data and methodology for the practical work.
3. CO3: apply the principles of electrochemistry, kinetics for carrying out the practical work.
4. CO4: demonstrate laboratory skills for safe handling of the equipment and chemicals

UNIT-I

Chemical kinetics

1. Determination of rate constant of acid catalysed hydrolysis of an ester (methyl acetate).
 2. Determination of order of reaction between iodide and persulphate (initial rate method).
 3. Polarimetry: Determination of rate constant of acid catalysed inversion of cane sugar
- Thermochemistry
4. Determination of heat of neutralisation of a strong acid by a strong base.
 5. Determination of heat of hydration of copper sulphate.

UNIT II

Electrochemistry – Conductance measurements

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

Colorimetry

9. Determination of concentration of copper sulphate solution

UNIT III

Colligative property

10. Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent

Adsorption

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

Reference Books

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

Website and e-learning source

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

Scheme of valuation

Criteria	marks
Record	5
Aim and tabulation	10
calculation	10
Results	
Allowed error 5%	35
5-10%	20
10%<	10

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH4CC8P	PHYSICAL CHEMISTRY PRACTICAL – I					3	3			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
C01	✓	✓	✓		✓	✓	✓	✓		✓	
C02	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
C03	✓	✓	✓	✓	✓	✓		✓			
C04	✓	✓	✓	✓	✓	✓	✓			✓	
C05	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =43 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

PREPARED BY

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SEMESTER-IV

Course Code	: 23UCH4SE6	Exam Hours	: 3
Instruction Hours	: 2	Internal Marks	: 25
Credits	: 2	External Marks	: 75

INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

Objectives of the course

The course aims at providing an overall view of the

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

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

1. CO1: apply error analysis in the calibration and use of analytical instruments, explain theory, instrumentation and application of flame photometry and Atomic Absorption spectrometry
2. CO2: explain theory, instrumentation and application of UV visible and Infrared spectroscopy.
3. CO3: able to discuss instrumentation, theory and applications of thermal and electrochemical techniques
4. CO4: explain the use of chromatographic techniques in the separation and identification of mixtures
5. CO5: explain preparation of solutions, stoichiometric calculations

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 plot.

UNIT II

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

UNIT III

UV-Visible and IR Spectroscopy

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. UV-Visible Spectrometry: Basic principles, instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Infrared Spectroscopy: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques.

UNIT IV

Thermal and Electro-analytical Methods of Analysis

TGA and DTA- Principle, Instrumentation, methods of obtaining Thermograms, factors affecting TGA/DTA, Thermal analysis of silver nitrate, calcium oxalate and calcium acetate DSC- Principle, Instrumentation and applications. Electroanalytical methods: polarography - principle, instrumentation and applications. Derivative polarography- Cyclic Voltammetry - principle.

UNIT V

Separation and purification techniques

Classification, principle, Factors affecting - Solvent Extraction – Liquid - Liquid Extraction, Chromatography: Column, TLC, Paper, Gas, HPLC and Electrophoresis, Principle, Classification, Choice of Adsorbents, Solvents, Preparation of Column, Elution Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms and R_f value.

Recommended Text

1. Vogel, Arthur I: A 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.
5. R.A. Day and A.L. Underwood, Quantitative Analysis, 6th edn., Prentice Hall of India Private Ltd., New Delhi, 1993

Reference Books

1. D. A. Skoog, D.M. West and F. J. Holler, Analytical Chemistry: An Introduction, 5th edn., Saunders college publishing, Philadelphia, 1998.
2. Dash UN, 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. & Chalmers, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elsevier Harwood Ltd. London
- a. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, sixth edition Pearson Education, 2000

Website and elearning sources

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

Question Pattern			
Section :A	I. a	5 Multiple Chose Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice(One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five(One question from each Unit)	3x10=30
Total Marks			75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH4SE6	INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS					3	2			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓	✓	✓		✓	✓		✓		✓	
CO4	✓	✓	✓	✓	✓	✓	✓	✓		✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =44 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

PREPARED BY

VERIFIED BY

SEMESTER-V

Course Code	: 23UCH5CC8	Exam Hours	: 3
Instruction Hours	: 6	Internal Marks	: 25
Credits	: 5	External Marks	: 75

ORGANIC CHEMISTRY – I

Objectives of the course

This course aims to provide an understanding of

1. Stereoisomerism in chirals and geometric isomerism in olefins, conformations of ethane and butane and preparation and properties of aromatic and aliphatic nitro compounds and amines
2. Preparation of different dyes, food colour and additives, preparation and properties of five membered heterocycles like pyrrole, furan and thiophene and preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline.

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

1. **CO1:** assign RS notations to chirals and EZ notations to olefins and explain conformations of ethane and butane.
2. **CO2:** explain preparation and properties of aromatic and aliphatic nitro compounds and amines
3. **CO3:** explain colour and constitution of dyes and food additives
4. **CO4:** discuss preparation and properties of five membered heterocycles like pyrrole, furan and thiophene
5. **CO5:** discuss preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline

Unit I

Stereochemistry

Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans, syn-anti isomerism, E/Z notations. Optical Isomerism: Optical activity, specific rotation, asymmetry, enantiomers, distereoisomers, meso structures - molecules with one and two chiral centres, racemisation- methods of racemisation; resolution- methods of resolution. C.I.P rules. R and S notations for one and two chirality (stereogenic) centres. Molecules with no asymmetric carbon atoms – allenes and biphenyls. Conformational analysis of ethane and butane.

Unit II

Chemistry of Nitrogen Compounds – I

Nitroalkanes

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

Nitro - aci nitro tautomerism.

Aromatic nitro compounds

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

Amines: Aliphatic amines

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

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

Unit III

Chemistry of Nitrogen Compounds – II

Aromatic amines – Nomenclature, preparation – from nitro compounds, Hofmann's method; Schmidt reaction, properties - basic nature, ortho effect; reactions – alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, oxidation, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid - zwitter ion formation. Distinction between primary, secondary and tertiary amines - aliphatic and aromatic Diazonium compounds, Diazomethane, Benzene diazoniumchloride- preparations and synthetic applications. Dyes Theory of colour and constitution; classification based on structure 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. S.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. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, seventh edition,2009.
4. 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 sources

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

Question Pattern			
Section :A	I. a	5 Multiple Chose Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice(One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five(One question from each Unit)	3x10=30
Total Marks			75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH5CC8	ORGANIC CHEMISTRY I					3	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓		✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓	✓		✓	✓	✓		✓			
CO4	✓	✓	✓	✓	✓		✓			✓	
CO5			✓	✓		✓	✓	✓	✓	✓	
Number of Matches(✓) =37 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

PREPARED BY

VERIFIED BY

SEMESTER-V

Course Code	: 23UCH5CC10	Exam Hours	: 3
Instruction Hours	: 5	Internal Marks	: 25
Credits	: 5	External Marks	: 75

INORGANIC CHEMISTRY -I

Objectives of the course

The course aims to provide knowledge on

1. nomenclature, isomerism and theory of coordination compounds, and chelate complexes, crystal field theory, magnetic properties, stability of complexes and Jahn Teller effect
2. preparation and properties of metal carbonyls and Lanthanoids and actinoids, preparation and properties of inorganic polymers

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

1. **CO1:** explain isomerism, Werner's Theory and stability of chelate complexes
2. **CO2:** discuss crystal field theory, magnetic properties and spectral properties of complexes.
3. **CO3:** explain preparation and properties of metal carbonyls
4. **CO4:** give a comparative account of the characteristics of lanthanoids and actinoids
5. **CO5:** explain properties and uses of inorganic polymers of silicon, sulphur, boron and phosphorus

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 of hardness of water using EDTA, metal ion indicators. Role of metal chelates in living systems – haemoglobin and chlorophyll

Unit II

Co-ordination Chemistry-II

Crystal field theory – Crystal field splitting of energy levels in octahedral and tetrahedral complexes, Crystal field stabilization energy (CFSE), spectrochemical series - calculation of CFSE in octahedral and tetrahedral complexes - 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 $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ -Jahn-Teller effect. Stability of complexes in aqueous solution, stability constants- factors affecting the stability of a complex, thermodynamic and kinetic Stability (elementary idea). Comparison of VBT and CFT.

