

J.J COLLEGE OF ARTS AND SCIENCE (Autonomous)**DEPARTMENT OF CHEMISTRY****B.Sc. CHEMISTRY**

Proposed Course Structure based on UGC-LOCF and TANSCH

(Choice Based Credit System)

(Applicable for the candidates admitted from academic year **2023-2024** onwards)**SEMESTER-I**

Part	Course Code	Courses Title	Hrs/ Week	Credit	Exam Hrs	Marks		Total Marks
						Int	Ext	
Part-I	U1R3TL1	Language Course – I	6	3	3	25	75	100
Part-II	U1R3EL1	English Language Course - I	6	3	3	25	75	100
Part-III	U1R3CHCC1	General Chemistry-I	5	5	3	25	75	100
	U1R3CHCC2P	Quantitative Inorganic Estimation (Titrimetry) and Inorganic Preparation Practical	5	5	3	40	60	100
	U1R3MADSE1	Mathematics-I	4	3	3	25	75	100
Part-IV	U1R3CHSEC1 (NME-I)	To be opted from other Department (Office Automation)	2	2	3	25	75	100
	U1R3CHFC	Foundation Course (Bridge Chemistry)	2	2	3	25	75	100
			30	23				700

SEMESTER-II

Part	Course Code	Courses Title	Hrs/ Week	Credit	Exam Hrs	Marks		Total Marks
						Int	Ext	
Part-I	U2R3TL2	Language Course-II	6	3	3	25	75	100
Part-II	U2R3EL2	English Language Course – II	6	3	3	25	75	100
Part-III	U2R3CHCC3	General Chemistry-II	5	5	3	25	75	100
	U2R3CHCC4P	Qualitative Organic Analysis and Preparation of Organic compounds Practical	5	5	3	40	60	100
	U2R3CHDSE2	Mathematics-II	4	3	3	25	75	100
Part-IV	U2R3CHSEC2 (NME-2)	To be opted from other department (Advanced Excel)	2	2	3	25	75	100
	U2R3CHSEC3:1/3:2	Cosmetic and Personal Grooming / Entrepreneurial Skills in Chemistry	2	2	3	25	75	100
			30	23				700

SEMESTER-III								
Part	Course Code	Courses Title	Hrs/ Week	Credit	Exam Hrs	Marks		Total Marks
						Int	Ext	
Part-I	U3R3TL3	Language Course-III	6	3	3	25	75	100
Part-II	U3R3EL3	English Language Course-III	6	3	3	25	75	100
Part-III	U3R3CHCC5	General Chemistry-III	5	5	3	25	75	100
	U3R3CHCC6P	Qualitative Inorganic Analysis Practical	5	5	3	40	60	100
	U3R3CHDSE3	Allied Physics -I	4	3	3	25	75	100
Part-IV	U3R3CHSEC4:1/ 4:2	Nutrition and Food Science /Forensic Science	2	2	3	25	75	100
	U3R3VE	Value Education	2	2	3	25	75	100
			30	23				700

SEMESTER-IV								
Part	Course Code	Courses Title	Hrs/ Week	Credit	Exam Hrs	Marks		Total Marks
						Int	Ext	
Part-I	U4R3TL4	Language Course-IV	5	3	3	25	75	100
Part-II	U4R3EL4	English Language Course - IV	5	3	3	25	75	100
Part-III	U4R3CHCC7	General Chemistry-IV	5	5	3	25	75	100
	U4R3CHCC8P	Physical Chemistry Practical-1	5	5	3	40	60	100
	U4R3CHDSE4P	Allied Physics Practical - II	4	3	3	40	60	100
Part-IV	U4R3CHSEC5:1/ 5:2	Pesticide Chemistry / Instrumental methods of Chemical analysis	2	2	3	25	75	100
	U4R3CHSEC 6:1/ 6:2	Industrial Chemistry / Fundamentals of Spectroscopy	2	2	3	25	75	100
	U4R3ES	Environmental Studies	2	2	3	25	75	100
			30	25				800

SEMESTER-V								
Part	Course Code	Courses Title	Hrs/ Week	Credit	Exam Hrs	Marks		Total Marks
						Int	Ext	
Part-III	U5R3CHCC9	Organic Chemistry-I	5	5	3	25	75	100
	U5R3CHCC10	Inorganic Chemistry-I	5	4	3	25	75	100
	U5R3CHCC11	Physical Chemistry	5	4	3	25	75	100
	U5R3CHCC12P	Physical Chemistry Practical -II	5	4	3	40	60	100
	U5R3CHDSE5:1/ 5:2	Polymer Science / Nano Science	5	3	3	25	75	100
	U5R3CHDSE6:1/6: 2	Pharmaceutical Chemistry / Health Chemistry	5	3	3	25	75	100
Part-IV	U5R3CHINT	Internship	-	2	-	-	-	100
			30	25	-	-	-	700
SEMESTER-VI								
Part	Course Code	Courses Title	Hrs/ Week	Credit	Exam Hrs	Marks		Total Marks
						Int	Ext	
Part-III	U6R3CHCC13	Organic Chemistry-II	5	4	3	25	75	100
	U6R34HCC14	Inorganic Chemistry-II	6	4	3	25	75	100
	U6R3CHCC15PW	Project Work	8	4	--	--	--	100
	U6R3CHDSE7:1/7:2	Agricultural Chemistry/ Biochemistry	4	3	3	25	75	100
	U6R3CHDSE 8:1/8:2	Chemistry of Everyday life / Soil, Dairy and Leather Chemistry	4	3	3	25	75	100
Part-IV	U6R3CHSEC 7:1/ 7:2	Green Chemistry / Material Chemistry and Nano technology	2	2	3	25	75	100
Part-V	U6R3GS	Gender Studies	1	1	3	25	75	100
		Extension Activities	-	1	-	-	-	-
			30	22				700
			Total	141				4300

Title of the Course :	GENERAL CHEMISTRY-I	Marks: CIA:25 + Ext:75=100
Category of the Course:	Core Course	Hrs/Week :05
Course Code :	U1R3CHCC1	Total Inst. Hrs: 75
Nature of the Course :	Skill Development	Sem: I Credit: 05

Objectives: The course aims at giving an overall view of the

1. Various atomic models and atomic structure
2. Wave particle duality of matter
3. Periodic table, periodicity in properties and its applications
4. Nature of chemical bonding
5. Fundamental concepts of organic chemistry

UNIT I: Atomic structure and Periodic trends (15 Hrs)

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.

Unit II: Introduction to Quantum mechanics (15 Hrs)

Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wave function, Formulation of Schrodinger wave equation - Probability and electron density-visualizing the orbitals -Probability density and significance of ψ and ψ^2 . **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 (15 Hrs)

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 salvation 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 , 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

(15 Hrs)

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 H_2 , C_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 (15 Hrs)

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 amine, 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.

Reference Book

1. Madan, R D and Sathya Prakash, Modern Inorganic Chemistry, 2nd Edn; S Chand and Company: New Delhi.
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 Edn, 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. Text book of Physical Chemistry, Sultan Chand & Sons: New Delhi, 2016.
6. Maron, S.H and Prutton C. P., Principles of Physical chemistry 4th Edn, The Macmillan Company: New York, 1972.
7. Lee, J.D. Concise Inorganic Chemistry, 4th Edn ; ELBS William Heinemann: London, 1991.
8. Gurudeep Raj, Advanced Inorganic Chemistry, 26th Edn; Goel Publishing House: Meerut, 2000
9. Atkins, P.W. & Paula, Physical Chemistry, 10th Edn.; Oxford University Press: New York 2014
10. Huheey, J. E. Inorganic Chemistry: Principles of structure and Reactivity, 4th Edn, Addison, Wesley Publishing Company: India, 1993

Web References:

- 1) <https://onlinecourses.nptel.ac.in>
- 2) [http://www.mikeblaber.org/oldwine/chm 1045/notes](http://www.mikeblaber.org/oldwine/chm%201045/notes)
- 3) http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.
- 4) <https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding>
- 5) <https://www.chemtube3d.com/>

Course Outcomes

Course Name: GENERAL CHEMISTRY-I		Course Code: U1R3CHCC1	K-Level
On Successful completion of the course, students will be able to			
CO-1	Explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.		K3
CO-2	Classify the elements in the periodic table, types of bonds, reaction intermediates electronic effects in organic compounds, types of reagents.		K4
CO-3	Apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, electronegativity, percentage ionic character and bond order		K2
CO-4	Evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects		K5
CO-5	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.		K3

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: General Chemistry-I							Course Code: U1R3CHCC1								
Course Outcomes (COs)	PO										PSO				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	2	2	2	3	3	3	3	3
CO3	3	3	3	2	3	3	3	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
CO5	3	2	3	3	3	3	3	2	2	3	3	3	3	3	3
Weightage											15	15	15	15	15
Weighted percentage of Course Contribution to POs											3.0	3.0	3.0	3.0	3.0

Title of the Course :	Quantitative Inorganic Estimation (Titrimetry) and Inorganic Preparation	Marks: CIA:40 + Ext:60=100
Category of the Course:	Core Course	Hrs/Week :05
Course Code :	U1R3CHCC2P	Total Inst. Hrs: 75
Nature of the Course :	Skill Development	Sem: I Credit: 05

Objectives: This course aims at providing knowledge on

1. Laboratory safety
2. Handling glassware's
3. Quantitative estimation
4. Preparation of inorganic compound
5. Principles of Quantitative Analysis

Unit I: Chemical Laboratory Safety in Academic Institutions (20 Hrs)

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) (10 Hrs)

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) (15 Hrs)

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) (20 Hrs)

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 (Volbard'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 (10 Hrs)

Potash alum

Tetraammine copper (II) sulphate

Hexamine cobalt (III) chloride

Mohr's Salt

Reference Books:

1. Venkateswaran V; Veeraswamy, R; Kulandivelu, A.R. Basic Principles of practical Chemistry, 2nd Edn ; Sultan Chand & Sons: New Delhi, 1997.
2. Nad, A. K., Mahapatra, B.; Ghoshal, A; An advanced course in Practical Chemistry, 3rd Edn; New Central Book Agency: Kolkata, 2007
3. Mendham, J; Denney, R. C.; Barnes, J. D.; Thomas, M.; Sivasankar, B.; Vogels Text book of Quantitative Chemical Analysis, 6th Edn.; Pearson Education Ltd: New Delhi, 2000.

Web References:

- 1) <http://www.federica.unina.it/agraria/nalytical-chemistry/volumetricanalysis>
- 2) <https://chemdictionary.org/titration-indicator/>

Course Outcomes

Course Name: Qualitative Inorganic Estimation (Tritrimetry) and Inorganic Preparation		Course Code: U1R3CHCC2P	K-Level
On Successful completion of the course, students will be able to			
CO-1	Explain the basic principles involved in titrimetric analysis and inorganic preparations		K2
CO-2	Compare the methodologies of different titrimetric analysis.		K3
CO-3	Calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of substance present in a given solution.		K4
CO-4	Assess the yield of different inorganic preparations		K3

CO-5	Explain the basic principles involved in titrimetric analysis and inorganic preparations	K3
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Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: Quantitative Inorganic Estimation (Titrimetry) and Inorganic Preparation							Course Code: U1R3CHCC2P								
Course Outcomes (COs)	PO										PSO				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	2	2	2	3	3	3	3	3
CO3	3	3	3	2	3	3	3	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
CO5	3	2	3	3	3	3	3	2	2	3	3	3	3	3	3
Weightage											15	15	15	15	15
Weighted percentage of Course Contribution to POs											3.0	3.0	3.0	3.0	3.0

Title of the Course :	Food Chemistry	Marks: CIA:25 + Ext:75=100
Category of the Course:	NME	Hrs/Week :02
Course Code :	U1R3CHSEC1:1	Total Inst. Hrs: 30
Nature of the Course :	Skill Development	Sem: I Credit: 02

Objectives: This course aims at giving an overall view of the

1. Types of Food
2. Food Adulteration
3. Food Poison
4. Food additives
5. Food Preservation

UNIT-I: Food Adulteration

(6 Hrs)

Sources of food, types, advantages and disadvantages. Food adulteration-contamination of wheat, rice, milk, butter etc. with clay stones, water and toxic chemicals -Common adulterants, Ghee adulterants and their detection. **Detection of adulterated foods by simple analytical techniques.**

UNIT-II: Food Poison**(6 Hrs)**

Food poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion) - Chemical poisons - First aid for poison consumed victims.

UNIT-III: Food Additives**(6 Hrs)**

Food additives -artificial sweeteners -- Saccharin - Cyclamate and Aspartate Food flavours - esters, aldehydes and heterocyclic compounds -- Food colours - Emulsifying agents - preservatives -leavening agents. Baking powder - yeast - tastemakers - MSG - vinegar.

UNIT-IV: Beverages**(6 Hrs)**

Beverages – softdrink -soda-fruit juices-alcoholic beverages-examples. Carbonation-addiction to alcohol-diseases of liver and social problems.

UNIT-V: Edible Oils**(6 Hrs)**

Fats and oils - Sources of oils - production of refined vegetable oils-preservation Saturated and unsaturated fats - iodine value - role of MUFA and PUFA in preventing heart diseases-determination of iodine value, RM value, saponification values and their significance.

Text Book

1. Food chemistry, H. K Chopra, P. S. Panesar, Narosa publishing house, 2010.
2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co.Publishers, second edition, 2006.
3. Food Chemistry, H K Chopra, P. S. Panesar, Narosa publishing house, 2010.
4. Food Chemistry, Dr. L. Rakesh Sharma, Evince pub publishing, 2022.
5. Food processing and preservation, G. Subbulakshmi, Shobha A Udipi, Padmini S Ghugre, New Age international publishers, second edition, 2021

Reference Book

1. . H.-D. Belitz, Werner Grosch, Food Chemistry Springer Science & Business Media, 4 Edition, 2009.
2. M.Swaminathan, Food Science and Experimental Foods, Ganesh and Company, 1979.
3. Hasenhuettl, Gerard. L.; Hartel Richard. W. Food Emulsifiers and their applications Springer New York 2nd ed. 2008.
4. Food Chemistry, H-D Belitz, W. Grosch, P. Schieberle, Springer, fourth revised and extended edition, 2009.
5. Principles of food chemistry, John M deMan, John W Finley, W. Jefferey Hurst, Chang Yong Lee, Springer, Fourth edition, 2018.

Course Outcomes

Course Name: Food Chemistry		Course Code: U1R3CHSEC1:1	K-Level
On Successful completion of the course, students will be able to			
CO-1	Learn about Food adulteration - contamination of Wheat, Rice, Milk, Butter.		K3

CO-2	Get an awareness about food poisons like natural poisons (alkaloids - nephrotoxin) pesticides, DDT, BHC, Malathion	K4
CO-3	Get an exposure on food additives, artificial sweeteners, Saccharin, Cyclornate and Aspartate in the food industries.	K3
CO-4	Acquire knowledge on beverages, soft drinks, soda, fruit juices and alcoholic beverages examples.	K2
CO-5	Study about fats and oils - Sources of oils - production of refined vegetable oils preservation. Saturated and unsaturated fats –MVFA and PUFA	K3

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: FOOD CHEMISTRY							Course Code: U1R3CHSCE1:1								
Course Outcomes (COs)	PO										PSO				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	2	2	2	3	3	3	3	3
CO3	3	3	3	2	3	3	3	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
CO5	3	2	3	3	3	3	3	2	2	3	3	3	3	3	3
Weightage											15	15	15	15	15
Weighted percentage of Course Contribution to POs											3.0	3.0	3.0	3.0	3.0

Title of the Course :	Role of Chemistry in Daily Life	Marks: CIA:25 + Ext:75=100
Category of the Course:	NME	Hrs/Week :02
Course Code :	U1R3CHSEC1:2	Total Inst. Hrs: 30
Nature of the Course :	Skill Development	Sem: I Credit: 02

Objectives: This course aims at providing an overall view of the

1. Importance of Chemistry in everyday life
2. Chemistry of building materials and food
3. Chemistry of food and nutrition
4. Chemicals in food production
5. Chemistry of Drugs and pharmaceuticals

UNIT-I:

(6 Hrs)

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

UNIT-II: (6 Hrs)

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

UNIT-III: (6 Hrs)

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

UNIT-IV: (6 Hrs)

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

UNIT-V: (6 Hrs)

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

Text Books

1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010
2. A textbook of Pharmaceutical Chemistry by Jayashree Ghosh, S Chand publishing, 2012.
3. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
4. B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014
5. Introduction to forensic chemistry Kelly M Elkins, CRC Press Taylor & Francis Group, 2019.
6. Jayashree Ghosh, fundamental Concepts of Applied Chemistry, S. Chand & Co. Publishers, second edition, 2006.

Reference Books

1. Randolph. Norris Shreve, Chemical Process Industries, McGraw-Hill, Texas, fourth edition, 1977.
2. W.A.Poucher, Joseph A Brink, Jr. Perfumes, Cosmetics and Soaps, Springer, 2000.
3. A.K. De, Environmental Chemistry, New Age International Public Co., 1990.

Course Outcomes

Course Name: Role of Chemistry in daily life		Course Code: U1R3CHSEC1:2	K-Level
On Successful completion of the course, students will be able to			
CO-1	learn about the chemicals used in everyday life as well as air pollution and water pollution		K4
CO-2	get knowledge on building materials cement, ceramics, glass and plastics, polythene, PVC, bakelite, polyesters,		K3
CO-3	acquire information about Food and Nutrition. Carbohydrates, Proteins, Fats Also have an awareness about Cosmetics Tooth pastes, face powder, soaps and detergents.		K3
CO-4	discuss about the fertilizers like urea, NPK fertilizers and super phosphate. Fuel classification solid, liquid and gaseous; nuclear fuel - examples and uses		K2
CO-5	Have an idea about the pharmaceutical drugs analgesics and antipyretics like paracetamol and aspirin and also about pigments and dyes and its applications		K3

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: Role of Chemistry in daily life		Course Code: U1R3CHSEC1:2													
Course Outcomes (COs)	PO										PSO				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	2	2	2	3	3	3	3	3
CO3	3	3	3	2	3	3	3	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
CO5	3	2	3	3	3	3	3	2	2	3	3	3	3	3	3
Weightage											15	15	15	15	15
Weighted percentage of Course Contribution to POs											3.0	3.0	3.0	3.0	3.0

Title of the Course :	Dairy Chemistry	Marks: CIA:25 +Ext:75=100
Category of the Course:	Skill Enhancement Course	Hrs/Week :02
Course Code :	U1R3CHSEC1:3	Total Inst. Hrs: 30
Nature of the Course :	Skill Development	Sem: II Credit: 02

Course objectives: This course aims at providing an overall view of the

1. Composition of Milk
2. chemistry of milk and milk products
3. processing of milk preservation
4. formation of milk products
5. fermented and other Milk Products

UNIT I: Composition of Milk

(6 Hrs)

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

(6 Hrs)

Microbiology of milk-destruction of microorganisms 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

(6 Hrs)

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

(6 Hrs)

Special Milk Standardised milk - definition-merits - reconstituted milk - definition - flow diagram of manufacture - Homogenised milk-flavoured milk- vitaminised milk-toned milk-Incitant milk Vegetable toned milk humanized milk-

UNIT V: Fermented and other Milk Products

(6 Hrs)

Fermented milk products fermentation of milk definition, conditions, cultured milk - definition of culture - example, conditions cultured cream, butter milk Bulgarian milk -acidophilous milk Yoheer Indigenous products- khoa and chhena definition Ice cream definition-percentage composition-types-ingredients-manufacture of ice-cream, stabilizers emulsifiersandthe irrole-milkpowder-definition-needformakingmilkpowder- dryingprocess-types of drying

Text Book

1. K. Bagavathi Sundari, Applied Chemistry, MJP Publishers, first edition 2006
2. K. S. Rangappa and KT. Acharya, Indian Dairy Products, Asia Publishing House New Delhi, 1974
3. Text book of dairy chemistry, MP 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, 1st edition,2013
5. Text book of dairy chemistry, P. L. Choudhury, Bio-Green book publishers, 2021

Reference Books

1. Robert Jenness and S. Patom, Principles of Dairy Chemistry, S. Wiley, New York, 2005
2. FP Wond, Fundamentals of Dairy Chemistry, Springer Singapore,2006
3. Sukumar De. Outlines of Dairy Technology, Oxford University Press, New Delhi, 1980
4. PF Fox and PLH. Mesweeney, Dairy Chemistry and Biochemistry, Springer, Second edition, 2016.
5. Dairy chemistry and biochemistry, P F Fox, T. Uniacke-Lowe, PI, H McSweeney, JA OMahony, Springer, Second edition, 2015

Course Outcomes

Course Name: Dairy Chemistry	Course Code: U2R3CHSEC2	K-Level
On Successful completion of the course, students will be able to		

CO-1	understand about general composition of milk-constituents and its physical properties	K2
CO-2	acquire knowledge about pasteurization of Milk and various types of pasteurization-	K4
CO-3	Bottle, Batch and HTST Ultra High Temperature Pasteurization	K2
CO-4	learn about Cream and Butter their composition and how to estimate fat in cream and Ghee	K3
CO-5	explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk	K3

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: Dairy Chemistry							Course Code: U1R3CHSEC1:3								
Course Outcomes (COs)	PO										PSO				
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	2	2	2	3	3	3	3	3
CO3	3	3	3	2	3	3	3	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
CO5	3	2	3	3	3	3	3	2	2	3	3	3	3	3	3
Weightage											15	15	15	15	15
Weighted percentage of Course Contribution to POs											3.0	3.0	3.0	3.0	3.0

Title of the Course	:	Bridge Chemistry	Marks: CIA:25 + Ext:75=100
Category of the Course:		Foundation Course	Hrs/Week :02
Course Code		U1R3CHFC	Total Inst. Hrs: 30

:		
Nature of the Course :	Skill Development	Sem: I 02 Credit:

Course objectives: This course aims at providing an overview of the

1. Basic concepts of chemistry
2. Periodic properties of elements
3. Chemical bonding and concepts of organic chemistry
4. Know about biomolecules
5. structure of atom

Unit -I: Quantum Number and Periodic Properties (6 Hrs)

Quantum Numbers-Principal, Azimuthal, Magnetic and Spin Quantum numbers and their significance, Pauli's Exclusion principle, Hund's rule, Aufbau Principle. **Periodicity**- Periodic law, Atomic and ionic radii, ionisation potential, electron affinity and electronegativity along periods and groups.

Unit -II: Chemical Bonding (6 Hrs)

Ionic Bond-Properties of ionic compounds-factors affecting formation of ionic compound, Lattice Energy – Born – Haber Cycle, Fajan's rule. **Covalent Bond**-Lewis Theory, Octet rule, Sidgwick-Powell theory, **VSEPR Theory**-Shapes of simple inorganic molecules(BeCl_2 , NH_3 , H_2O , PCl_3 , XeF_4 , SF_4 , BrF_5 , PCl_5 , IF_7) Hydrogen bonding.

UNIT III: Basic Concepts in Organic Chemistry (6 Hrs)

Classification of Organic Compounds - Functional group- Nomenclature- Tautomerism -Types of organic reaction-Electrophile and Nucleophile - Carbocation and Carbanion.

UNIT-IV: Alcohol, Ether and Biomolecules (6 Hrs)

Nomenclature, Classification, Preparation and Properties of alcohols. Ether and Carbonyl Compounds. Biomolecules: Carbohydrates- Protein, Amino acids and Nucleic acids.

Unit - V: Atomic Structure (6 Hrs)

Dualism of light-Wave nature of radiation classical theory of electromagnetic, radiation. Particle nature of radiation-black body radiation and Planck's quantum theory, Photo electric effect and Compton effect of matter – de Broglie hypothesis Heisenberg's uncertainty principle, Concept of atomic orbitals, Schrodinger Equation

Text and Reference Book

1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 21st ed, S. Chand and Company, New Delhi.
2. Sathya Prakash, Tuli G D, Basu S K and Madan R D. (2003), Advanced Inorganic Chemistry, 17th ed., S.Chand and Company, New Delhi.
3. Bahl B S. Arul Bhal, (2003), Advanced Organic Chemistry, 3rd ed. S.Chand and Company, New Delhi.
4. Tewari K S, Mehrothra S N and Vishnoi N K. (1998). Text book of Organic Chemistry, 2nd ed., Vikas Publishing House, New Delhi.
5. Puri B R, Sharma L. R, (2002), Principles of Physical Chemistry, 38th ed. Vishal Publishing Company, Jalandhar

Reference Books

1. Maron SH and Prutton C P. (1972), Principles of Physical Chemistry, 4th ed. The Macmillan Company, Newyork
2. Barrow GM, (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-1, 26th ed., Goel Publishing House, Meerut

Course Outcomes

Course Name: Foundation Course		Course Code: U1R3CHFC	K-Level
On Successful completion of the course, students will be able to			
CO-1	explain the concept of periodicity properties		K3
CO-2	discuss the periodic properties of sand p-block elements		K3
CO-3	classify hydrocarbons, types of reactions		K2
CO-4	explain theories of chemical bonding		K3
CO-5	know about structure of atom		K2

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: Foundation Course							Course Code: U1R3CHFC								
Course Outcomes (Cos)	PO										PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	2	2	2	3	3	3	3	3
CO3	3	3	3	2	3	3	3	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3

CO5	3	2	3	3	3	3	3	2	2	3	3	3	3	3
Weightage											15	15	15	15
Weighted percentage of Course Contribution to POs											3.0	3.0	3.0	3.0

Title of the Course :	General Chemistry-II	Marks: CIA:25 + Ext:75=100
Category of the Course:	Core Course	Hrs/Week :05
Course Code :	U2R3CHCC3	Total Inst. Hrs: 75
Nature of the Course :	Skill Development	Sem: II Credit: 05

Course objectives: This course aims at providing an overview of the

1. Chemistry of acids, bases and ionic equilibrium
2. Properties of s and p block elements
3. Chemistry of hydrocarbons
4. Application of acid and bases
5. Compounds of main block elements and hydrocarbon

UNIT-I: Acid, bases and ionic equilibria

(15 Hours)

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

(15 Hours)

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:

(15 Hours)

(Group 15-18) General characteristics of elements of Group 15, chemistry of H₂N-NH₂, NH₂OH, HN₃) and HNO₃ Chemistry of PH₃, PCl₃, PCl₅, POCl₃, P₂O₅ and oxy acids of phosphorous (H₃PO₃) and H₃PO₄) General properties of elements of group 16 Structure and allotropy of elements chemistry of ozone - Classification and properties of oxides - oxides of sulphur and selenium-Oxy acids of sulphur (Caro's and Marshall's acids). **Chemistry of Halogens:** General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power Peculiarities of fluorine Halogen acids (HF, HCl, HBr and HI), oxides and oxy acids (HClO₄). Inter-halogen compounds (ICl, ClF₃, BrF₅ and IF₇), pseudo halogens [(CN)₂ and (SCN)₂] and basic nature of Iodine: **Noble gases-** Position in the periodic table. Preparation, properties and structure of XeF₂, XeF₄, XeF₅ and XeOF₄ uses of noble gases - clathrate compounds

UNIT-IV: Hydrocarbon Chemistry-I: Petroproducts

(15 Hours)

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**: 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**: 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

(15 Hours)

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 -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.

Text Books

1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 21sted, 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

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1. Maron SH and Prutton C P. (1972), Principles of Physical Chemistry, 4thed. The Macmillan Company, Newyork
2. Barrow GM, (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-1, 26th ed., Goel Publishing House, Meerut
6. Agarwal O P. (1995), Reactions and Reagents in Organic Chemistry, 8thed, Goel Publishing House, Meerut

Website and e-learning source

https://onlinecourses.nptel.ac.in/http://cactus.dixieedu/smbblack/chem1010/lecture_notes/48.html
<http://www.auburn.edu/~deruija/pdareson.pdf>
<https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding>
<http://nptel.ac.in/courses/104101090/>
<http://nptel.ac.in/courses/104101090/>

Course Outcomes

Course Name: General Chemistry-II		Course Code: U2R3CHCC3	K-Level
On Successful completion of the course, students will be able to			
CO-1	Explain the concept of acids, bases and ionic equilibria, periodic properties of s and p block elements, preparation and properties of aliphatic and aromatic hydrocarbon		K3
CO-2	Discuss the periodic properties of sand p-block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids		K3
CO-3	Classify hydrocarbons, types of reactions, acids and bases,		K2
CO-4	Explain theories of acids examine the properties s and p- block elements		K3
CO-5	Explain theories of acids, bases and indicators, buffer action and important compounds of s-block elements		K2

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: General Chemistry-II							Course Code: U2R3CHCC3								
Course Outcomes (COs)	PO										PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	2	2	2	3	3	3	3	3
CO3	3	3	3	2	3	3	3	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
CO5	3	2	3	3	3	3	3	2	2	3	3	3	3	3	3
Weightage											15	15	15	15	15
Weighted percentage of Course Contribution to POs											3.0	3.0	3.0	3.0	3.0

3-Strong, 2-Medium, 1-Low

Title of the Course :	Qualitative Organic Analysis and Preparation of Organic Compounds Practical	Marks: CIA:40 +Ext:60=100
Category of the Course:	Core Course	Hrs/Week :05
Course Code :	U2R3CHCC4P	Total Inst. Hrs: 75
Nature of the Course :	Skill Development	Sem: II Credit: 05

Course objectives: This course aims at providing knowledge on

- laboratory safety
- principles of qualitative organic analysis
- handling glass wares
- analysis of organic compounds

- preparation of organic compounds

UNIT I

(15 Hours)

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

(30 Hours)

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

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

Confirmation of functional groups

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

UNIT III: Preparation of Organic Compounds

(30 Hours)

- 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)**

- (i) Separation of amino acids by Paper Chromatography
- (ii) Thin Layer Chromatography mixture of sugars / plant pigments /permanganate dichromate
- (iii) Column Chromatography - extraction of carotene, chlorophyll and xanthophyll from leaves/separation of anthracene - anthracene picrate.