Unit III

Organometallic compounds

Metal Carbonyls

Mono and poly nuclear 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 (poly dimethyl siloxane and poly methyl hydrosiloxane) phosphorous based polymer (poly phosphazines and poly phospho nitric chloride), sulphur based polymer (polysulfide and polymeric sulphur nitride), boron based polymers (borazine polymers)— industrial applications of inorganic polymers.

Recommended Text

1. Puri BR, Sharma LR, Kalia KC (2011), Principles of Inorganic Chemistry, 31th Edition, 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 JD, (1991), Concise Inorganic Chemistry, 4th Edition, ELBS William Heinemann, London.
4. WVMalik, GDTuli, RDMadan, (2000), Selected Topics in Inorganic Chemistry, S. Chand and Company Ltd.
5. K. De, Textbook of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992.

Reference Books

1. Madan RD, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nd ed., S. Chand and Company, New Delhi.

- GopalanR,(2009)InorganicChemistryforUndergraduates,IstEdition,UniversityPress(India)PrivateLimited,Hyderabad
- Sivasankar B,(2013) Inorganic Chemistry. 1st Edition, Pearson, Chennai
- Alan G. Sharp(1992),Inorganic Chemistry, 3rd Edition, Addition-Wesley, England
- PeterAtkins, TinaOverton, Jonathan Rourke and MarkWeller,InorganicChemistry,OxfordUniversityPress,sixthedition,2014.

Websiteand e-learning sources

- www.epgpathshala.nic.in
- www.nptel.ac.in
- <http://swayam.gov.in>

Question Pattern			
Section :A	I. a	5 Multiple Chose Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice(One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five(One question from each Unit)	3x10=30
Total Marks			75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH5CC10	INORGANIC CHEMISTRY – I					3	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓		✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓	✓		✓	✓	✓	✓	✓			
CO4	✓	✓	✓	✓	✓	✓	✓			✓	
CO5			✓	✓		✓	✓	✓	✓	✓	
Number of Matches(✓) =39 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
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Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

PREPARED BY

VERIFIED BY

SEMESTER-V

Course Code	: 23UCH5CC11	Exam Hours	: 3
Instruction Hours	: 6	Internal Marks	: 25
Credits	: 5	External Marks	: 75

PHYSICAL CHEMISTRY -I

Objectives of the course

The course aims at providing an overall view of

1. Gibbs free energy, Helmholtz free energy, Ellingham's diagram and partial molar properties and chemical kinetics and different types of chemical reactions
2. adsorption, homogeneous and heterogeneous catalysis, colloids and macromolecules and photochemistry, fluorescence and phosphorescence.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

1. CO1: explain Gibbs and Helmholtz free energy functions, partial molar quantities and Ellingham's
2. CO2: apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction, demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation.
3. CO3: compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogeneous and heterogeneous catalysis.
4. CO4: demonstrate the types and characteristics of colloids, preparation of sols and emulsions, and determine the molecular weights of macromolecules.
5. CO5: utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and color perception of vision.

Unit I

Thermodynamics-III

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

Partial molar properties - chemical potential, Gibbs Duhem equation, variation of chemical potential

with temperature and pressure, chemical potential of a system of ideal gases, Gibbs-Duhem-Margules equation.

UNIT II

Chemical Kinetics

Rate of reaction - Average and instantaneous rates, factors influencing rate of reaction - molecularity of a reaction - rate equation - order of reaction. order and molecularity of simple and complex reactions, Rate laws- Rate constants - derivation of rate constants and characteristics for zero, first order, second 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 uni molecular reaction. Theory of absolute reaction rates - Derivation of rate constant for a bi molecular reaction - significance of entropy and free energy of activation. Comparison of collision theory and ARRT. Complex reactions - reversible and parallel reactions (no derivation and only examples) kinetics of consecutive reactions - steady state approximation.

UNIT III

Adsorption - Chemical and physical adsorption and their general characteristics - distinction between them Different types of isotherms - Freundlich and Langmuir. Adsorption isotherms and their limitations - BET theory, kinetics of enzyme catalysed reaction - Michaelis-Menten and Briggs-Haldane equation - Lineweaver-Burk plot - inhibition - reversible - competitive, non competitive and uncompetitive (no derivation of rate equations) Catalysis - general characteristics of catalytic reactions, auto catalysis, promoters, negative catalysis, poisoning of a catalyst - theories of homogeneous and heterogeneous catalysis - Kinetics of Acid - base and enzyme catalysis. Heterogeneous catalysis

UNIT IV

Colloids and Surface Chemistry

Colloids: Types of Colloids, Characteristics Colloids (Lyophilic and Lyophobic sols), Preparation of Sols - Dispersion methods, aggregation methods, Properties of Sols - Optical properties, Electrical properties - Electrical double layer, Electrokinetic properties - Electro-osmosis, Electrophoresis Coagulation or precipitation, Stability of sols, associated colloids, Emulsions, Gels - preparation of Gels, Applications of colloids Macro molecules: Molecular weight of Macromolecules - Number average molecular weight - average molecular weight, Determination of Molecular weight of molecules

Unit V

Photochemistry

Laws of photochemistry–Lambert–Beer, Grotthus–Draper and Stark–Einstein. Quantum efficiency. Photochemical reactions–rate law–Kinetics of H₂-Cl₂, H₂-Br₂ and H₂-I₂ reactions, comparison between thermal and photochemical reactions.

Fluorescence–applications including fluorimetry–sensitized fluorescence, phosphorescence – applications – chemi luminescence and photo sensitisation– examples Chemistry of Vision–11 cisretinal– vitamin A as 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 Juliode Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.
3. Arun Bahl, B.S.Bahl, G.D.Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co.
4. S.K.Dogra and S.Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996.
5. J.Rajaram and J.C.Kuriacose, Thermodynamics, Shoban Lal Nagin Chand and CO., 1986.