5. Electrophoresis (Demonstration) - Separation of amino acids and proteins

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, AR. 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, AR. Vogel's Textbook of Practical Organic Chemistry, 5th ed.; Pearson: India, 1989

Website and e-learning source

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

Course Outcomes

Course Name: Qualitative organic analysis and preparation of organic compounds		Course Code: U2R3CHCC4P	K-Level
On Successful completion of the course, students will be able to			
CO-1	Observe the physical state, odour, colour and solubility of the given organic compound.		K4
CO-2	identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis		K3

CO-3	compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, mono and polyhydric phenols, aldehyde and ketone	K3
CO-4	Reducing and non- reducing sugars and explain the reactions behind it.	K2
CO-5	Exhibit a solid derivative with respect to the identified functional group.	K3

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: Qualitative organic analysis and Preparation of organic compounds											Course Code: U2R3CHCC4P				
Course Outcome s (COs)	PO										PSO				
	PO 1	P O2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO 2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	2	2	2	3	3	3	3	3
CO3	3	3	3	2	3	3	3	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
CO5	3	2	3	3	3	3	3	2	2	3	3	3	3	3	3
Weightage											15	15	15	15	15
Weighted percentage of Course Contribution to POs											3.0	3.0	3.0	3.0	3.0

3-Strong, 2-Medium, 1-Low

Title of the Course	:	Cosmetic and Personal Grooming	Marks: CIA:25 + Ext:75=100
Category of the Course:		Skill Enhancement Course	Hrs/Week :02
Course Code	:	U2R3CHSEC3:1	Total Inst. Hrs: 30
Nature of the Course	:	Employability	Sem: II Credit: 02

Course objectives: This course aims at familiarizing the students with

1. formulations of various types of cosmetics and their significance

2. hair, skin and dental care
3. makeup preparations and personal grooming
4. know about perfumes
5. understand about beauty treatments

Unit I

(06 Hours)

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

(06 Hours)

Hair care Shampoos types powder, cream, liquid, gel ingredients, conditioner -types-ingredients
Dental care Tooth pastes - ingredients - mouth wash

Unit III: Make up

(06 Hours)

Base foundation types shadow, concealers, rouge ingredients, lipstick, eyeliner, mascara, eye

Unit IV: Perfumes

(06 Hours)

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

(06 Hours)

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

Reference Books

1. Thankamma Jacob, (1997) Foods, drugs and cosmetics - A consumer guide, Macmillan publication, London
2. Wilkinson J B E and Moore R J. (1997) Harry's cosmeticology, 7th ed., Chemical Publishers, London.
3. George Howard, (1987) Principles and practice of perfumes and cosmetics

Course Outcomes

Course Name: Cosmetic and Personal Grooming		Course Code: U2R3CHSEC3:1	K-Level
On Successful completion of the course, students will be able to			
CO-1	know about the composition of various cosmetic products		K3
CO-2	understand chemical aspects and applications of hair care and dental care and skin care products		K2
CO-3	understand chemical aspects and applications of perfumes and skin care products.		K2
CO-4	understand the methods of beauty treatments their advantages and disadvantage		K4
CO-5	understand the hazards of cosmetic products		K2

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: Cosmetic and Personal Grooming											Course Code: U2R3CHSEC3:1				
Course Outcomes (COs)	PO										PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	2	2	2	3	3	3	3	3
CO3	3	3	3	2	3	3	3	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
CO5	3	2	3	3	3	3	3	2	2	3	3	3	3	3	3
Weightage											15	15	15	15	15
Weighted percentage of Course Contribution to Pos											3.0	3.0	3.0	3.0	3.0

3-Strong, 2-Medium, 1-Low

Title of the Course :	Entrepreneurial Skills in Chemistry	Marks: CIA:25 + Ext:75=100
Category of the Course:	Skill Enhancement Course	Hrs/Week : 02

Course Code	:	U2R3CHSEC3:2	Total Inst. Hrs: 30
Nature of the Course	:	Employability	Sem: II Credit: 02

Course objectives: This course aims at familiarizing the students with

1. To develop entrepreneur skills in students
2. To know about Food chemistry
3. To understand about Dyes and confectionery items
4. Know about skin care products
5. Understand about beauty treatments

UNIT –I : Food Chemistry

(06 Hours)

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.

UNIT II: Dyes

(06 Hours)

Classification – Natural, synthetic dyes and their characteristics – basic methods and principles of dyeing

UNIT III

(06 Hours)

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.

Unit IV

(06 Hours)

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 V: Beauty treatments**(06 Hours)**

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

Text Books

- 1.George S&Muralidharan V. (2007) Fibre to Finished Fabric-A Simple Approach, Publication Division, University of Madras, Chennai
2. Appuswamy GP. A Handbook on Printing and Dyeing of Textiles Shyam Jha, Rapid detection of food adulterants and contaminants (Theory and Practice), Elsevier, e Book ISBN 9087128004289, 1st Edition 2015

e-learning source

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

Course Outcomes

Course Name: ENTREPRENEURIAL SKILLS IN CHEMISTRY		Course Code: U2R3CHSEC3:2	K-Level
On Successful completion of the course, students will be able to			
CO-1	Identify adulterated food items by doing simple chemical tests.		K4
CO-2	prepare cleaning products and become entrepreneurs		K2
CO-3	educate others about adulteration and motivate them to become entrepreneurs		K3
CO-4	learn about skin care products		K2
CO-5	Apply the beauty treatment		K4

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: ENTREPRENEURIAL SKILLS IN CHEMISTRY											Course Code: U2R3CHSEC3:2				
Course Outcomes (COs)	PO										PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5

CO1	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
CO2	2	3	3	3	3	3	3	2	2	2	3	3	3	3	3
CO3	3	3	3	2	2	3	3	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
CO5	3	3	2	3	3	3	2	3	2	3	3	3	3	3	3
Weightage											15	15	15	15	15
Weighted percentage of Course Contribution to Pos											3.0	3.0	3.0	3.0	3.0

3-Strong, 2-Medium, 1-Lo

Title of the Course :	General Chemistry-III	Marks: CIA:25 + Ext:75=100
Category of the Course:	Core course	Hrs/Week :05
Course Code :	U3R3CHCC5	Total Inst. Hrs:75
Nature of the Course :	Skill Development	Sem: III Credit: 05

Course objectives: This course aims to provide a comprehensive knowledge on

1. The physical properties of gases, liquids, solids and X-ray diffraction of solids.
2. Fundamentals of nuclear chemistry and nuclear waste management.
3. Applications of Nuclear Chemistry.
4. Basic chemistry of halo-organic compounds, phenol and other aromatic alcohols.
5. Preparation and properties of phenols and alcohols.

UNIT-I: Gaseous State

(18 Hours)

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.

UNIT-II: Solid State

(15 Hours)

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.

UNIT-III: Nuclear Chemistry:

(15Hours)

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.Nuclear energy; nuclear fission and fusion – major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures.

UNIT-IV: Alcohols

(12Hours)

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

(15Hours)

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, Gattermann synthesis, Libermann, nitro reaction, phthalein reaction.

Text Books

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. 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 & 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

<https://nptel.ac.in/courses/104104101> :Solid state chemistry

<https://nptel.ac.in/courses/103106071> : Nuclear industries and safety

<https://nptel.ac.in/courses/104106119s> : Introduction to organic chemistry

Course learning Outcomes: The Students Should be able to

CO-1: Explain the kinetic properties of gases by using mathematical concepts. (K4)

CO-2: Describe the physical properties of liquid and solids; identify various types of crystals with respect to its packing and apply the XRD method for crystal structure determinations. (K3)

CO-3: Investigate the radioactivity, nuclear energy and it's production, also the nuclear waste management. (K2)

CO-4: write the nomenclature, physical & chemical properties and basic mechanisms of halo organic compounds and alcohols. (K3)

CO-5: Investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol including thiol. (K3)

Course Name: General Chemistry-III		Course Code: U3R3CHCC5		
	Programme Outcomes (POs)	Programme	Specific Outcomes	Mean

Course Outcomes (COs)						(PSOs)					Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	3	3	2	2	2	2	2	2.4
CO2	3	2	3	2	3	2	3	2	3	2	2.5
CO3	2	2	3	2	2	3	2	2	2	3	2.3
CO4	2	2	2	3	2	3	2	2	2	2	2.3
CO5	2	2	2	3	2	3	2	3	2	3	2.4
Mean Overall Score											2.37
Mean Overall Relationship is 2.38 (HIGH)											

Title of the Course :	Qualitative Inorganic Analysis Practical	Marks: CIA:40 + Ext:60=100
Category of the Course:	Core course	Hrs/Week :05
Course Code :	U3R3CHCC6P	Total Inst. Hrs: 75
Nature of the Course :	Skill Development	Sem: III Credit: 05

Course objectives: This course aims at providing an overall view of the

1. To develop the skill on systematic analysis of simple inorganic salts
2. To develop the mixture of Salts.
3. To understanding the acid radicals.
4. To understanding the basic radicals.
5. To identifying the group of basic radicals.

Semi - Micro Qualitative Analysis (75 Hours)

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

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 e-learning source

1. www.epgpathshala.nic.in

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

Course learning Outcomes

The students should be able to

CO-1 -Acquire knowledge on the systematic analysis of the mixed salts (K4)

CO-2 -Identify the cations and anions in the unknown substance.(K3)

CO-3-Identify the cations and anions in the soil and water.(K2)

CO-4-To test quality of the water.(K3)

CO-5-Assess the role of Common ion effect and Solubility product.(K3)

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Course Name: Qualitative Inorganic Analysis Practical						Course Code: U3R3CHCC6P					
	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	3	3	2	2	2	2	2	2.4
CO2	3	2	3	2	3	2	3	2	3	2	2.5
CO3	2	2	3	2	2	3	2	2	2	3	2.3
CO4	2	2	2	3	2	3	2	2	2	2	3.4
CO5	2	2	2	3	2	3	2	3	2	3	2.4
Mean Overall Score											2.38
Mean Overall Relationship is 2.38 (HIGH)											

Title of the Course :	Nutrition and Food Science	Marks: CIA:25 + Ext:75=100
Category of the Course:	Skill Enhancement Course	Hrs/Week :02
Course Code :	U3R3CHSEC4:1	Total Inst. Hrs: 30
Nature of the Course :	Employability	Sem: III Credit: 02

Objectives : To make students learn,

1. the importance of biomolecules
2. about food adulteration and preservation
3. vitamins and minerals
4. food and nutrition
5. balanced diet and dietary standards

Unit – I Bio Molecules (6 Hours)

1.1 Carbohydrates– Definition, classification, sources and biological functions

1.2 Proteins – Definition, classification, sources and biological functions

1.3 Lipids – Definition, classification, sources and biological functions

1.4 Nucleic Acids – Definition, classification, sources and biological functions

Unit – II Food Adulteration and Preservation (6 Hours)

2.1 Food Adulteration– definition, common adulterants, types, simple test for common food adulterants in milk, Ghee, edible oil, soft drink, honey and turmeric powder.

2.2 Food Preservation–definition, importance, foods spoilage, spoilage by microbial, enzymes and insects. food preservation –principles and methods

Unit – III Vitamins and Minerals (6 Hours)

3.1 Vitamins–introduction, classification, **Water soluble vitamins-B complex** (B₁, B₆, B₉ and B₁₂) and **Vitamin C**- chemical name, sources, functions and deficiency.

Fat soluble vitamins (A,D,E and K) - Chemical name, sources, functions and deficiency

3.2 Minerals– introduction, classification, general functions, sources, factors favouring absorption, deficiency symptoms of calcium, Phosphorus, iron, iodine and fluorine.

Unit – IV Food and Nutrition (6 Hours)

4.1 Food – definition, classification, functions, factors affecting acceptability of food, food processing –milling, cooking, boiling, steaming, braising, stewing, pressure-cooking, roasting, frying, boiling or grilling and baking

4.2 Nutrition– definition, classification, food groups based on nutrients

Unit – V Balanced Diet and Dietary Standards (6 Hours)

5.1 Balanced Diet- Definition, principles, classification based on their functions, low cost, moderate, high cost balanced diet, five group diet foods. Balanced diet for children, adolescent boys and girls, adult man and women.

5.2 Dietary Standards - Recommended Dietary Allowances of calories, proteins and fats for infants, children, adolescent boys and girls, adult men and women, pregnancy and lactating women. Respiratory quotient. BMR, Food grade pyramid

Course Outcomes : At the end of the course, the learners will be able to

CO-1: know the biomolecules (K2)

CO-2: identify the food adulterants in food (K3)

CO-3: know about vitamins and minerals (K4)

CO-4: understand about the food and nutrition (K3)

CO-5: know about balanced diet (K2)

Reference Books:

1. Gurdeep Chatwal, Organic chemistry of Natural Products, volume 1 and 2, Himalaya publishing house, 3rd reprint, 2013.
2. S.P. Butani, Chemistry of Biomolecules, Ane books Pvt. Ltd., 2010.
3. Srimathy Venkatraman and Suchetra Dandekar, Nutrition and Biochemistry for Nurses, Elsevier, reprinted 2012.
4. Sunetra Roday, Food Science and Nutrition, Oxford University Press, 2nd edition, 2012.

Text Books :

1. Ambika Shanmugam, fundamentals of Biochemistry for medical students, 7th Edition, reprint 2004.
2. Mahindraa Deshpande and Dr. Nikhilesh Kulkarni, Food and Nutrition, Himalaya Publishing House Pvt. Ltd., 1st edition, 2010.
3. Sumati R. Mudambi, Shalini M. Rao and M.V. Rajagopal, Food Science, New Age International Publishers, 2nd edition, reprint 2008.
4. Avantina Sharma, Text Book of Food Science & Technology, ibdc publishers, 2nd edition, 2010.