Reference Books

1. J.Rajaram and J.C.Kuriacose, Chemical Thermodynamics, Pearson, 1st edition, 2013.
2. Keith J.Laidler, Chemical kinetics, third edition, Pearson, 2003.
3. P.W.Atkins, and Juliode 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, Shoban Lal Nagin Chand and Co. Jaipur, forty first, edition, 2001

Website and e-learning sources

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

Question Pattern			
Section :A	I. a	5 Multiple Choice Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice (One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five (One question from each Unit)	3x10=30

Total Marks	75
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Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH5CC11	PHYSICAL CHEMISTRY – I					6	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓		✓	✓	✓	✓		✓	✓	✓	
CO3	✓	✓		✓	✓	✓		✓			
CO4	✓	✓	✓	✓	✓	✓	✓			✓	
CO5		✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =39 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

PREPARED BY

VERIFIED BY

SEMESTER-V

Course Code	: 23UCH5CC12PW	Exam Hours	: 3
Instruction Hours	: 3	Evaluation	: 80
Credits	: 3	Viva-voce	: 20

PROJECT WITH VIVA VOCE

PREPARED BY

VERIFIED BY

SEMESTER-V

Course Code	: 23UCH5DE1	Exam Hours	: 3
Instruction Hours	: 4	Internal Marks	: 25
Credits	: 4	External Marks	: 75

INDUSTRIAL CHEMISTRY

Objectives of the course

This course is designed to provide knowledge on

1. Classifications and characteristics of fuels and preparation of cosmetics.
2. Manufacture of sugar, paper, cement and leather and food processing, applications of abrasives, lubricants and other industrial products and intellectual property rights.

Course Learning Outcomes(for Mapping with POs and PSOs)

On completion of the course the students should be able to

1. **CO1:** Summarize the properties of fuels which include petroleum, water gas, natural gas and propellents.
2. **CO2:**Evaluate cosmetic products, soaps, detergents.
3. **CO3:**Explain manufacture of sugar, food spoilages and food additives
4. **CO4:**Explain properties of abrasives, manufacture of leather and paper
5. **CO5:**Explain properties and manufacture of lubricants and cement, and intellectual property rights.

UNIT I

Survey of Indian Industries and mineral resources in India

Fuels: Classification, characteristics of fuels. Solid fuels: coal-classification; analysis of coal-proximate analysis and ultimate analysis; calorific value-determination, carbonisation of coal.

Liquidfuels: Petroleum-characteristics;Gasolineaviationpetrol-knock ingin internal combustion engines, anti knock agents; unleaded petrol-octane number, cetane number.

Gaseous fuel: advantages over solid and liquid fuels; water gas, producer gas, carbureted water gas-preparations-uses. Naturalgas: LPG- composition, advantages, application;gobargas-production composition, advantages ,application .Propellants– rocket fuels(basicidea)

UNIT II

Cosmetics

Skincare: powders, ingredients; creams and lotion leansing, moisturising, all purposes having cream,

sunscreen ; makeup preparations.

Dental care: toothpastes–ingredients.

Haircare:shampoos-types,ingredients;conditioners-types,ingredients.Perfumes:natural-plantorigin-
partsoftheplantused,chiefconstituents;animalorigin-ambergries,civetoneandmusk;synthetic-
classification-esters-amylsalicylatealcohols-citronello;terpeneols-geraniolandnerol;ketones-
muskone,coumarin;aldehydes-vanilin.

Soaps and Detergents

Soaps-properties, manufacture of soap-batch process;types-transparent soap, toilet soap, powder soap
and liquid soap–ingredients.

Detergents-definition, properties-cleansing action; soapless detergents-anionic, cationic and non-ionic
(general idea only); uses of detergents assurfactants. Biodegradability of soaps and detergents.

UNITIII

Sugar Industry

Manufacture from sugarcane; recovery of sugar from molasses; testing and estimation of sugar.

Food Preservation and processing

Food spoilage – causes; Food preservation - methods – high temperature, lowtemperature, drying,
radiation; Food additives–preservatives, flavours, colours, anti-oxidants, sweetening agents; hazards of
using food additives; Food standards–Agmark and Code xalimentarius.

UNITIV

Abrasives

Definition, characteristics, types-natural and synthetic; natural abrasives –diamond, corundum, emery,
garnet, quartz – composition, uses; synthetic abrasives–carborundum, aluminiumcarbide, boron
carbide, boron nitride, synthetic graphite–composition and uses.

Leather Industry

Structure and composition of skin, hide; Manufacture of leather–pre-tanning process – curing, liming,
beating, pickling; methods of tanning-vegetable,chrome–onebath,twobathprocess;finishing.

Paper Industry

Manufacture of pulp - mechanical, chemical processes; sulphate pulp, ragpulp;manufacture ofpaper-
beating,refining,filling,sizing,colouring,calendaring;cardboard.

UNITV

Lubricants Definition, classification-liquid, semi-solid, solid and

synthetic; properties- iscosityindex,flashpoint,cloudpoint,pourpoint,anilinepointanddroppoint;greases-
properties,types;cuttingfluids, selection of lubricants.

Cement Industry

Cement – types, raw materials; manufacture-wet process, constituent of cement, setting of cement;
properties of cement-quality, setting time, soundness, strength; mortar, concrete, RCC; curing and

decay of concrete.

Intellectual Property Rights

Introduction to Intellectual Property Rights–Patents-Factors for patentability - Novelty, Non obviousness, Industrial applications – Patent offices in India: Trademark - Types of trademarks- Certification marks, logos, brand names, signatures, symbols and servicemarks

Recommended Text

1. Sharma, B.K. *Industrial Chemistry*, 9th ed.; Goel Publishing House: Meerut, 1998.
2. Wilkinson, J.B. E. Moore, R.J. *Harry's Cosmeticology*, 7th ed.; Chemical Publishers: New York, 1982.
3. Alex V. Ramani, *Food Chemistry*, MJP publishers: Chennai, 2009.
4. Jayashree Ghosh, *Applied Chemistry*, S. Chand: New Delhi, 2006.
5. Srilakshmi, B. *Food Science*, 4th ed.; New Age International Publication, 2005.

Reference Books

1. Jain, P.C.; Jain, M. *Engineering Chemistry*, 16th ed.; Dhanapet Rai: Delhi, 1992
2. George Howard, *Principles and Practice of Perfumes and Cosmetics*, Stanley Theron, Cheltenham: UK, 1987.
3. Thankamma Jacob, *Foods, Drugs and Cosmetics - A Consumer Guide*, Macmillan: London, 1997.
4. Shankuntala Manay, N.; Shadaksharaswamy, M. *Food Facts and Principles*, 3rd ed.; New Age Publication, 2008.
5. Neeraj Pandey, Khushdeep Dharni, *Intellectual Property Rights*, PHI Learning, 2014.

Website and e-learning sources

1. http://www.sciencecases.org/irradiation/irradiation_notes.asp
2. <http://discovery.kcpc.usyd.edu.au/9.5.5/>
3. <https://www.wipo.int/about-ip/en/>
4. www.nptel.ac.in
5. <http://swayam.gov.in>

Question Pattern			
Section :A	I. a	5 Multiple Chose Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice(One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five(One question from each Unit)	3x10=30
Total Marks			75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
V	23UCH5DE1	INDUSTRIAL CHEMISTRY					3	4			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓		✓	✓	✓	✓	✓	
CO3	✓				✓			✓			
CO4		✓	✓	✓	✓	✓	✓			✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =37 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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SEMESTER-V

Course Code	: 23UCH5DE2	Exam Hours	: 3
Instruction Hours	: 4	Internal Marks	: 25
Credits	: 4	External Marks	: 75

AGRICULTURAL CHEMISTRY

Objectives of the course

The course aims at providing an overall view of

1. To give the students the importance of Agricultural chemistry and an exposure to find, analyse and find a suitable method
2. To cultivate and promote agricultural methods.