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Course Name: NUTRITION AND FOOD SCIENCE						Course Code: U3R3CHSEC4:1					
	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	3	3	2	2	2	2	2	2.4
CO2	3	2	3	2	3	2	3	2	3	2	2.5
CO3	2	2	3	2	2	3	2	2	2	3	2.3
CO4	2	2	2	3	2	3	2	2	2	2	3.4
CO5	2	2	2	3	2	3	2	3	2	3	2.4
Mean Overall Score											2.38
Mean Overall Relationship is 2.38 (HIGH)											

Title of the Course :	FORENSIC SCIENCE	Marks:CIA:25+ Ext:75=100
Category of the Course:	Skill Enhancement Course	Hrs/Week :02
Course Code :	U3R3CHSEC4:2	Total Inst. Hrs: 30
Nature of the Course :	Skill Development	Sem: III Credit: 02

Course objectives: This course aims at providing an overall view of the

1. Poison and its types
2. crime detection through analytical instruments
3. forgery and its detection
4. Tracks and Traces
5. Medical aspects involved

UNIT I- Poisons

(06 Hours)

Poisons - types and classification - diagnosis of poisons in the living and the dead -clinical symptoms - postmortem appearances. Heavy metal contamination (Hg, Pb, Cd) of seafoods - use of neutron activation analysis in detecting arsenic in human hair. Treatment in cases of poisoning – use of antidotes for common poisons.

Unit-II-Crime Detection

(06 Hours)

Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Human

bombs - possible explosives (gelatin sticks and RDX) - metal detector devices and other security measures for VVIP - composition of bullets and detecting powder burns.

UNIT-III: Forgery and Counterfeiting (06 Hours)

Documents - different types of forged signatures - simulated and traced forgeries - inherent signs of forgery methods - writing deliberately modified - uses of ultraviolet rays - comparison of type written letters - checking silver line water mark in currency notes - alloy analysis using AAS to detect counterfeit coins - detection of gold purity in 22 carat ornaments - detecting gold plated jewels - authenticity of diamond.

UNIT-IV: Tracks and Traces (06 Hours)

Tracks and traces - small tracks and police dogs - foot prints - casting of foot prints - residue prints, walking pattern or tyre marks - miscellaneous traces and tracks - glass fracture - tool marks - paints - fibres - Analysis of biological substances - blood, semen, saliva, urine and hair - Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies - detecting steroid consumption in athletes and racehorses.

UNIT-V: Medical Aspects (06 Hours)

Aids - causes and prevention - misuse of scheduled drugs - burns and their treatment by plastic surgery. Metabolite analysis using mass spectrum - Gas chromatography-Arson - natural fires and arson - burning characteristics and chemistry of combustible materials - nature of combustion. Ballistics - classification - internal and terminal ballistics - small arms - laboratory examination of barrel washing and detection of powder residue by chemical tests.

Text Book

1. SA Iqbal, M Liviu, Textbook of forensic chemistry, Discovery publishing house private limited, 2011.
2. Kelly M. Elkins, Introduction to Forensic Chemistry, CRC Press, Taylor & Francis Group, 2019.
3. Javed I. Khan, Thomas J. Kennedy, Donnell R. Christian, Jr., Basic principles of Forensic chemistry, Humana Press, first edition, 2012.

4. Bapuly AK, (2006) Forensic Science – Its application in crime investigation, Paras Medical Publisher, Hyderabad.
5. Sharma B.R., (2006) Scientific Criminal Investigation, Universal Law Publishing Co. Pvt. Ltd, New Delhi

Reference Book

1. Richard Saferst in and Criminalistics-An Introduction to Forensic Science (College Version), Sopfestein, Printice hall, eighth edition, 2003
2. Suzanne Bell, Forensic Chemistry, Pearson, second international edition, 2014.
3. Jay Siegel, Forensic chemistry: Fundamentals and applications, Wiley-Blackwell, first edition, 2015.
4. Max M. Houck & Jay A. Segal, (2006) Fundamentals of Forensic Science, Elsevier Academic press.
5. Henry C. Lee, Timothy Palmbach, Marilyn T. Miller, (2006) Henry Lee's Crime Scene Book Elsevier Academic press.

Website and learning source

1. <http://www.library.ucsb.edu/ist/03-spring/internet.html>
2. <http://www.wonderhowto.com/topic/forensic-science/>

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

- CO 1:** learn about the Poisons - types and classification of poisons in the living and the dead organisms and also get information about Postmortem. **(K2)**
- CO 2:** get awareness on Human bombs, possible explosives (gelatin sticks and RDX) and metal defector devices and other security measures for VVIP - composition of bullets and detecting powder burns **(K4)**
- CO 3:** detect the forgery documents, different types of forged signatures **(K3)**
- CO4:** have an idea about how to tracks and trace using police dogs, foot prints identification and gain the knowledge in analyzing biological substances - blood, semen, saliva, urine and hair - DNA Finger printing for tissue identification in dismembered bodies **(K4)**
- CO 5:** get the awareness on Aids - causes and prevention and also have an exposure on handling fire explodes. **(K3)**

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Course Name: Forensic Science						Course Code: U3R3CHSEC4:2					
	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	2	3	3	3	2	3	3	3	3	3	2.8
CO3	3	3	3	2	3	3	3	3	3	3	2.9
CO4	3	3	3	3	3	3	3	3	3	3	3.0
CO5	3	2	3	3	3	3	3	3	3	3	2.9
Mean Overall Score											2.92
Mean Overall Relationship is 2.92 (HIGH)											

Title of the Course :	GENERAL CHEMISTRY-IV	Marks: CIA:25 + Ext:75=100
Category of the Course:	Core Course	Hrs/Week :05
Course Code :	U4R3CHCC7	Total Inst. Hrs: 75
Nature of the Course :	Skill Development	Sem: IV Credit: 05

Objectives: This course aims at providing knowledge on

1. Thermodynamic concepts on chemical Processes and applied aspects.
2. Thermo chemical calculations
3. Transition elements with reference to periodic properties and group study of transition metals.
4. The organic chemistry of ethers, aldehydes and ketones
5. The organic chemistry of carboxylic acids Basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry

UNIT I :Thermodynamics I

(18 hours)

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). 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 relations, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application.

Unit II: Thermodynamics II

(15 hours)

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. 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

(15 hours)

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: Aldehydes and Ketones

(12 hours)

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 – Ponnordorf Verley reduction, reduction with LiAlH_4 and NaBH_4 .

UNIT V: Carboxylic Acids

(15 hours)

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

Recommended Text

1. B.R.Puri and L.R.Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chand and Co.,thirtythree edition,1992.
2. K.L.Kapoor, *A Text book of Physical chemistry*,(volume-2and3), Macmillan, India Ltd, thirddedition,2009.
3. P.L.Soni and Mohan Katyal, *Text book of Inorganic Chemistry*, Sultan Chand & Sons, twentieth edition, 2006.
4. M.K.Jain,S.C.Sharma ,*Modern Organic Chemistry*,Vishal Publishing ,fourth reprint, 2003.

Reference Book

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

Course Learning Outcomes

CO-1: Explain the term sand processes in thermodynamics; discuss the various laws of thermodynamics and thermochemical calculations. (K3)

CO-2: Discuss the second law of thermodynamics and its application to heatengine; discuss third law and its application on heat capacity measurement. (K4)

CO-3: Investigate the chemistry of transition elements with respect to various periodic properties and group wise discussions. (K2)

CO-4: Discuss the fundamental organic chemistry of ethers, epoxide sandcarbonyl compound including named organic reactions. (K5)

CO-5 :Discuss the chemistry and named reactions related to carboxylic acid sand their derivatives; discuss chemistry of active methylene compounds,halogen substituted acid sand hydroxylacids. (K3)

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Course Name: GENERAL CHEMISTRY-IV						Course Code: U4R3CHCC7					
	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	2	3	3	3	2	3	3	3	3	3	2.8
CO3	3	3	3	2	3	3	3	3	3	3	2.9
CO4	3	3	3	3	3	3	3	3	3	3	3.0
CO5	3	2	3	3	3	3	3	3	3	3	2.9
Mean Overall Score											2.92
Mean Overall Relationship is 2.92 (HIGH)											

Title of the Course :	PHYSICAL CHEMISTRY PRACTICAL-I	Marks:CIA:40+ Ext:60=100
Category of the Course:	Core course	Hrs/Week :05
Course Code :	U4R3CHCC8P	Total Inst. Hrs: 75
Nature of the Course :	Skill Development	Sem: IV Credit: 05

Course objectives: This course aims at providing an overall view of the

1. Laboratory experiments in order to understand the concepts of physical changes in chemistry
2. Rates of chemical reactions
3. Colligative properties and adsorption isotherm
4. Thermochemistry of reaction
5. Conductance measurements

UNIT-I: Chemical kinetics (25 Hours)

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 (25 Hours)

- ### UNIT III- Colligative property (25 Hours)

- ## Adsorption

- ## Text Books

- ### 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

C01: describe the principles and methodology for the practical work (K2)

CO2: explain the procedure, data and methodology for the practical work. **(K3)**

CO3: apply principles of electrochemistry, kinetics for carrying out the practical work. **(K4)**

CO4: demonstrate laboratory skills for safe handling of the equipment and chemicals (K3)

CO5: Determine the colligative property (K4)

Course Name: Physical Chemistry Practical-I						Course Code: U4R3CHCC8P					
	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	2	3	3	3	2	3	3	3	3	3	2.8
CO3	3	3	3	2	3	3	3	3	3	3	2.9
CO4	3	3	3	3	3	3	3	3	3	3	3.0
CO5	3	2	3	3	3	3	3	3	3	3	2.9
Mean Overall Score											2.92
Mean Overall Relationship is 2.92 (HIGH)											

Title of the Course :	Pesticide Chemistry	Marks: CIA:25 + Ext:75=100
Category of the Course:	Skill Enhancement Courses	Hrs/Week :2
Course Code :	U4R3CHSEC5:1	Total Inst. Hrs: 30
Nature of the Course :	Skill Development	Sem: III Credit: 02

Course objectives: This course aims at providing an overall view of the

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.
3. Knowledge on choice of alternate and eco-friendly pesticides.
4. Knowledge about the various pesticide residue.
5. To understand plant glycosides and marine drugs.

UNIT-I: Introduction-History of pesticides

(08Hours)

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.

UNIT-II: Classification of Insecticides

(05Hours)

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.

UNIT-III: Pesticides residues

(05Hours)

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.

UNIT-IV: Pesticide Residues effect and analysis

(06Hours)

Effects of pesticides residue on human life, birds and animals. Analysis of pesticides residues- sample preparation, extraction of pesticides residues (soil, water and vegetables/fruits) schemes of analysis, multi-residue analysis.

UNIT-V: Plant Glycosides and Marine drugs

(06Hours)

Glycosides: Basic ring system, classification, isolation, properties, qualitative analysis. Pharmacological activity of Senna glycosides, Cardiac glycosides-Digoxin, digitoxin, Steroidal saponins glycosides- Diosgenin, hecogenin.

Text Books

1. Handa SK. Principles of pesticide chemistry. Agrobios (India); 2012.
2. Matolcsy G, Nádas M, Andriska 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

Course learning Outcomes: The students should be able to

CO 1: Teach about the pesticides and their toxicity with respect to structure and category. (K3)

CO 2: Explain the preparation and property of pesticides. (K4)

CO 3: Investigate the pesticide residues, prevention and care. (K3)

CO 4: Demonstrate the extraction and analytical methods of pesticide residues. (K2)

CO 5: Make awareness to the public on bio-pesticides. (K3)

Course Name: Pesticide Chemistey						Course Code: U4R3CHSEC5:1					
	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	3	3	2	2	2	2	2	2.4
CO2	3	2	3	2	3	2	3	2	3	2	2.5
CO3	2	2	3	2	2	3	2	2	2	3	2.3
CO4	2	2	2	3	2	3	2	2	2	2	2.3
CO5	2	2	2	3	2	3	2	3	2	3	2.4
Mean Overall Score											2.37
Mean Overall Relationship is 2.38 (HIGH)											

Title of the Course :	Instrumental Methods of Chemical Analysis	Marks: CIA:25 + Ext:75=100
Category of the Course :	Skill Enhancement Course	Hrs/Week :02
Course Code :	U4R3CHSEC5:2	Total Inst. Hrs: 30
Nature of the Course :	Skill Development	Sem:IV Credit: 02

Objectives: To make students understand

1. Operation and trouble shooting of chemical instruments

2. Fundamentals of analytical techniques and its application in the characterization of compounds
3. Theory of chromatographic separation and
4. Theory of thermo/electro analytical techniques
5. Stoichiometry and the related concentration terms

Unit-I:Qualitative and Quantitative Aspects of Analysis (6 hours)

S.I Units, Distinction between Mass and Weight. Moles, Millimoles, Milli equivalence, Molality, Molarity, Normality, Percentage by Weight and Volume, ppm. 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.

Unit-II: Atomic Absorption Spectroscopy (6 hours)

Basic principles of instrumentation (choice of source, mono chromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of back ground 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 Spectrometry: (6 hours)

Basic principles, instrumentation (choice of source, mono chromator 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, mono chromator & detector) for single and double beam instrument; sampling

Unit-IV: Thermal and Electro-analytical Methods of Analysis (6 hours)

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. **Electro analytical methods:** polarography-principle, instrumentation and applications. Derivative polarography-Cyclic Voltammetry principle.

Unit-V: Separation and purification techniques (6 hours)

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

Text Books

1. 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, NewDelhi,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

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. & Chalmes, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elles Harwood Ltd. London

CO No.	CO-Statements	K-Level
On Successful completion of the course, students will be able to		
CO-1	learn about in chemistry in quantitative and qualitative analysis	K3
CO-2	set up as small entrepreneurs	K3
CO-3	Understand the concept of AAS	K3
CO-4	Examined the thermal analysis techniques	K5
CO-5	Prepared the various chromatography methods for isolation and purification	K4

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: Instrumental Methods of Chemical Analysis							Course Code: U4R3CHSEC5:1				
Course Outcomes (Cos)	Programme Outcomes(POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	2	3	2	2	3	3	2	2	3	2.3
CO2	3	3	1	3	2	3	2	3	3	3	2.6
CO3	2	1	3	2	2	3	2	2	3	3	2.3
CO4	3	2	1	2	2	3	3	3	3	3	2.5
CO5	3	1	2	3	3	3	3	2	3	3	2.6
	Mean Overall Score										2.46
	Result										High

Title of the Course :	INDUSTRIAL CHEMISTRY	Marks: CIA:25 + Ext:75=100
Category of the Course :	Skill Enhancement Course	Hrs/Week :02
Course Code :	U4R3CHSEC6:1	Total Inst. Hrs: 30
Nature of the Course :	Skill Development	Sem: IV Credit: 02

Objectives: To make students understand

1. Classifications and characteristics of fuels
2. Preparation of cosmetics
3. Manufacture of sugar, paper, cement and leather and food processing
4. Applications of lubricants and other industrial products
5. Intellectual property rights

UNITI: Survey of Indian Industries and mineral resources in India (6 hours)

Fuels: Classification, characteristics of fuels. Solid fuels: coal- classification; **Liquid fuels:** Petroleum- characteristics; Gasoline aviation petrol knocking in internal combustion engines, antiknock agents; unleaded petrol octane number, cetane number. **Gaseous fuel:** advantages over solid and liquid fuels; water gas, producer gas,- preparations:-uses. **Natural gas:** LPG composition, advantages, application; gobar gas production, composition, advantages, application.

Unit-II: Cosmetics (6 hours)

Skincare: powders, ingredients; creams and lotion-cleansing, moisturising, all purpose shaving cream, sunscreen; make up preparations. **Dentalcare:** toothpastes- ingredients **Soap and Detergent:** Soaps-properties, manufacture of soap-batch process; types-transparent soap, toilet soap, powder soap and liquid soap- ingredients. **Detergents-** definition, properties-cleansing action; soap less detergents-anionic, cationic and non-ionic (general idea only); uses of detergents as surfactants. Biodegradability of soaps and detergent

Unit-III: Sugar Industry (6 hours)

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, low temperature, drying, radiation; Food additives-preservatives, flavours, colours, anti-oxidants, sweetening agents; hazards of using food additives; Food standards-Agmark and Codexalimentarius.

Unit-IV: Leather Industry: (6 hours)

Structure and composition of skin, hide; Manufacture of **leather-pre-tanning process – curing, liming, beating, pickling; methods of tanning- vegetable, chrome-one bath, two bath process; finishing.** **Paper Industry** Manufacture of pulp - mechanical, chemical processes; sulphate pulp, ragpulp; manufacture of paper-beating, refining, **filling, sizing, colouring**, calendaring; cardboard

Unit-V:Cement Industry (6 hours)

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 - Patentoffices in India: Trademark - **Types of trademarks**- Certification marks,

Text Books

- ## Reference Books

- | CO No. | CO-Statements | K-Level |
|--|--|---------|
| On Successful completion of the course, students will be able to | | |
| CO-1 | learn about in classification and characteristics of fuels | K2 |
| CO-2 | set up as small entrepreneurs | K3 |
| CO-3 | Get awareness on effect of cosmetics, understand more about cosmetics and their uses | K3 |
| CO-4 | Understand the application of fuels | K4 |
| CO-5 | Learn about intellectual property | K4 |

Title of the Course: INDUSTRIAL CHEMISTRY								Course Code: U4R3CHSEC6:1			
Course Outcomes (Cos)	Programme Outcomes(POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	2	3	2	2	3	3	2	2	3	2.3
CO2	3	3	1	3	2	3	2	3	3	3	2.6
CO3	2	1	3	2	2	3	2	2	3	3	2.3
CO4	3	2	1	2	2	3	3	3	3	3	2.5
CO5	3	1	2	3	3	3	3	2	3	3	2.6
	Mean Overall Score										2.46
	Result										High

Title of the Course :	FUNDAMENTALS OF SPECTROSCOPY	Marks: CIA:25 + Ext:75=100
Category of the Course:	Skill enhancement Course	Hrs/Week :02
Course Code :	U4R3CHSEC6:2	Total Inst. Hrs: 30
Nature of the Course :	Skill Development	Sem: IV Credit: 02

Objectives: The course aims at giving an overall view of the

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

UNIT-I: Electrical and Magnetic properties of molecules (06 hours)

Dipole moment— polar and non polar molecules—polarisability of molecules. Magnetic permeability, volume susceptibility, mass susceptibility and molar susceptibility; diamagnetism, paramagnetism – determination of magnetic susceptibility using Gouy balance, ferromagnetism, anti ferromagnetism.

UNIT-II: Ultraviolet and Visible spectroscopy (06 hours)

Instrumentation Types of electronic transition sample handling Some terms Chromophore, Auxochrome, Bathochromic shift, Hypsochromic shift, Hyperchromic shift, Hypochromic shift- Solvent effects – Woodward-Fieser rules- Calculation of λ_{max} : dienes and unsaturated carbonyls. Differentiate geometrical isomerism -Applications of UV and Visible Spectroscopy.

UNIT-III: Infrared spectroscopy (06 hours)

Instrumentation-sample handling techniques Types of Fundamental vibrations-position of IR absorption frequencies for functional groups like aldehyde, ketone, acid and amide. Factors affecting the frequency absorption-Conjugation, Inductive effect and Hydrogen bonding- Applications of IR spectroscopy.

UNIT-IV: Nuclear magnetic resonance spectroscopy (06 hours)

PMR – theory of PMR – instrumentation - number of signals – chemical shift – proton counting – spin-spin coupling – applications. Shielding and deshielding of protons, chemical shifts factors affecting chemical shift, coupling constant – factors affecting coupling constant s ; spin-spin splitting of neighbouring protons in vinyl and allyl systems

UNIT-V: Mass spectrometry (06 hours)

Principle – different kinds of ionisation – instrumentation – the mass spectrum – types of ions- determination of molecular formula-fragmentation and structural – McLafferty rearrangement;

Retro Diels Alder reaction - **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 Hill, New Delhi, 2017.
4. U.N. Dash, *Analytical Chemistry Theory and Practice*, Sultan Chand & Sons, 2nd Ed., 2005
5. B.K. Sharma, *Spectroscopy*, 22nd ed., Goel Publishing House, 2011.

Reference 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.Graw Hill: 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*, 43rd ed.; Vishal Publishing: Delhi, 2008.
- 6.

WEBSITE AND e-LEARNING COURSE

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

Course Learning Outcomes: Students will be able:

CO1: Explain electrical and magnetic properties of materials (K3)

CO2: Explain Theory, Instrumentation and Applications of IR and Raman Spectroscopy (K3)

CO3: Apply Selection Rules to Understand Spectral Transitions, Explain Woodward–Fieser’s Rule for the Calculation of Wavelength Maximum of Conjugated Dienes (K2)

CO4: Explain Theory, Instrumentation and Applications of NMR Spectroscopy (K3)

CO5: Explain Theory, Instrumentation and Applications of Mass Spectrometry. (K3)

Course Name: Fundamentals of Spectroscopy	Course Code: U4R3CHSEC6:2		
	Programme Outcomes (POs)	Programme Specific Outcomes	Mean

Course Outcomes (COs)						(PSOs)					Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	3	3	2	2	2	2	2	2.4
CO2	3	2	3	2	3	2	3	2	3	2	2.5
CO3	2	2	3	2	2	3	2	2	2	3	2.3
CO4	2	2	2	3	2	3	2	2	2	2	2.3
CO5	2	2	2	3	2	3	2	3	2	3	2.4
Mean Overall Score											2.37
Mean Overall Relationship is 2.38 (HIGH)											

Title of the Course :	ORGANIC CHEMISTRY-I	Marks: CIA:25+Ext:75=100
Category of the Course :	Core Course	Hrs/Week :05
Course Code :	U5R3CHCC9	Total Inst. Hrs: 75
Nature of the Course :	Skill Development	Sem: V Credit: 05

Objectives: The course aims at giving an overall view of the

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

UNIT I: Stereochemistry

(15 hours)

Fischer Projection, Newmann and Sawhorse Projection formula and their interconversions; Geometrical isomerism: cis-trans, syn anti isomerism, E/Z notations. Optical Isomerism: Optical activity, specific rotation, asymmetry, enantiomers, diastereoisomers, 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

(15 hours)

Nitroalkanes Nomenclature, isomerism, preparation from alkylhalides, haloacids, alkanes; physical properties; reactions–reduction, halogenations, Grignard reagent. Aromatic nitro compound Nomenclature, preparation–nitration, from diazonium salts, physical properties; reactions–reduction of nitrobenzene in different medium, Electrophilic substitution reactions. Amines: Aliphatic amines Nomenclature, isomerism, preparation– Hofmann's degradation reaction, Gabriel's phthalimide synthesis, Physical properties, reactions -alkylation, acylation, carbylamine reaction, Mannich reaction, basicity of amines.

Unit III: Chemistry of Nitrogen Compounds – II

(15 hours)

Aromatic amines–Nomenclature, preparation–from nitro compounds, Hofmann's method properties - basic nature, ortho effect; reactions – alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid - zwitter ion formation. Distinction between primary, secondary and tertiary amines - aliphatic and aromatic Diazonium compounds Diazomethane, Benzene diazonium chloride -preparations and synthetic applications

Unit-IV: Heterocyclic compounds

(15 hours)

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 reaction

Unit-V: Six-membered heterocyclic compounds

(15 hours)

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, 4th reprint, 2009.
2. S.M.Mukherji,and S.P.Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd.3rd edition,2009.
3. ArunBahl and B.S.Bahl, Advanced organic chemistry, NewDelhi, S.Chand & Company Pvt.Ltd.,Multicolour edition,2012.
4. P.L.Soni and H.M.Chawla, Text Book of Organic Chemistry , Sultan Chand & Sons, New Delhi, 29th edition,2007.
5. C.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, 6th edition,2012.
2. T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons.
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,andG.F.Smith, Heterocyclic Chemistry, Wiley, 5th Edition, 2010.

Web References

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. <http://swayam.gov.in>
4. VirtualTextbookofOrganicChemistry
- 5.

Course Learning Outcomes: Students will be able to

CO1: Assign RS notations to chirals and EZ notations to olefins and explain conformations of ethane and butane (K3)

CO2: Explain preparation and properties of aromatic and aliphatic nitro compounds and amines (K2)

CO3: Explain colour and constitution of dyes and food additives (K3)

CO4: Discuss preparation and properties of five membered heterocycles like pyrrole, furan and thiophene (K3)

CO5: Discuss preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline. (K3)

Course Name: Organic Chemistry-I						Course Code: U5R3CHCC9					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	3	3	2	2	2	2	2	2.4
CO2	3	2	3	2	3	2	3	2	3	2	2.5
CO3	2	2	3	2	2	3	2	2	2	3	2.3
CO4	2	2	2	3	2	3	2	2	2	2	2.3
CO5	2	2	2	3	2	3	2	3	2	3	2.4
Mean Overall Score											2.37
Mean Overall Relationship is 2.37 (HIGH)											

Title of the Course :	Inorganic Chemistry-I	Marks: CIA:25 + Ext:75=100
Category of the Course:	Core course	Hrs/Week :05
Course Code :	U5R3CHCC10	Total Inst. Hrs: 75
Nature of the Course :	Skill Development	Sem: III Credit: 04

Course objectives: This course aims at providing an overall view of the

1. Nomenclature, isomerism and theory of coordination compounds, and chelate complexes
2. Crystal field theory, magnetic properties, stability of complexes and Jahn Teller effect
3. Preparation and properties of metal carbonyls
4. To learn about Lanthanoids and actinoids
5. Preparation and properties of inorganic polymers

UNIT-I: Coordination Chemistry-I

(18 Hours)

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 and 6.

UNIT-II: Co-ordination Chemistry – II

(10 Hours)

Crystal field theory – Crystal field splitting of energy levels in octahedral and tetrahedral complexes, Crystal field stabilization energy (CFSE), spectrochemical series, stability constants- factors affecting the stability of a complex ion, thermodynamic and kinetic stability (elementary idea).

UNIT-III: Organometallic Compounds

(17 Hours)

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

UNIT-IV: Inner transition elements (Lanthanoids and Actinoids)

(15 Hours)

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.

UNIT-V: Inorganic polymers

(15 Hours)

General properties – classification of inorganic polymers based on element in the backbone (Si, S, B and P) - preparation and **properties of silicones** (polydimethylsiloxane and polymethylhydrosiloxane) .boron based polymers (borazine polymers) – industrial applications of inorganic polymers.

Text Books

1. Puri B R, Sharma L R, Kalia K C (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 J D, (1991), Concise Inorganic Chemistry, 4th Edition, ELBS William Heinemann, London.
4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, S. Chand and Company Ltd.
5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992.

Reference Books

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

Website and e-learning source

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. <http://swayam.gov.in>
- 4.

Course Learning Outcomes: The Students Should be able to

CO1: Explain isomerism, Werner's Theory and stability of chelate complexes.(K4)

CO-2:Discuss crystal field theory, magnetic properties and spectral properties of complexes.(K3)

CO-3: Explain preparation and properties of metal carbonyls.(K2)

CO-4: Give a comparative account of the characteristics of lanthanoids and actinoids.(K3)

CO-5: Give the preparation and Properties of Inorganic Polymers.(K3)

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Course Name: Inorganic Chemistry-I						Course Code: U5R3CHCC10					
	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	2	3	3	3	2	3	3	3	3	3	2.8
CO3	3	3	3	2	3	3	3	3	3	3	2.9
CO4	3	3	3	3	3	3	3	3	3	3	3.0
CO5	3	2	3	3	3	3	3	3	3	3	2.9
Mean Overall Score											2.92
Mean Overall Relationship is 2.92 (HIGH)											

Title of the Course :	Physical Chemistry	Marks: CIA:25 + Ext:75=100
Category of the Course:	Core Course	Hrs/Week :05
Course Code :	U5R3CHCC11	Total Inst. Hrs: 75
Nature of the Course :	Skill Development	Sem: III Credit: 04

Course objectives: This course aims at providing an overall view of the

- To understand about thermodynamics law.
- To apply kinetic theory and reaction.
- Preparation and properties of Colloids.
- To learn about electro kinetic properties.
- To understand about electrical conductance and transferences

UNIT-I: Thermodynamics

(15 Hours)

Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy, Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships, Partial molar properties – chemical potential, Gibbs Duhem equation, variation of chemical potential with temperature and pressure, , Gibbs- Duhem-Margules equation.

UNIT II: Chemical Kinetics

(18 Hours)

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

Unit-III: Kinetics of reactions**(16 Hours)**

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

UNIT-IV: Colloids and Surface Chemistry**(12 Hours)**

Colloids: Types of Colloids, Characteristics Colloids (Lyophilic and Lyophobic sols), Preparation of Sols- Dispersion methods, aggregation methods, Properties of Sols- Optical properties, Electrical properties - Electro-osmosis, Electrophoresis, Coagulation or precipitation, **Surface Chemistry:** Adsorption, **Distinction between adsorption** and absorption, Mechanism of adsorption, Types of adsorption, Adsorption isotherm- Langmuir and Freundlich, Application of adsorption.

UNIT-V: Electrochemistry**(14 Hours)**

Arrhenius theory of electrolytic **dissociation – Ostwald's** dilution law, limitations of Arrhenius theory; Debye Huckel theory –Onsager equation (no derivation), significance of Onsager equation, Debye Falkenhagen effect, Wien effect. Ionic mobility – transport **number – determination –Hittorf's method, moving boundary method – Kohlrausch's law-** applications; conductometric titrations .