Course Outcomes:

- Students can gain knowledge on Soil Chemistry.
- It clarifies the basics of knowledge on Fertilizers and application.
- Gain knowledge about the Pesticides and its effects.
- Students can gain knowledge on general basic Plant Growth Regulators.
- Students can learn Plant hormones and importance.

UNIT 1: Soil Chemistry

Soil analysis . Composition of soil : Organic and Inorganic constituents. Soil acidity : buffering capacity of soils. Limiting of soil. Absorption of cations and anions : availability of soil nutrients to plants.

UNIT 2: Fertilizers

Peat and organic manures (composts).Role of humus.Effluent form gobar gas plants. Use of fertilizers: urea, DAP, Super phosphate, Gypsum, NPK-mixed fertiizers, Optimal addition of Fertilizers to obtain estimated yields.

UNIT 3: Pesticides

Insecticides: stomach and contact poisons. Plant derivatives :pyrethrine, Nicotine and rotenone Synthetic organic: carbophos, carbaryl, p-DCB, dimethoate, butachlor, Endrin, Aldrin (Chemical name and uses). Rodenticides.Fungicides : Inorganic (Bordeaux Mixture) and organic(dithiocarbamate). Industrial fungicides: creosote fractions. Herbicides and weedicides: Selective and non-selective, 2, 4-D and 2, 4, 5-t (structure and function)

UNIT 4: Plant Growth Regulators and functions

3-Indole acetic acid: Naphthalene acetic acid: Ethepon (2-chloroethyl phosphoric acid): Alar (succinin acid-2, 2-dimethyhydrzine :) their function.

UNIT 5: Plant hormones

Plant hormones: Gibberlin, Cyclocel, Phosphon, dwarfing compound (CCC: 2 Chlorethyltrimethyl ammonium chloride). Defoliant.

TEXT BOOK:

1. G.T. Austin., shreve's Chemical Process Industries, 5th edition, Mc-Graw-Hill, 1984
2. H. ParameshwarHegdeTextbook of Agro-Chemistry Hardcover – 1 January 2009

REFERENCES:

1. B.A. Yagodin (Ed). Agricultural Chemistry, 2 Volumes, Mir Publishers (Moscow), 1976.
2. U. D. Chavan, Key Notes on Agriculture Chemistry and Soil Science, 2015.
3. Douglas Watson Gilchrist Shirlaw A Practical Course in Agricultural Chemistry, 1967.
4. https://hidot.hawaii.gov/highways/files/2013/02/Landscape-ch11_FERTILIZERS.pdf

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH5DE2	AGRICULTURAL CHEMISTRY					3	6			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓		✓	✓	✓	✓	✓	
CO3	✓	✓			✓	✓		✓	✓	✓	
CO4		✓	✓	✓	✓	✓	✓			✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =41 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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SEMESTER-VI

Course Code	: 23UCH6CC13	Exam Hours	: 3
Instruction Hours	: 6	Internal Marks	: 25
Credits	: 5	External Marks	: 75

ORGANIC CHEMISTRY - II

Objectives of the course

This course aims at providing knowledge on

1. Classification, isolation and discussing the properties of alkaloids and terpenes
2. Preparation and properties of saccharides
3. Biomolecules
4. Different molecular rearrangement
5. Preparation and properties of Organometallic compounds

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

1. CO1: Explain isolation and properties of alkaloids and terpenes
2. CO2: Explain preparation and reactions of mono and disachharides
3. CO3: Classify biomolecules and natural products based on their structure, properties, reactions and uses.
4. CO4: Explain molecular rearrangements like benzidine, Hoffmann etc.,
5. CO5: Preparation and properties of organolithium compounds

UNIT I

Alkaloids

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

Terpenes: Classification, Isoprenerule, isolation and structural elucidation of Citral, alphaterpineol, 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.

Mono saccharides— configuration— D and L hexoses— aldohexoses and ketohexoses. Glucose, Fructose—Occurrence, preparation, properties, reactions, structural elucidation, uses. Inter conversions of sugar series—ascending, descending, aldose to ketose and ketose to aldose.

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

Polysaccharides—Source, constituents and biological importance of homo polysaccharides—starch and cellulose, hetero polysaccharides—hyaluronic acid, heparin.

UNIT III

Molecular rearrangements:

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

UNIT IV

Special reagents in organic synthesis

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

Organometallic compounds in Organic Synthesis

Preparation, Properties and applications: Grignard Reagents, Organo Lithium Compounds, Ziegler–Natta, Wilkinson, Metal Carbonyl, Zeiss's Salt

UNIT V

Green Chemistry: Principles, chemistry behind each principle and applications in chemical synthesis. Green reaction media—green solvents, green reagents and catalysts; tools used like microwave and 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., Multi color edition, 2012.
4. P.L.Soni and H.M.Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, 29th edition, 2007.
5. CB and yopadhy; 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, 5thEdition,2010.

Website and learning sources

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/>

Question Pattern			
Section :A	I. a	5 Multiple Chose Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice(One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five(One question from each Unit)	3x10=30
Total Marks			75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
VI	23UCH6CC13	ORGANIC CHEMISTRY II					3	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓	✓	✓		✓	✓		✓		✓	
CO4	✓	✓	✓	✓	✓	✓	✓	✓		✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =44 Relationship: High											
Mapping	1-29%		30-59%		60-69%		70-89%		90-100%		
Matches	1-14		15-29		30-34		35-44		45-50		
Relationship	Very Poor		Poor		Moderate		High		Very High		

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SEMESTER-VI

Course Code	: 23UCH6CC14	Exam Hours	: 3
Instruction Hours	: 6	Internal Marks	: 25
Credits	: 5	External Marks	: 75

INORGANIC CHEMISTRY –II

Objectives of the course

The course aims to provide knowledge on

1. Trace elements and their role in the biological system., iron transport and storage
2. Metallo enzymes, oxygen transport. Silicates and their applications and industrial applications of refractories, alloys, paints and pigments

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

1. **CO1:**ability to explain the importance of trace elements on biological system.
2. **CO2:**explain the metal ion transport, Bohr effect, Na, K, Ca pump.
3. **CO3:**explain the function of VitaminB12, Zn-Cu enzyme, ferredoxin, cluster enzymes.
4. **CO4:**classification and structure of silicates.
5. **CO5:**explain the manufacture of refractories, explosives, paints and pigments

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

UNIT III

Metallo enzymes

Isomerase and synthetases, structure of cyanocobalamin (Vitamin B12), nature of Co-C bond;

Metalloenzymes – functions of carboxy peptidase, zinc metalloenzyme–mechanism and uses, Zn-Coenzyme-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 molybdoenzymes.

UNITIV

Silicates

Introduction–general properties of silicates, structure–types of silicates–orthosilicates (zircon), pyrosilicates (thortveitite), chainsilicates (pyroxenes), ringsilicates(beryl), sheetsilicates (talc,mica,asbestos), silicates having three dimensional structure (feldspars,zeolites,ultramarines)

UNITV

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-

knockingagents, anti-skinningagents, plasticizers, binders-application; varnishes-oils,spirit;enamels.