Text Books

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

Reference Books

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

Website and e-learning source

1. www.epgpathshala.nic.in
2. www.nptel.ac.in

3. <http://swayam.gov.in>

Course learning Outcomes: The Students Should be able to

CO-1: Explain Gibbs and Helmholtz free energy functions, partial molar quantities and Ellingham's. (K3)

CO-2: Apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction. (K4)

CO-3: The effect of temperature on reaction rate, and the significance of free energy and entropy of activation. (K3)

CO-4: Demonstrate the types and characteristics of colloids, preparation of sols and emulsions, and determine the molecular weights of macromolecules. (K2)

CO-5: Apply electrical conductance to predict the transference. (K3)

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Course Name: Physical Chemistry						Course Code: U5R3CHCC11					
	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	2	3	3	3	2	3	3	3	3	3	2.8
CO3	3	3	3	2	3	3	3	3	3	3	2.9
CO4	3	3	3	3	3	3	3	3	3	3	3.0
CO5	3	2	3	3	3	3	3	3	3	3	2.9
Mean Overall Score											2.92
Mean Overall Relationship is 2.92 (HIGH)											

Title of the Course :	PHYSICAL CHEMISTRY PRACTICAL II	Marks: CIA:40+ Ext:60=100
Category of the Course :	Core Course	Hrs/Week :05
Course Code :	U5R3CHCC12P	Total Inst. Hrs:75
Nature of the Course :	Skill Development	Sem: V Credit: 04

Objectives: The course aims at giving an overall view of the

1. Basic Principles of Physical Chemistry Experiments
2. Hands on Experience in Carrying out The Experiments
3. Effect on impurity of two component system.
4. Principle of conductometric titration.
5. Principle of potentiometric titration

Phase diagrams (30 hours)

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

Distribution law (30 hours)

6. Determination of the distribution coefficient of iodine between CCl_4 and H_2O .
7. Determination of equilibrium constant of the reaction $\text{I}_2 + \text{I}^- \leftrightarrow \text{I}_3^-$
8. Determination of concentration of the given potassium iodide solution using the above equilibrium constant.

Electrochemistry (15hours)

9. Conductometric titration of hydrochloric acid against sodium hydroxide.
10. Potentiometric titration of ferrous ion against potassium dichromate using quinhydrone electrode.

Recommended text

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>

Course Learning Outcomes: Students will be able to:

CO1: Describe the principles and methodology for the practical work.

CO2: Explain the procedure, data and methodology for the practical work

CO3: Apply the principles of phase rule and electrochemistry for carrying out practical work

CO4: Demonstrate laboratory skills for safe handling of the equipment and chemical

CO5: Elaborate the types of titration using conductometric and potentiometric.

Course Name: Physical Chemistry Practical-II						Course Code: U5R3CHCC12P					
	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	3	3	2	2	2	2	2	2.4
CO2	3	2	3	2	3	2	3	2	3	2	2.5
CO3	2	2	3	2	2	3	2	2	2	3	2.3
CO4	2	2	2	3	2	3	2	2	2	2	2.3
CO5	2	2	2	3	2	3	2	3	2	3	2.4
Mean Overall Score											2.37
Mean Overall Relationship is 2.37 (HIGH)											

Title of the Course :	POLYMER SCIENCE	Marks: CIA:25 + Ext:75=100
Category of the Course:	Discipline Specific Elective	Hrs/Week :05
Course Code :	U5R3CHDSE5:1	Total Inst. Hrs: 75
Nature of the Course :	Skill Development	Sem: V Credit: 03

Objectives: The course aims at giving an overall view of the

1. Classification of polymers, preparation of polymers
2. Kinetics of polymerization and characterization of polymers
3. Analytical techniques used to characterize polymers
4. Reactions of polymers
5. Speciality polymers like PVC, PMMA

UNIT-I

(15 hours)

Introduction-Difference between polymer and macromolecule – classification – synthetic and natural, organic and inorganic, thermoplastic and thermosetting. Plastics, elastomers, fibres and liquid resins. Techniques of polymerization Bulk, solution, emulsion and suspension polymerization

UNIT-II

(15 hours)

Kinetics of polymerization Kinetics of condensation and addition polymerisation; ionic, free radical, copolymerisation and coordination polymerisation – reactivity ratios – block and graft copolymers. Characterisation of polymers Appearance, feel and hardness, density, effect of heat,

solubility, combustion, tensile strength, shear, stress, impact strength, mechanical, thermo mechanical and rheological properties of polymers in viscoelastic state

UNIT-III

(15 hours)

Molecular Weight and Properties of Polymers -Number Average and Weight Average, Molecular Weight Distribution, Determination of Molecular Weight polydispersity index – membrane and vapour phase osmometry, light scattering - Zimm plot, ultracentrifuge – sedimentation velocity and sedimentation equilibrium – viscometry– gel permeation chromatography Thermal properties of polymers – Glass Transition Temperature-State of Aggregation and State of Phase Transitions, Factors Influencing Glass Transition Temperature, Importance of Glass Transition Temperature, Heat Distortion Temperature, TGA / DTA, Crystallinity of Polymers: Crystalline Behaviour, Degree of Crystallinity

UNIT IV

(15 hours)

Reactions of Polymers-Hydrolysis, Acidolysis, Aminolysis, Addition and Substitution Reactions (One Example Each) Cyclisation, Cross-Linking and Reactions of Specific Functional Groups in the Polymer Polymer technology Processing of polymers – casting, thermoforming, moulding ,extrusion, compression, blow moulding – foaming lamination, reinforcing – processing of fibres – melt, wet and dry spinning.

UNIT V

(15 hours)

Speciality polymers-Polyelectrolytes, conducting polymers, polymeric supports for solid phase synthesis, biomedical polymers, liquid crystalline polymers, electro luminescent polymers – two examples of each of these polymers. Polyethylene, PVC, PMMA, polyester; rubber – synthetic and natural, vulcanization of rubber. Polymer Degradation. Types of Degradation - Thermal, Mechanical, Ultra Sound, Photo Radiation and Chemical Degradation Methods. Rubber-Natural and Synthetic-Structure, Mechanism of Vulcanisation Biodegradable and Non-Biodegradable Polymer.

Recommended text

1. Gowariker V.R, N.V.Viswanthan and Jayadev Sreedhar. PolymerScience. New Delhi:NewAge International,2015
2. Misra G.S. Introductory Polymer Chemistry. New Delhi:Wiley Eastern,2010.
3. Bahadur P and Sastry NV. Principles of Polymer Science. New Delhi: Narosa Publishing House,2005
4. Ahluwalia,V.K.Anuradha Mishra, *Polymer Science A Text Book*, Ane Books India:New

5. Morrison, R.R; Boyd, R.N; Bhattacharjee, S.K. *Organic Chemistry*, 7th ed ; Pearson: New Delhi, 2011.

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

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

CO1: Explain classification of polymers, elastomers, fibres and liquid resins (K3)

CO2: Explain addition and condensation polymerization, mechanical properties (K3)

CO3: Determine the molecular weight of polymers, and thermal properties of polymers (K4)

CO4: Explain reactions of polymers and polymer processing (K3)

CO5: Discuss speciality polymers like PVC, Puma, rubbers, biodegradable polymers (K3)

Course Name: Polymer Science						Course Code: U5R3CHDSE5:1					
	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	3	3	2	2	2	2	2	2.4
CO2	3	2	3	2	3	2	3	2	3	2	2.5
CO3	2	2	3	2	2	3	2	2	2	3	2.3
CO4	2	2	2	3	2	3	2	2	2	2	2.3
CO5	2	2	2	3	2	3	2	3	2	3	2.4
Mean Overall Score											2.37
Mean Overall Relationship is 2.38 (HIGH)											

Title of the Course :	NANOSCIENCE	Marks: CIA:25 + Ext:75=100
Category of the Course :	Discipline Specific Elective	Hrs/Week :05
Course Code :	U5R3CHDSE5:2	Total Inst. Hrs: 75
Nature of the Course :	Skill Development	Sem: V Credit: 03

Objectives: This course aims at providing knowledge on

1. Introduction to nano particles/ clusters and nano composites
2. Properties of nanomaterials
3. Characterization of nano materials by different methods
4. Synthesis of carbon nanotubes, graphene, quantum dots, self-assembled nanomaterials
5. Applications of nanomaterials as sensors

UNIT I :Introduction to nano science

(18 hours)

Definition of terms – nanoscience, nanoparticles, clusters, quantum dots, nano structures and nanocomposites. Electron behavior in freespace, bulk material and nanomaterials. Synthesis and stabilization of nanomaterials Top down approach (physical methods), mechanical dispersion – ballmilling, methods based on vaporization of a precursor inert gas condensation, ion sputtering, spray pyrolysis, aerosol synthesis- nanolithography. Bottom-up approach (chemical methods) solvo thermal synthesis, photochemical method, gamma radiolysis, sonochemical synthesis, electrodeposition, sol-gel method, nano materials via chemical routes-solvents reducing agents,

Unit II: Properties of materials on nanoscale

(15 hours)

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, super magnetic properties, electronic properties, Chemical properties- chemical process on the surface of nanoparticles, catalysis, mechanical properties

UNIT III: Techniques employed for characterization of nanomaterials (15 hours)

Spectroscopy– UV-visible, Photoelectron spectroscopy –Electron microscopy Scanning Electron Microscopy (SEM), Transmission 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 1V: Special nanomaterials

(12 hours)

Carbon Nano Structures Carbon nano tubes: 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 of Fullerene, Graphene, properties, DLC and nano diamonds and Applications

UNIT V: Application of nanomaterials

(15 hours)

Biomedical Applications- drug, drug delivery, **biolabelling, artificial implants, cancer treatment. Sensors-Natural nanoscale** sensors, chemical sensors, biosensors. 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 nano materials** 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., New Delhi.
2. Pradeep T., *Nano: The Essentials, Understanding Nanoscience and Nanotechnology*; Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.
3. Shah M.A.; Tokeer Ahmad, *Principles of Nanoscience and Nanotechnology*; Narosa Publishing House, New Delhi, 2010.
4. Murthy B.S.; Shankar P., Baldev Raj.; Rath B.B. James Murday, *Text book of Nanoscience and Nanotechnology*; Universities press, India Ltd, Hyderabad. 2012.

Reference Book

1. Sharma P.K., *Understanding Nanotechnology*; Vista International Publishing House, Delhi. 2008.
2. Charles P. Poole Jr.; Frank J. Owens. *Introduction to Nanotechnology*; A John Wiley & Sons, INC., Publication, 2003.
3. Viswanathan B., *Nano Materials*; Narosa Publishing House, New Delhi, 2009.

4. C.N.R.Rao; Muller.A; Cheetham,_A.K. *Nanomaterials Chemistry Recent Developments and New Directions*.
5. Jing Zhong Zhang, *Optical properties and spectroscopy of Nanomaterials*; World Scientific Publishing Pvt.Ltd.,Singapore.

Course Learning Outcomes

CO-1: Explain the general concepts and physical phenomena of relevance with in the field of nanoscience. (K3)

CO-2: Describe the properties, synthesis, characteristics of nanomaterials, special nanomaterials and applications (K4)

CO-3:Examine the structure, properties, applicability and characterization of nanomaterials (K2).

CO-4: Analyze various synthesis procedures, characterization and uses of carbon nanotubes, fullerene and graphene (K5)

CO-5: Discuss applications of nanomaterials of sensors and in optics and electronics (K3)

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Course Name: Nano Science						Course Code: U5R3CHSEC5:2					
	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	2	3	3	3	2	3	3	3	3	3	2.8
CO3	3	3	3	2	3	3	3	3	3	3	2.9
CO4	3	3	3	3	3	3	3	3	3	3	3.0
CO5	3	2	3	3	3	3	3	3	3	3	2.9
Mean Overall Score											2.92
Mean Overall Relationship is 2.92 (HIGH)											

Title of the Course :	PHARMACEUTICAL CHEMISTRY	Marks: CIA:25 + Ext:75=100
Category of the Course:	Discipline Specific Elective	Hrs/Week :05
Course Code :	U5R3CHDSE6:1	Total Inst. Hrs: 75
Nature of the Course :	Employability	Sem: V Credit: 03

Objectives of the course: The course aims at providing an overall view of

1. drugs design and drug metabolism
2. important Indian medicinal plants, common diseases and antibiotics
3. drugs for major diseases like cancer, diabetes and AIDS
4. analgesics and antipyretic agents
5. significance of clinical tests

UNIT I: Introduction

(15 Hours)

Important terminologies – drug, pharmacognosy, pharmacy, pharmacology, pharmacodynamics, pharmacokinetics, **clinical pharmacology**, pharmacotherapeutics, chemotherapy, toxicology, pharmacophore, antimetabolites, mutation, bacteria, virus, fungi, actinomycetes, vaccines, pharmacopeia, posology and therapeutic index. Sources of drugs – dosage forms – bio availability – routes of administration – absorption, **distribution and elimination of drugs – drug metabolism – prescription** terms. by method of variation – disjunction and conjunction methods

Unit II: Indian medicinal plants

(15 Hours)

Some important Indian medicinal plants – tulsi, neem, kizhanelli, mango, semparuthi, adadodai, turmeric and thoothuvalai – uses. **Antibiotics:** Definition – classification – structure and therapeutic uses **of chloramphenicol, penicillins**, structure activity relationship of chloramphenicol; therapeutic uses of ampicillin, streptomycin, erythromycin, tetracycline, rifamycin.

UNIT III: Drugs for major diseases

(15 Hours)

Cancer – common causes – chemotherapy – anti neoplastic agents - classification – adverse effects of cytotoxic agents; alkylating agents – chlorambucil; anti metabolites – methotrexate, fluorouracil; Vinca alkaloids – vincristine, vinblastine. Diabetes – types – management of diabetes – insulin; oral hypoglycemic agents – sulphonyl ureas – chlorpropamide; biguanides – metformin – thiazolidinediones.

UNIT IV: Analgesics and antipyretic agents

(15 Hours)

Anaesthetics: Definition, characteristics, classification - general anaesthetics – volatile anaesthetics – nitrous oxide, ethers, cyclopropane, chloroform, halothane, trichloro ethylene – storage, advantages and disadvantages ; non volatile anaesthetics – thiopental sodium ; local anaesthetics – requisites – advantages- esters – cocaine, benzocaine ; amides – lignocaine, cinchocaine. **Blood and haematological agents:** Blood – composition, grouping – physiological functions of plasma proteins – mechanism of clotting; Coagulants – vitamin K, protamine sulphate, dry thrombin

UNIT V: Clinical Chemistry

(15 Hours)

Blood tests – blood count – complete haemogram – Hb, RBC, GTT, TC, DC, platelets, PCV, ESR; bleeding and clotting time – glucose tolerance test. **Significance of Clinical Tests:** Serum electrolytes - blood Glucose - orthotoluidine method; Renal functions tests - blood urea, creatinine; liver function tests - serum proteins, albumin globulin ratio, serum bilirubin, enzymes SGOT, SGPT

Text Book

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

Reference Books

1. Chatwal G R, (2013), Pharmaceutical chemistry, inorganic (vol-I) 6th ed., Himalaya publishing house, Bombay.
2. Chatwal G R, (1991), Pharmaceutical chemistry, organic (vol-II), Himalaya publishing house, Bombay.
3. Patrick G, (2002), Instant Notes Medicinal Chemistry, Viva Books Private Limited, New Delhi.
4. Intellectual Property Rights, Neeraj Pandey, Khushdeep Dharni. Publisher: PHI Learning Pvt. Ltd., 2014 ISBN: 812034989X, 9788120349896.