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

Recommended Text

1. PuriBR,SharmaLR,KaliaKC(2011),PrinciplesofInorganicChemistry,31thed.,MilestonePublishers&Distributors,Delhi.
2. SatyaPrakash,TuliG.D.,BasuS.K.,MadanR.D.(2009),AdvancdInorganicChemistry,18thEdition, S.Chand&Co.,NewDelhi
3. LeeJD,(1991),ConciseInorganicChemistry,4thed.,ELBSWilliamHeinemann,London.
4. WVMalik,GDTuli,RDMadan,(2000),SelectedTopicsinInorganicChemistry,SchandandCompanyLtd.
5. De,TextbookofInorganicChemistry,WileyEastLtd,seventhedition,1992

Reference Books

1. Madan RD, SathyaPrakash,(2003),ModernInorganicChemistry,2nded.,S.Chand and Company, NewDelhi.
2. GopalanR,(2009)InorganicChemistryforUndergraduates,IstEdition,UniversityPress(India)PrivateLimited,Hyderabad
3. SivasankarB,(2013)InorganicChemistry.IstEdition,Pearson,Chennai
4. AlanG. Sharp(1992), InorganicChemistry,3rdEdition, Addition-Wesley,England
5. PeterAtkins,TinaOverton,JonathanRourkeandMarkWeller,InorganicChemistry,OxfordUniversityPress,sixthedition,2014.

Website and e-learning sources

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

Question Pattern			
Section :A	I. a	5 Multiple Chose Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice(One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five(One question from each Unit)	3x10=30
Total Marks			75

Semester	Code	Title of the Course					Hours	Credits			
VI	23UCH6CC14	INORGANIC CHEMISTRY -II					3	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓	✓		✓	✓	✓		✓			
CO4	✓		✓	✓	✓		✓			✓	
CO5		✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =39 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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SEMESTER-VI

Course Code	: 23UCH6CC15P	Exam Hours	: 3
Instruction Hours	: 6	Internal Marks	: 25
Credits	: 5	External Marks	: 75

GRAVIMETRIC & ORGANIC ANALYSIS PRACTICAL

Objectives:

1. To learn the techniques of gravimetric analysis
2. To learn the methods of organic preparations

Course Outcomes:

- To enable the students to learn the techniques of physical constants determination.
- To enable the students to learn about gravimetric estimation.
- Be able to learn qualitative analysis of organic compounds.
- Synthesize the students to understand single stage preparations of some organic complex.
- learn single stage preparations of some organic compounds.

Experiments

1. Determination of physical constants

Determination of boiling / melting point of given organic compound

Melting Points: 1. Acetamide 2. m-dinitrobenzene 3. Benzoic acid 4. Benzamide 5. Urea and 6. Cinnamic acid

Boiling Points: 1. Water 2. Ethylmethylketone, 3. Ester and 4. Toluene

2. Gravimetric Estimation:

Sintered Crucible

1. Ni as nickel dimethyl glyoxime
2. Ba as barium chromate.
3. Ca as calcium oxalate monohydrate

Silica Crucible

1. Ca as calcium sulphate.
2. Ba as barium sulphate.

3. Organic analysis:

Analysis of Simple Organic compounds: i) Carboxylic acids, ii) Phenols, iii) Ketones, iv) Carbohydrates, v) Amines and vi) Amides vi) aldehyde

- a. Aliphatic/Aromatic

- b. Saturation / Unsaturation
- c. Special elements (Only Nitrogen)
- d. Functional group
- f. Preparation of derivatives.

4. Organic preparations

Preparation of organic compounds involving the following chemical conversions

1. Oxidation (Benzoic acid from benzaldehyde)
2. Hydrolysis (Salicylic acid from methylsalicylate)
3. Nitration (m-Dinitrobenzene from nitrobenzene)
4. Bromination (p-Bromoacetanilide from acetanilide, Tri-bromoaniline from aniline)
5. Diazotization (Methylorange from aniline)

Reference Book(s):

1. Venkateswaran V. Veerasamy R. Kulandaivelu A.R., Basic principles of Practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons (1997).
2. Vogel's. A.I., Quantitative Inorganic Analysis, 5th Ed., Prentice Hall (1996).
3. https://www.researchgate.net/profile/Aldalea-Marques/publication/225399518_Nickel-dimethylglyoxime_complex_modified_graphite_and_carbon_paste_electrodes_Preparation_and_catalytic_activity_towards_methanol_oxidation/links/0fcfd50eff40d6029c000000/Nickel-dimethylglyoxime-complex-modified-graphite-and-carbon-paste-electrodes-Preparation-and-catalytic-activity-towards-methanol-ethanol-oxidation.pdf?origin=publication_detail

Scheme of valuation

Criteria	Marks		
Record	5		
Procedure writing	5		
Physical constant	5		
Organic preparation	10		
Organic analysis	{15}	Gravimetry{20}	
Aliphatic/aromatic	2	error	Marks
Saturated/unsaturated	2		
Element test	4	< 1 %	20
Functional group	4	1-2%	15
Derivative	3	2-3%	10
		>3%	5

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	223UCH6CC15P	GRAVIMETRIC & ORGANIC ANALYSIS PRACTICAL					6	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓		✓	✓	✓	✓	✓	
CO3	✓	✓			✓			✓	✓		
CO4		✓	✓	✓	✓	✓	✓			✓	
CO5	✓	✓	✓	✓		✓	✓	✓	✓	✓	
Number of Matches(✓) =38 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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SEMESTER-VI

Course Code	: 23UCH6DE3	Exam Hours	: 3
Instruction Hours	: 5	Internal Marks	: 25
Credits	: 4	External Marks	: 75

FUNDAMENTALS OF SPECTROSCOPY

Objectives of the course

This course is designed to provide knowledge n

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

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

1. **CO1:** explain electrical and magnetic properties of materials and microwave spectroscopy
2. **CO2:** explain theory, instrumentation and applications of Infrared and Raman spectroscopy
3. **CO3:** apply selection rules to understand spectral transitions, explain Woodward–Fieser’s rule for the calculation of wavelength maximum of conjugated dienes
4. **CO4:** explain theory, instrumentation and applications of NMR spectroscopy
5. **CO5:** explain theory, instrumentation and applications of Mass spectrometry

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, antiferromagnetism

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- Birge Spomer method of evaluation of dissociation energy - pre-dissociation transition - $\sigma-\sigma^*$, $\pi-\pi^*$, $n-\sigma^*$, $n-\pi^*$ 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 molecules 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 inter nuclear 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 mono functional 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.; McCash, E. M. *Fundamentals of Molecular Spectroscopy*, 4th ed.; Tata McGraw

awHill,NewDelhi,2017.

4. U.N.Dash, Analytical Chemistry Theory and Practice, Sultan Chand & Sons, 2nd Ed., 2005
5. B.K.Sharma, Spectroscopy, 2nd ed., Goel Publishing House, 2011.

Reference Books

1. Srivastava, A. K.; Jain, P. C. *Chemical Analysis an Instrumental Approach*, 3rd ed.; S.Chand, New Delhi, 1997.
2. Robert D Braun. *Introduction to Instrumental Analysis*; Mc.GrawHill: New York, 1987.
3. Skoog, D. A.; Crouch, S. R.; Holler, F.J.; West, D. M. *Fundamentals of Analytical Chemistry*, 9th ed.; Harcourt college Publishers: USA, 2013.
4. Madan, R. L.; Tuli, G. D. *Physical Chemistry*, 2nd ed.; S.Chand: New Delhi, 2005.
5. Puri, B. R.; Sharma, L. R.; Pathania, M.S. *Principles of Physical Chemistry*, 4th ed.; Vishal Publishing: Delhi, 2008.

Website and e-learning sources

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

Question Pattern			
Section :A	I. a	5 Multiple Chose Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice (One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five (One question from each Unit)	3x10=30
Total Marks			75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits		
VI	23UCH6DE3	FUNDAMENTALS OF SPECTROSCOPY					3	4		
Course Outcomes	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5

(COs)										
CO1	✓	✓	✓		✓	✓	✓	✓		✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓		✓	✓	✓		✓	✓	✓
CO4	✓	✓	✓	✓	✓		✓			✓
CO5		✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches(✓) =42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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SEMESTER-VI

Course Code	: 23UCH6DE4	Exam Hours	: 3
Instruction Hours	: 5	Internal Marks	: 25
Credits	: 4	External Marks	: 75

NANOSCIENCE

Objectives of the course

This course aims at providing knowledge on

1. introduction to nanoparticles/clusters and nano composites
2. properties of nanomaterials
3. characterization of nanomaterials by different methods
4. synthesis of carbon nanotubes, graphene, quantumdots, self-assembled nanomaterials
5. applications of nanomaterials as sensors.

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

1. **CO1:**explain the general concepts and physical phenomena of relevance with in the field of nanoscience.
2. **CO2:**describe the properties, synthesis, characteristics of nanomaterials, special nanomaterials and applications.
3. **CO3:**examine the structure, properties, applicability and characterization of nanomaterials.
4. **CO4:**analyze various synthesis procedures, characterizations and uses of carbon nanotubes, fullerene and graphene
5. **CO5:**discuss applications of nanomaterials of sensors and in optics and electronics

UNITI

Introduction to nanoscience

Definition of terms – nanoscience, nanoparticles, clusters, quantum dots,nano structures and nano composites. Electron behavior in free space, bulk material and nanomaterials.

Synthesis and stabilization of nanomaterials Top down approach(physical methods), mechanical dispersion – ballmilling, methods based on evaporation of a precursor-inert gas condensation, ions puttering, spray pyrolysis, aerosol synthesis-nanolithography. Bottom–up approach (chemical methods)-solvo thermal synthesis, photo chemical method, gamma radiolysis, Sonochemical synthesis, electro deposition, sol-gel method, nanomaterials via chemical routes-solvents reducing agents, Capping agents-stabilization of nanoparticles-electrostatic and steric stabilization, common stabilizers, nanoparticle growth in solution, template growth, Langmuir–Blodgett(L-B)method,

reverse micelles- emulsion method.

Unit II

Properties of materials on a nano scale

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

UNIT III

Techniques employed for characterization of nanomaterials

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

UNIT IV

Special nanomaterials

Carbon Nano Structures Carbon nanotubes: Introduction-types-zigzag, armchair, helical, synthesis by CVD, Functionalization of Carbon Nanotubes, Reactivity of Carbon Nanotubes, Field emission, Fuel Cells, Display devices. Other Important Carbon based materials: Preparation and Characterization Fullerene, Graphene, properties, DLC and nano diamonds and Applications Semiconductor nanoparticles: Quantum dots, synthesis - chemical synthesis using clusters, properties, porous silicon-electrochemical etching, aerogel-types-silica aerogel, resorcinol formaldehyde (RF)

aerogels, zeolites-applications. Self Assembled Nanomaterials: Self Assembled Monolayers (SAMs)-inorganic, organic molecules.

UNIT V

Application of nanomaterials

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

Optics & Electronics-Nanomaterials in the next generation computer technology, high definition TV, flat panel displays, quantum dot laser, single electron transistors [SET]. Nanotechnology in agriculture-Fertilizer and pesticides nanomaterials for water purification, nanomaterials in food and packaging materials, fabric industry. Impacts of Nanotechnology-human & environmental safety risks.

Recommended Text

1. Sulabha K. Kulkarni, *Nanotechnology: Principles and Practices*, Capital Publishing

Co.,NewDelhi.

2. Pradeep.T,*Nano:TheEssentials, UnderstandingNanoscienceandNanotechnology*;TataMcGraw-HillPublishingCompanyLimited,NewDelhi,2007.
3. Shah.M.A.;TokeerAhmad,*PrinciplesofNanoscienceandNanotechnology*;NarosaPublishing House,NewDelhi,2010.
4. Murthy.B.S;Shankar.P,BaldevRaj.;Rath.B.B.JamesMurday,*TextbookofNanoscienceandNanotechnology*;Universitiespress,IndiaLtd,Hyderabad.2012.

Reference Books

1. Sharma.P.K.,*UnderstandingNanotechnology*;VistaInternationalPublishingHouse,Delhi.2008.
2. CharlesP.PooleJr.;FrankJ.Owens.*IntroductiontoNanotechnology*;AJohnWiley&Sons,INC.,Publication,2003.
3. ViswanathanB.,*NanoMaterials*;NarosaPublishingHouse,NewDelhi,2009.
4. EditedbyC.N.R.Rao;Mueller.A;Cheetham_A.K.*NanomaterialsChemistryRecentDevelopmentsandNewDirections*,WILEY-VCHVerlagGMBH&Co.,KGaA,Darmstad.
5. JingZhongZhang,*OpticalpropertiesandspectroscopyofNanomaterials*;WorldScientificPublishingPvt.Ltd.,Singapore.

Websiteand-elearningsources

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

Question Pattern			
Section :A	I. a	5 Multiple Chose Questions (One question from each Unit)	5x1=5
	I.b	5 Fill in the blanks Questions (One question from each Unit)	5x1=5
	II	5 short answer Questions (One question from each Unit)	5x2=10
Section :B (5 Marks)		Either OR choice(One set of question from each Unit)	5x5=25
Section :C (10 Marks)		Ans three out of five(One question from each Unit)	3x10=30
Total Marks			75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UCH6DE4	NANOSCIENCE					3	6			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓		✓	✓	✓	✓	✓	
CO3	✓				✓			✓			
CO4		✓	✓	✓	✓	✓	✓			✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =37 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

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Value added Courses

SEMESTER – I

UV-VISIBLE, IR SPECTROSCOPIC INSTRUMENTATION AND SEPARATION TECHNIQUES

Course Code: 23UCHVA1

Exam Hours: 3

Instruction Hours: 30

Internal Marks: 25

Credits: 2

External Marks: 75

OBJECTIVES:

- To improve student sense of enthusiasm for spectroscopy and to involve them in an intellectually compounds prediction.
- To expose the students to various developing new areas of spectroscopy and impart them with their established in their future studies and their applications in various spheres of molecular structure.

Course Outcomes:

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

- Explain the fundamental components of UV-Visible spectrophotometer
- Familiarize the instrumentation of IR spectroscopy
- Examine the given material by UV-Visible spectroscopy
- The nature of the functional groups present in the sample by IR spectroscopy
- Separate the sample by distillation techniques.