Course Name: Pharmaceutical Chemistry						Course Code: U5R3CHDSE6:1					
	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	2	3	3	3	2	3	3	3	3	3	2.8
CO3	3	3	3	2	3	3	3	3	3	3	2.9
CO4	3	3	3	3	3	3	3	3	3	3	3.0
CO5	3	2	3	3	3	3	3	3	3	3	2.9
Mean Overall Score											2.92
Mean Overall Relationship is 2.92 (HIGH)											

Title of the Course :	HEALTH CHEMISTRY	Marks: CIA:25 + Ext:75=100
Category of the Course :	Discipline Specific Elective	Hrs/Week :05
Course Code :	U5R3CHDSE6:2	Total Inst. Hrs: 75
Nature of the Course :	Skill Development	Sem:V Credit:03

Objectives: To make students understand,

1. the fundamentals of nutrition and dietetics
2. the need for water-electrolyte balance and its importance for health
3. the vital role of acid-base balance in human health
4. the symptoms and cures of common diseases
5. the impact of drugs on human health

Unit – I Nutrition (15 Hrs)

Nutrition – definition – food pyramid – health – hygiene – nutritional food – sources – significance of nutritional supplements – malnutrition – under nutrition and over nutrition – causes and remedies

Unit – II Water and Electrolyte Balance (15 Hrs)

Functions of water – Water distribution in the body – sources of water – water loss – dehydration – signs symptoms – management of dehydration – regulation of water in the body- Electrolytes – functions and balance

Unit – III Acid – Base Balance (15 Hrs)

Importance of acid-base balance – buffer systems – bicarbonate buffer system – phosphate buffer system – protein buffer system – acid-base balance in kidneys – Urinary buffers

Unit – IV Common Diseases (15 Hrs)

Diseases – malaria, typhoid, dysentery, vomiting, jaundice, asthma, epilepsy, ulcer, anemia, diabetes and their causes

Unit – V Drugs (15 Hrs)

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

Text books

1. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, 2nd edition, S.Chand and Co Ltd, New Delhi, 2006.
2. Alex V Ramani, Food Chemistry, MJP Publishers, Chennai, 2009
3. Sreemathy Venkatraman and Sucheta Dandekar, *Nutrition and Biochemistry for Nurses*, Elsevier, 2012

Reference Books

1. Ashutosh Kar, *Medicinal Chemistry*, Wiley Esterns limited, New Delhi, 1993
2. Bahl and Arun Bahl, *A text book of Organic Chemistry*, 22nd Edition, S.Chand Publishers, New Delhi, 2019.

CO No.	CO-Statements	Cognitive Level (K-Level)
On Successful completion of the course, students will be able to		
CO-1	discuss issues related to nutrition and dietetics	K2

CO-2	identify optimal levels of water-electrolyte balance for specific life styles	K3
CO-3	discover acid-base imbalance in the digestive systems, its impact on health and possible ways of alleviation	K3
CO-4	identify causes and symptoms of common diseases	K3
CO-5	analyze the effects of drugs on various symptoms in the human body and corresponding alleviative measures	K4

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: HEALTH CHEMISTRY							Course Code: U5R3CHDSE6:2				
Course Outcomes (Cos)	Programme Outcomes(POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	3	2	2	3	3	2	2	2	3	2.3
CO2	3	3	1	3	2	3	2	3	3	3	2.6
CO3	2	1	3	3	2	3	3	3	3	3	2.6
CO4	3	2	1	2	2	3	2	3	3	3	2.4
CO5	3	1	2	3	2	3	3	3	3	3	2.6
	Mean Overall Score										2.50
	Result										High

Title of the Course :	ORGANIC CHEMISTRY-II	Marks: CIA:25 + Ext:75=100
Category of the Course:	Core Course	Hrs/Week :05
Course Code :	U6R3CHCC13	Total Inst. Hrs: 75
Nature of the Course :	Skill Development	Sem: VI Credit: 04

Objectives: This course aims at providing knowledge on

1. Classification, isolation and discussing the properties of Alkaloids, Terpenes
2. Preparation and properties of saccharides
3. Biomolecules
4. Different Molecular Rearrangement
5. Preparation and properties of organo metallic Compounds

UNIT I: Alkaloids

(18hours)

Classification, isolation, general properties- Hofmann Exhaustive Methylation; Structure

elucidation - Coniine, piperine, nicotine. **Terpenes**: Classification, Isoprene rule, isolation and structural elucidation of Citral, alpha terpineol, Menthol, Geraniol and Camphor

Unit II: Carbohydrates

(15 hours)

Definition and Classification of Carbohydrates with examples. Relative configuration of sugars. Determination of configuration (Fischer's Proof). Definition of enantiomers, diastereomers, epimers and anomers with suitable examples. Monosaccharides -configuration-D and L hexoses-aldo hexoses and keto hexoses. Glucose, Fructose-Occurrence, preparation, properties, reactions, structural elucidation, uses. Interconversions of sugar series- ascending, descending, aldose to ketose and ketose to aldose. Disaccharides- sucrose, lactose, maltose-preparation, properties and uses (no structural elucidation). Polysaccharides: Source, constituents and biological importance of homo polysaccharides-starch and cellulose.

Unit III: Molecular rearrangements

(12 hours)

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

Unit-IV: Special reagents in organic synthesis

(15hours)

AIBN, 9BBN, BINAP/BINOL, BOC, DCC, 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

(15 hours)

Principles, chemistry behind a 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 Books

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 colour edition, 2012.
4. P.L.Soni and H.M.Chawla, Text Book of Organic Chemistry,
5. CB and yopadhy; An Insight in to Green Chemistry; Published on 2020

Reference Books

Course Name: Organic Chemistry-II						Course Code: U6R3CHCC13					
	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	3	3	2	2	2	2	2	2.4
CO2	3	2	3	2	3	2	3	2	3	2	2.5
CO3	2	2	3	2	2	3	2	2	2	3	2.3
CO4	2	2	2	3	2	3	2	2	2	2	2.3
CO5	2	2	2	3	2	3	2	3	2	3	2.4
Mean Overall Score											2.37
Mean Overall Relationship is 2.37 (HIGH)											

Title of the Course :	INORGANIC CHEMISTRY-II	Marks: CIA:25 + Ext:75=100
Category of the Course:	Core course	Hrs/Week :06
Course Code :	U6R3CHCC14	Total Inst. Hrs: 90
Nature of the Course :	Skill Development	Sem: VI Credit: 04

Course objectives: This course aims at providing an overall view of the

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

UNIT I: Bioinorganic Chemistry

(18 Hours)

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

(18 Hours)

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

(18 Hours)

Isomerase and synthetases, structure of cyanocobalamin (Vitamin B_{12}), nature of Co-C bond; Metalloenzymes - functions of carboxy peptidase A, zinc metalloenzyme – mechanism and uses, Zn-Cu enzyme - structure and function, carbonic anhydrase, Vitamin B-12 as transferase and isomerase - Iron-sulphur proteins - 2Fe-2S – rubredoxin, 4Fe-2S – ferridoxin, Iron sulphur cluster enzymes. In vivo and In vitro nitrogen fixation – biological functions of nitrogenase and molybdo enzymes.

UNIT IV: Silicates

(18 Hours)

Introduction – general properties of silicates, structure – types of silicates – ortho silicates (zircon), pyrosilicates (thortveitite), chain silicates (pyroxenes), ring silicates (beryl), sheet

silicates (talc, mica, asbestos), silicates having three dimensional structure (feldspars, zeolites, ultramarines)

UNIT V: Industrial Applications of Inorganic Compounds (18 Hours)

Refractories, pyrochemical, explosives. Alloys, Paints and pigments - requirements of a good paint; classification, constituents of paints – pigments, vehicles, thinners, driers, extenders, anti-knocking agents, anti-skinning agents, plasticizers, binders-application; varnishes- oils, spirit; enamels. Nanocomposite Hydrogels: synthesis, characterization and uses.

Text Book

1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31th ed., Milestone Publishers & Distributors, Delhi.
2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advanced Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi
3. Lee J D, (1991), Concise Inorganic Chemistry, 4th ed., ELBS William Heinemann, London.
4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, Schand and Company Ltd.
5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992

Reference Book

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

Website and e-learning source

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

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: ability to explain the importance of tracer elements on biological system. **(K2)**

CO2: explain the metal ion transport, Bohr effect, Na, K, Ca pump. **(K3)**

CO3: explain the function of Vitamin B12, Zn-Cu enzyme, ferredoxin, cluster enzymes. **(K4)**

CO4: classification and structure of silicates. **(K2)**

CO5: explain the manufacture of refractories, explosives, paints and pigments **(K3)**

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Course Name: Inorganic Chemistry-II						Course Code: U6R3CHCC14					
	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	2	3	3	3	2	3	3	3	3	3	2.8
CO3	3	3	3	2	3	3	3	3	3	3	2.9
CO4	3	3	3	3	3	3	3	3	3	3	3.0
CO5	3	2	3	3	3	3	3	3	3	3	2.9
Mean Overall Score											2.92
Mean Overall Relationship is 2.92 (HIGH)											

Title of the course:	AGRICULTURAL CHEMISTRY	Marks:CIA:25 +Ext:75=100
Category of the course:	Discipline Specific Elective	Hrs/week:4
Course code:	U6R3CHDSE7:1	Total Inst. Hrs: 60
Nature of the course:	Skill Development	Sem:VI Credit:03

Objectives: To make Students

1. *understand the origin of soil*
2. *know the chemical composition of soil*
3. *determine the chemical analysis*
4. *understand the plant nutrients*
5. *learn fertilizer, pesticides and fungicides*

Unit -I: Origin of Soil

(12 Hrs)

Origin of soils, their properties, acid, alkali and saline soils- diagnosis – remediation of acid and salt affected soils – methods of reclamation and after care.

Unit – II: Soil Chemical Analysis (12 Hrs)

Determination of soil analysis: Nitrate, Nitrogen in Soil, total Cobalt in soil, sulphur in soil, Boron in soil, Carbonate in soil,

Unit – III: Plant Nutrients (12 Hrs)

Plant nutrients – macro and micro nutrients – their role in plant growth – sources - forms of nutrient absorbed by plants – factors affecting nutrient absorption - deficiency symptoms in plants – corrective measures – chemicals used for correcting nutritional deficiencies – nutrient requirement of crops – their availability fixation and release of nutrients.

Unit – IV: Fertilizers (12 Hrs)

Fertilizers – classification of NPK fertilizers – sources - natural and synthetic – straight – complex – liquid fertilizers, their properties, use and relative efficiency secondary and micronutrient fertilizers – mixed fertilizers.

Unit – V: Pesticides and Fungicides (12 Hrs)

Pesticides: definition – Classification – organic and inorganic pesticides – mechanism of action – characteristics safe handling of pesticides – impact of pesticides on soil, plants and environment. **Fungicides:** Definition – Classification – mechanism of action – sulphur, copper, mercury compounds, dithanes, dithiocarbamate.

Reference Books

1. T. D. Biswas and S. K. Mukherjee, Text book of soil science 1987.
2. J. Daji, A text book of soil science, Asia publishing House, Madras – 1970.
3. S. L. Tisdale, W.L. Nelson and J. D. Beaton, Soil fertility and fertilizers, Macmillon Pub Co New York 1990.
4. P. R. Hesse, A text book of soil chemical analysis John Murray, New York, 1971.
5. K. H. Buchel, Chemistry of Pesticides, John Wiley & Sons New York 1983.
6. V. S. Sree Ramulu, Chemistry of Insecticides and Fungicides, Oxford and IBH Publishing Co., New Delhi 1979.

CO No.	CO-Statements	Cognitive Level (K-Level)
On Successful completion of the course, students will be able to		
CO-1	Know the origin of soil and its composition	K1
CO-2	Determine the soil analysis	K3
CO-3	Understand the plant nutrients and its importance	K2
CO-4	Learn the composition of fertilizers and its commercial uses	K1
CO-5	Known the composition of pesticides	K4

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: AGRICULTURAL CHEMISTRY							Course Code: U6R3CHDSE7:1				
Course Outcomes (Cos)	Programme Outcomes(POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	2	3	1	3	3	3	2	3	3	2.4
CO2	3	2	2	3	3	2	3	2	3	2	2.5
CO3	2	1	1	3	3	2	3	2	3	3	2.4
CO4	3	3	1	3	3	3	2	3	2	3	2.6
CO5	3	3	3	2	2	2	2	3	2	3	2.5
	Mean Overall Score										2.48
	Result										High

Title of the Course :	Biochemistry	Marks: CIA:25 + Ext:75=100
Category of the Course :	Discipline Specific Elective	Hrs/Week :04
Course Code :	U6R3CHDSE7:2	Total Inst. Hrs: 60
Nature of the Course :	Skill Development	Sem:VI Credit: 03

Objectives: To make students understand

1. relationship between biochemistry and medicine, composition of blood
2. structure and properties of amino acids, peptides, enzyme, vitamins and proteins
3. biological functions of proteins, enzymes, vitamins and hormones
4. biochemistry of nucleic acids and lipids.
5. Metabolism of lipids

Unit-I: peptides and proteins: (12 hours)

Peptides: Amino acid introduction and structure of amino acid, peptide bond–nomenclature–synthesis of simple peptides–solution and solid structure of peptides. Determination of structure of peptides, N terminal analysis–Sanger’s & Edmann method; C terminal analysis –Enzymatic method Proteins: classification based on composition, functions and structure, properties and reactions–colloidal nature, coagulation, hydrolysis, oxidation, denaturation, renaturation; colour tests for proteins; structure of proteins–primary, secondary, tertiary and quaternary.

Unit-II: Enzymes and Vitamins (12 hours)

Nomenclature and classification, characteristics, factors influencing, enzyme activity – mechanism of enzyme action – Lock and Key hypothesis, Koshland's induced fit model. Proenzymes, antienzymes, coenzymes and isoenzymes; allosteric enzyme regulation. Vitamins as coenzymes – functions of TPP, lipoic acid, NAD, NADP, FMN, FAD, pyridoxal phosphate.

UNIT III: Nucleic acid and hormones

(12 hours)

Nucleic acid : Components of nucleic acids – nitrogenous bases and pentose sugars, structure of nucleosides and nucleotides, DNA – structure & functions, RNA – types – structure – functions; biosynthesis of proteins. **Hormones**: Adrenalin and thyroxine – chemistry, structure and functions (No structure elucidation).