UNIT-I: Instrumentation of UV-Visible Spectroscopy

6 Hours

- 1.1 UV-Visible Spectroscopy-principle, nomenclature of the components of IR instrument - fundamental components- Schematic diagram of fundamental components, photometer, spectrometer optical, spectrophotometer, colorimeter and spectrograph.
- 1.2 UV-Visible Radiation source - essential characteristics, UV- light sources, visible light sources;
- 1.3 Dispersing devices, filters and monochromators: prism, gratings; slits, test sample and optical materials, radiation detector and indicator- barrier layer cell, photo emissive cell, photomultiplier cell.

UNIT-II: Instrumentation of IR Spectroscopy

6 Hours

- 2.1 IR Spectroscopy- principle, instrumentation-IR spectrometer-types-single beam and double beam spectrometer;
- 2.2 Source of IR radiation, IR mono chromator, detector- selective detector-photo conductive cell; non-selective detectors-thermocouple, bolometer, pneumatic detector cell. Preparation of sample- liquid, solid; characteristic group frequencies.

UNIT-III: UV-Visible Spectroscopy-Practical

6 Hours

- Detection of λ_{\max} of given organic compounds: aniline, toluene, benzaldehyde, Acetophenone, *o*-cresol, ethyl acetate.
- Determination of indicator constant of an indicator
- Determination of band gap of ZnO nanoparticle.

UNIT-IV: IR Spectroscopy-Practical

6 Hours

- Identification of functional groups of organic compounds-urea, benzaldehyde, cinnamic acid, glucose and acetophenone.
- Determination of the purity of the commercial benzoic acid

UNIT-V:SeparationTechniques –Practical**6 Hours**

- Purification of aniline by distillation.
- Separation of organic liquid mixture by fractional distillation.
- Removal of solvent from a reaction mixture by reduced pressure distillation.

References

1. A. K.SrivastavaandP.O. Jain InstrumentalApproachto ChemicalAnalysis4th Revised Edition.
Chand &CompanyLtd NewDelhi 2008

SEMESTER – II

REAGENTS PREPARATIONS AND THEIR VALIDATION

Course Code: 23UCHVA2

Instruction Hours: 30

Credits: 2

Exam Hours: 3

Internal Marks: 25

External Marks: 75

OBJECTIVES

- To expose the students to various emerging new areas of reagents preparations in laboratory.
- To enhance student sense of preparation of new compounds in laboratory and to involve them in an academically compounds preparation experience.

LEARNING OUTCOMES:

At the end of the course the learners should be able to

- Prepare solutions of desired strength for analysis.
- Prepare important reagents for inorganic, organic and food analysis
- Prepare indicators for chemical analysis
- To inculcate the knowledge on how to prepare different concentration solutions for chemical analysis.
- To imbibe the basic ideas of preparing reagents for inorganic, organic and food analysis.

Unit: I

6 hrs

Preparation of different concentrated solutions: Introduction-Normality, Molarity, ppm. Preparation-acetic acid, hydrochloric acid, nitric acid, Sulphuric acid, ammonium hydroxide, barium hydroxide, calcium hydroxide, potassium hydroxide, sodium hydroxide.

Unit: II

6 hrs

Preparation of salt solutions: Ammonium acetate, ammonium carbonate, ammonium chloride, ammonium oxalate, ammonium sulphate, barium chloride, calcium chloride, calcium sulphate, cobalt nitrate, copper sulphate, ferric chloride, ferrous sulphate, lead acetate, magnesium sulphate, potassium chromate, potassium ferricyanide, potassium ferrocyanide, potassium thiocyanate, sodium carbonate.

Unit: III

6 hrs

Preparation of Reagents for organic analysis: Sodium nitro prusside, chlorine water, bromine water, Borche's reagent, phenyl hydrazine, Schiff's reagent, Tollen's reagent, bromine in carbon tetra chloride, neutral FeCl_3 solution, KMnO_4 solution, alcoholic potash.

Unit: IV 6 hrs

Preparation of Reagents for Food analysis: Benedict reagent for sugar, Biuret solution for protein, Sudan III stain for fat, dichlorophenol in dophenol for vitamin C, Molische' reagents, Fehling reagent A and B, Barfoed reagent, Seliwanoff reagent, Bial's reagent

Unit: V

6 hrs

Preparation of Indicators: Phenolphthalein, Methyl orange, N-Phenylanthranilic acid, potassium ferricyanide, Starch solution, Potassium chromate, Ferricalum indicator, Fluorescein, Eosin, Erichrome Black T, diphenylamine.

Books for References

1. P.K. Mani and A.O. Thomas – Text Book of Physical Chemistry B.Sc Main Students, Scientific publications, 3rd Edition, 1973, Cannanore.
2. Vogel's Text Book of Practical Organic Chemistry 5th edition, 1989, London

3. Vogel AI, A text book of Quantitative Inorganic Analysis 3rd edition, London
4. Dr. N.S. Gnanaprasadam, Prof. G. Ramamurthy, Organic Chemistry Lab Manual, S. Viswanathan Publishers, 2014

SEMESTER – III
SOAP PRODUCTION

Course Code: 23UCHVA3

Exam Hours: 3

Instruction Hours: 30

Internal Marks: 25

Credits: 2

External Marks: 75

OBJECTIVES

- To expose the students to various emerging new areas of Chemistry and apprise them with their prevalent in their future studies and their applications in various spheres of chemical sciences.
- To enhance student sense of enthusiasm for chemistry and to involve them in an intellectually stimulating experience of learning in a supportive environment.

COURSE OUTCOMES

- The students should define house hold products, various processes of household products.
- The students should define natural, floor, toilet, bathroom and kitchen cleaning agents
- The students should explain preparations and reactions of soap, liquid soap.
- The students should explain preparations and various types of detergents and surfactants.
- The students should explain preparation phenyl and sanitizer.

UNIT I Household chemicals

History of household Industry, Basic Theory of Household Chemicals, and Raw material required for household product, Product manufacture in household industry. Role of household product in day to day life.

UNIT II Cleaning agents

Introduction, synthesis and applications of Natural cleaning agents, cleaning action, Floor cleaner, Toilet Cleaner, Bathroom Cleaner, Kitchen Cleaner.

UNIT III Technology of Soap

Chemistry of soap; Raw material for soap industry and their selection; hard fats yielding and oil yielding soaps; Chemical reactions of soaps; Hard and Soft soaps; Plant and process employed in soap manufacture; Liquid hand wash and liquid dish wash.

UNIT IV Detergents and surfactants

Introduction; Different terms used in detergents; Raw materials for detergents; Washing action of detergents; Types of detergents; Introduction of surfactants; Types of surfactants.

UNIT IV Phenyl and sanitizer

Chemistry of phenyl and sanitizer, Raw material for Phenyl, sanitizer. Preparative methods of phenyl and sanitizer and their applications.

References:

1. Industrial chemistry by B.K.Sharma.
2. Flavours & Essential oils, Industries SBP Board.
3. Perfumes soaps & cosmetics by Poucher.
4. Manufacture of perfumes, cosmetics and detergents by Giriraj Prasad.
5. A Text Book of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis: A.I. Vogel (Third Ed.).

Practical Course: Preparation of household Products

1. Preparation of sanitary acid
2. Preparation of liquid soap
3. Preparation of white phenyl
4. Solid soap manufacture

References:

1. Vogel's text book of Qualitative Chemical Analysis (Longman ELBS Edition)

2. Vogel's text book of Quantitative Analysis (Longman ELBS Edition)
3. Practical Organic Chemistry by A.I. Vogel
4. Practical Organic Chemistry by O.P. Agrawal.
5. Practical Organic Chemistry by F. G. Mann & B. C. Saunders
6. Comprehensive Practical Organic Chemistry Qualitative Analysis by V. K. Ahluwali
7. A Text Book of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis:
A.I. Vogel (Third Ed.).

SEMESTER – IV

SOIL AND WATER MANagements

Course Code: 23UCHVA4

Exam Hours: 3

Instruction Hours: 30

Internal Marks: 25

Credits: 2

External Marks: 75

Objectives:

- To Learn about importance of water and soil management
- To Increase effective needs of society by knowing idea to implement new methods

Course Outcomes:

At the end of the course students will be able to

- Understand the composition of soils
- Infer the optimal growth conditions for plants
CO3: Analyze the soil quality
- Categorize the types of water and sources of water pollution
CO5: Interpret the quality of water

UNIT-I

6hrs

Properties of Soil

Soil- definition, composition, types. Soil pH- importance of soil pH on plant growth, saline, alkaline and acidic soils, reclamation of acidic and alkaline soils. Fertilizer –definition, classification, role of fertilizers on plant growth, adverse effects. Soil for banana, cotton, groundnut, sugar cane, paddy and maize cultivation.

UNIT-II

6hrs

Properties of Water

Water: types of water- hard and soft water, types of hardness- temporary and permanent, softening of water, water pollution-causes and remedial measures. Water quality parameters-hardness, pH of water, electrical conductivity, turbidity, TDS, DO, BOD, COD-standards and limits (WHO and BIS)

UNIT-III

6hrs

Soil Testing Practical -I

Determination of soil pH, electrical conductance and turbidity by soil analyzer kit

UNIT-IV

6hrs

Soil Testing Practical-II

Determination of Na, K and Ca in soil by flame photometer

UNIT-V

6hrs

Water Quality Analysis-Practical

Determination of water pH, electrical conductivity, turbidity, TDS and DO. Preparation of a comparative report of standard values (WHO & BIS) and experimental values.

Text Books:

S. No	Author	Book	Edition	PublisherDetails	Year	UnitsCovered
1.	L. Bhattacharya	Text Book of Soil Chemistry	1 th Edition	Discovery Publishing House, New Delhi	2019	I, III&IV
2.	RL Arya And Khalil Khan	Fundamentals of Soil Science	1 th Edition	Scientific Publishers, Jodhpur	2020	I, III&IV
3.	James Edzwald	Water Quality and Treatment	4 th Edition	McGraw Hill Inc, New York	1990	II&V

SEMESTER – V
BASIC CHEMISTRY FOR COMPETITIVE EXAMINATIONS

Course Code: 23UCHVA5

Exam Hours: 3

Instruction Hours: 30

Internal Marks: 25

Credits: 2

External Marks: 75

Objectives:

- To Learn about importance of basic Chemistry
- To Increase effective needs of society by knowing idea to implement new methods

Course Outcomes:

At the end of the course students will be able to

- Understand the concepts of Periodicity
- Analyze the Soaps and Manufacture of soaps
- Categorize the types of the reaction mechanism

Unit –I

(6 Hrs)

Inorganic chemistry Periodicity – Hund's rule – Aufbau principle – Pauli principle – electronic configurations of s, p, d and f block elements – types of solvents – polarity of solvents – coordination compounds – definitions of terms – calculation of net charge – oxidation states both inorganic and coordination compounds – types of ligands

Unit – II

(6 Hrs)

Analytical chemistry Mole concept – molarity – molality – normality – mole fraction – parts by weight – parts by volume – parts per thousand – parts per million – definition and problems – application of law of normality on volumetric analysis – acid base – redox – and complexometric titrations – theories of indicators – Beer-Lambert law – definition for Hard water, soft water, desalination, demineralization, BOD and COD – distillation – steam distillation – vacuum distillation – brief introduction to column chromatography

Unit – III

(6 Hrs)

Physical chemistry Gaseous laws – Ideal and kinetic gas equations – equilibrium – equilibria involving physical processes – Henry's law – law of chemical equilibrium – effects of catalyst – Le Chatelier's principle – pH scale – common ion effect – redox reaction – assigning oxidation number – electrochemistry – Kohlrausch's law and its applications – types of electrodes – Nernst equation and its applications – buffer solutions – types of buffer solutions

Unit – IV

(6 Hrs)

Organic chemistry – I Nomenclature of alkanes, alkenes, alkynes, cyclic compounds - aromatic compounds – reactions of alkanes – halogenation by free radical method – reactions of alkenes – electrophilic addition – hydrogenation – halogenations – hydrohalogenation – reactions of alkynes – hydrogenation/halogenations – hydrohalogenation – cycloalkenes – angular strain theory – applications of SN1, SN2, SNi reactions – elimination reactions E1 and E2 – aromatic electrophilic substitution reactions

Unit – V

(6 Hrs)

Applied chemistry Soaps and Manufacture of soaps – Lubricants and mechanism of lubricants – Fertilizers and NPK fertilizers – advanced antibiotics – pharmacopoeia – antioxidants – chemotherapy – radiotherapy – soil chemistry – types of soils

TEXT BOOKS

1. Puri B.R., Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., (1993)
2. Lee J.D., Concise Inorganic Chemistry, UK, Black well science (2006)

REFERENCES

- 1.Puri B.R., Sharma L.R., Pathania M.S.,Principles of Physical Chemistry, (23rd edition) New Delhi, Shoban Lal, Nagin Chand & Co., (1993).
- 2.Morrison R.T. and Boyd R.N., Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., (1976)
- 3.Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997).

SEMESTER – VI

CHEMISTRY OF COSMETICS

Course Code: 23UCHVA6

Exam Hours: 3

Instruction Hours: 30

Internal Marks: 25

Credits: 2

External Marks: 75

OBJECTIVES

- Cosmetic plays an important role in our everyday lives as they make an individual's appearance more attractive and boost one's self-esteem and confidence.
- Keeping in view the tremendous potential which the cosmetic industry has today around the globe, this course will be useful for introducing students to the world of cosmetic chemistry.
- This has been designed to impart the theoretical and practical knowledge on basic principles of cosmetic chemistry, manufacture, formulation of various cosmetic products.

COURSE OUTCOMES

On successful completion of this course, the student will be able to

- Learn basic of cosmetics, various cosmetic formulation, ingredients and their roles in cosmetic products.
- Learn the use of safe, economic and body-friendly cosmetics
- Prepare new innovative formulations.

Unit-I

Preparation of soft soap.

Unit-II

Ingredients-composition –preparation of organic lipbalm.

Unit-III

Constituents-configuration-preparation of shampoo and room freshener.

Unit-IV

Ingredients-composition-preparation of organic hair dye.

Unit-V

Constituents-Configuration-Preparation of nail polish, nail polish remover and organic kajal.

TEXTBOOK:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Barel, A.O.; Paye, M.; Maibach, H.I.	Handbook of Cosmetic Science and Technology	CRC Press	2014

REFERENCEBOOK:

S.No.	Author(s)	Titleof the Book	Publisher	Year ofPublication
1.	Garud, A.; Sharma, P.K.; Garud,N	Text Book ofCosmetic s	PragatiPrakashan	2012