UNIT IV: Lipids I:

(12 hours)

Occurrence, biological significance of fats, classification of lipids. **Simple lipids** – Oils and fats, chemical composition, properties, reactions hydrolysis, hydrogenation, trans-esterification, saponification, rancidity; analysis of oils and fats – saponification number, iodine number, acid value, R.M. value. Distinction between animal and vegetable fats.

UNIT V: Lipids II:

(12 hours)

Compound lipids – Lipoproteins – VLDL, LDL, HDL, chylomicrons – biological significance. Cholesterol – occurrence, structure, test, physiological activity. Metabolism of lipids: β -oxidation of fatty acids

Text Books

1. Jain, M.K.; Sharma, S.C. *Modern Organic Chemistry*, Vishal Publications: New Delhi, 2017.
2. Shanmugam, A. *Fundamentals of Biochemistry for Medical Students*, 6th ed.; Published by the author, 1999.
3. Veerakumari, L. *Biochemistry*, 1st ed.; MJP Publications: Chennai, 2004.
4. Thangammal Jacob, A textbook of applied chemistry, Mcmillan Company Ind. Ltd, 1997.
5. K. Bagavathi Sundari, Applied Chemistry, MJP publishers Chennai, 1st Ed., 2006.

Reference Books:

1. B.K. Sharma Conn, E.E.; Stumpf, P.K. *Outline of Biochemistry*, 5th ed.; Wiley Eastern: New Delhi, 2002.

2. West, E.S.; Todd, W.R.; Mason, H.S.; VanBruggen, J.T. *Text Book of Biochemistry*, 4th ed.; Macmillan: New York, 1970.
3. Lehninger, A.L. *Principles of Biochemistry*, 2nd ed.; CBS Publisher: Delhi, 1993.

CO No.	CO-Statements	K-Level
On Successful completion of the course, students will be able to		
CO-1	learn about in relations between the biomecules and medicine	K2
CO-2	Known about structure and properties of biomecules	K3
CO-3	Understand the biological functions of biomecules	K3
CO-4	Understand the biochemistry of nucleic acid and lipids	K1
CO-5	appreciate the medicinal uses of biomecules	K4

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: BOCHEMISTRY								Course Code: U6R3CHDSE7:2			
Course Outcomes (Cos)	Programme Outcomes(POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	2	3	2	2	3	3	2	2	3	2.3
CO2	3	3	1	3	2	3	2	3	3	3	2.6
CO3	2	1	3	2	2	3	2	2	3	3	2.3
CO4	3	2	1	2	2	3	3	3	3	3	2.5
CO5	3	1	2	3	3	3	3	2	3	3	2.6
	Mean Overall Score										2.46
	Result										High

Title of the Course	CHEMISTRY OF EVERYDAY LIFE	Marks: CIA:25 + Ext:75=100
Category of the Course	Discipline Specific Elective Course	Hrs/Week :04
Course Code	U6R3CHDSE8:1	Total Inst. Hrs: 60
Nature of the Course	Skill Development	Sem:VI Credit: 03

Objectives: To make students understand

1. *the characteristics of water*
2. *properties the essential oils, perfumes, flavours*
3. *cosmetics and their applications*
4. *the components of soap and their properties*
5. *the action of detergents*

Unit-I: Water Chemistry (12 Hrs)

Water- Characteristics of water – Surface water- Ground Water- Atmospheric water -Soft water and Hard water. **Hardness of Water-** Temporary Hardness- Permanent Hardness- Removal of hardness- Ion exchange and reverse osmosis method **Water Quality Parameters and determination** - pH-Electrical Conductivity- Dissolved Oxygen- Chemical Oxygen demand- Biological oxygen demand-Total Dissolved Solids-Alkalinity-SAR. **Heavy Metals:** Definition- Mercury- Cadmium- Zinc- Copper-Nickel-Aluminium-Chromium- Health Impacts of Metal.

Unit-II: Essential oils, Perfumes and Flavours (12 Hrs)

Essential oils – definition – occurrences – methods of production plants – steam distillation and expression method. **Perfumes:** Formulations, Requirements of a good perfume, composition of perfumes, classification of perfumery materials – animals - synthetic – formulations Manufacturing and Packaging processes of Perfumes. **Flavours:** Definition of flavours – classification, chemical composition, common characteristics, formulation, uses and hazards.

Unit-III: Cosmetics (12 Hrs)

Face cream, sun screen lotion, shaving cream-composition-formulation - uses and their hazard. Sprayer, hand lotion, nail lacquers; nail bleaches, hair oil, hair dyes – Composition, formulation-uses and their hazards.

Unit-IV: Soaps**(12 Hrs)**

Definition- Types of Soap- Medicated soaps, Herbal soaps. Soft soaps. Shaving soaps - Mechanism of action of soap.- Manufacture of soaps- Saponification of oils and fats- Formulation of toilet soaps. Different ingredients used and their functions. Shaving soap and creams- ISI specifications. Testing procedures/limits.

Unit-V: Detergents**(12 Hrs)**

Anionic Detergents: Manufacture of LAB (linear alkyl benzene). Sulphonation of LAB – preparation of acid slurry. Different ingredients in the formulation of detergent powders and soaps. Liquid detergents. Foam boosters. AOS (alpha olefin sulphonates). **Cationic detergents:** examples. Manufacture and applications. **Non-ionic** detergents: examples. Manufacture of ethylene oxide condensate. Mechanism of action of detergents. Comparison of soaps and detergents. Biodegradation – environmental effects. ISI specifications / limits.

Text Books:

1. Thangammal Jacob, A textbook of applied chemistry, Mcmillan Company Ind. Ltd, 1997.
2. K.Bagavathi Sundari, Applied Chemistry, MJP publishers Chennai, 1st Ed., 2006.

Reference Books:

1. B.K.Sharma, Industrial Chemistry, Goel Publishing House, 2011.
2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, 1st Ed., S.Chand Company Ltd – New Delhi, 2010.

CO No.	CO-Statements	K-Level
On Successful completion of the course, students will be able to		
CO-1	learn about in chemistry in everyday life	K2
CO-2	set up as small entrepreneurs	K3
CO-3	Get awareness on effect of cosmetics, understand more about cosmetics and their uses	K3
CO-4	Understand the importance of fuels and fire protection	K1
CO-5	appreciate the medicinal uses of chemical products	K4

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: CHEMISTRY OF EVERYDAY LIFE							Course Code: U6R3CHDSE8:1				
Course Outcomes (Cos)	Programme Outcomes(POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	2	3	2	2	3	3	2	2	3	2.3
CO2	3	3	1	3	2	3	2	3	3	3	2.6
CO3	2	1	3	2	2	3	2	2	3	3	2.3
CO4	3	2	1	2	2	3	3	3	3	3	2.5
CO5	3	1	2	3	3	3	3	2	3	3	2.6
	Mean Overall Score										2.46
	Result										High

Title of the Course	SOIL DAIRY AND LEATHER CHEMISTRY	Marks: CIA:25 + Ext:75=100
Category of the Course	Discipline Specific Elective Course	Hrs/Week :04
Course Code	U6R3CHDSE8:2	Total Inst. Hrs: 60
Nature of the Course	Skill Development	Sem:VI Credit:03

Objectives: To enable students to learn

1. about different types of soil
2. the composition of fertilizers
3. the various processes of water chemistry
4. about leather and dairy chemistry
5. various industrial processes involved in manufacturing processes

Unit – I: Soil Chemistry (12 Hrs)

Soil Chemistry: Introduction - soil classification, physical and chemical properties of soil, soil water, soil air, soil temperature, soil minerals, soil colloids, soil reaction and buffering – soilpH, soil acidity, soil salinity and alkalinity, soil fertility and soil formation.

Unit– II: Fertilizers (12 Hrs)

Fertilizers: Organic Manures - Farmyard Manure - compost - oil cakes - bone meal – meatmeal - fish meal - blood meal and green manures - Fertilizers - classification of fertilizers -requisites

of a good fertilizers – preparation properties and uses of nitrogenous fertilizers, urea, CAN - phosphatic fertilizers - super phosphate of lime - triple super phosphate - NPK fertilizers – ill effects of fertilizers -Micronutrients – definition - role of micronutrients in plants .

Unit – III: Water Chemistry (12 Hrs)

Water Chemistry: Water – types of water – soft and hard water – hardness, degree of hardness, temporary and permanent hardness, removal of hardness - Reverse osmosis and ionexchange methods – principle and techniques. Water analysis - Determination of TDS, Totalhardness by EDTA, BOD and COD.

Unit – IV: Leather Chemistry (12 Hrs)

Leather Chemistry: Introduction, chief process used in leather manufacture, structure ofhide and skin, leather processing-process before tannage - tanning process- vegetable tanning and chrome tanning, Tannery effluent and by product problems and treatment .

Unit – V: Dairy Chemistry (12 Hrs)

Dairy Chemistry: Milk - Definition, physicochemical properties of milk, constituents of milk, chemical change taking place in milk - boiling, pasteurization, sterilization and homogenization. Definition and composition of creams, butter, ghee and ice creams. Milk powder, definition, need for making powder. Principles involved in drying process - spray drying and drum drying.

Reference Books:

1. B.K.Sharma, Industrial Chemistry, 13th Ed., Goel Publishing House, Reprint 2011.
2. Dilip Kumar Das, Introductory Soil Science, 1st Ed., Kalyani Publishers, Reprint 2002.
3. Gurdeep Chatwal, Organic Chemistry of Natural Products, Vol. 2, Himalaya Publishing House, 3rd Edition, 2013.
4. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, 1stEd., S.Chand & Co Ltd,2010.
5. Clarence Henry Eckles, Willes Barnes Combs, Harold Macy, Milk and Milk Products, 4th Ed., Tata McGraw Hill Publishing Company Ltd, Reprint 2002.
6. G.R. Agarwal, Kiran Agarwal and O.P. Agarwal, Agarwal's Text Book of Biochemistry, 11th Ed., Goel Publishing House, 2014

CO No.	CO-Statements	K-Level
On Successful completion of the course, students will be able to		
CO-1	apply their knowledge on soil and fertilizers, water, leather and dairy in	K3

	practical life	
CO-2	advise farmers on the use of fertilizers	K2
CO-3	Take up employment in leather processing and dairying	K3
CO-4	set-up MSME'S in the fields studied	K1
CO-5	apply their knowledge on soil and fertilizers, water, leather and dairy in practical life	K3

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: SOIL, DAIRY AND LEATHER CHEMISTRY										Course Code: U6R3CHDSE8:2	
Course Outcomes (Cos)	Programme Outcomes(POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	3	3	2	3	3	2	2	2	3	2.4
CO2	3	3	1	3	3	2	2	3	3	3	2.6
CO3	2	1	2	2	2	3	3	3	3	3	2.4
CO4	3	2	1	2	2	2	3	3	3	3	2.4
CO5	3	1	3	3	2	3	2	3	3	3	2.6
Mean Overall Score											2.46
Result											High

Title of the Course	Green Chemistry	Marks: CIA:25+ Ext:75=100
Category of the Course	Skill Enhancement Course	Hrs/Week :02
Course Code	U6R3CHSEC7:1	Total Inst. Hrs: 30
Nature of the Course	Employability	Sem:VI Credit: 02

Objectives: To enable students learn

1. the basics of green chemistry
2. about green reagents in synthetic chemistry
3. microwave green synthesis
4. the importance of PTC
5. the synthetic application of catalysis and biocatalysts

Unit-I: Introduction to Green Chemistry

(06 Hrs)

1.1. Green chemistry- General introduction – need of green chemistry – principles of green chemistry – planning a green synthesis in chemistry lab – choice of starting material, reagents, catalysts and solvents.

1.2. Green chemistry in day today life—dry cleaning of clothes, versatile bleaching agents – environmental pollution.

Unit- II: Green Reagents and Catalysts

(06 Hrs)

2.1. Green reagents: Dimethyl carbonate, Polymer supported reagents – Polymer supported chromic acid, Poly N-Bromo succinamide, Polystyrene Wittig reagent, Polystyrene anhydride.

2.2. Green catalyst: Acid catalyst, Base catalyst, Oxidation catalyst, Polymer supported catalyst- Polystyrene Aluminium chloride, Polymeric super acid catalyst

Unit-III: Microwave induced Green Synthesis

(06 Hrs)

3.1. Microwave method-General introduction, Microwave assisted reaction in water : Hydrolysis, Oxidation of alcohol, saponification reaction.

3.2. Microwave assisted reaction in organic solvents: Esterification, Diels-Alder reaction, Claisen rearrangement.

3.3. Microwave assisted solvent free reaction(Solidstate): Deacetylation, Saponification of ester, reductions, synthesis of heterocyclic compounds.

Unit-IV : Phase Transfer Catalysis in Green Chemistry

(06 Hrs)

4.1. Introduction- Application of PTC in organic synthesis – Elimination reactions, N-Alkylation, C-Alkylation, Wittig reaction, Darzen reaction. Crown ethers: Esterification, Aromatic substitution reaction, Alkylation reactions, Elimination reactions, Displacement reactions.

Unit-V: Bio Catalysis in Organic Chemistry

(06 Hrs)

5.1. Introduction- Biochemical oxidation, Reduction Enzyme catalysed hydrolytic process – Enantio selective hydrolysis of meso, di ester, hydrolysis of N-acyl amino acids, Green chemistry in pharmaceuticals – Synthesis of Ibuprofen, Paracetamol, Benzimidazole.

Unit -VI: Latest Learning's (For CIA only)

(06 Hrs)

Latest development related to the course during the semester concerned

Course outcomes: At the end of the course, the learners will be able to

CO-1: appreciate the application of green chemistry in everyday life (K1)

CO-2: understand the applications of green reagents (K2)

CO-4: understand PTC in green chemistry (K4)

Text Books:

1. V.K. Ahluwalia, Green chemistry, Anees Books India, New Delhi, 2nd edition 2015.
2. V.K. Ahluwalia, M. Kidwai, New Trends in Green chemistry, 2nd Ed., Anamaya Publication, New Delhi, 2008.
3. Dr.K.R.Desai, Green Chemistry-Microwave synthesis, Himalaya publication House, Mumbai, 2nd revised Edition 2014.

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: Green Chemistry							Course Code: U6R3CHSEC7:1				
Course Outcomes (Cos)	Programme Outcomes(POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	2	3	2	2	3	3	2	2	3	2.3
CO2	3	3	1	3	2	3	2	3	3	3	2.6
CO3	2	1	3	2	2	3	2	2	3	3	2.3
CO4	3	2	1	2	2	3	3	3	3	3	2.5
CO5	3	1	2	3	3	3	3	2	3	3	2.6
	Mean Overall Score										2.46
	Result										High

Title of the Course	MATERIAL CHEMISTRY AND NANO TECHNOLOGY	Marks:CIA:25+ Ext:75=100
Category of the Course	Skill Enhancement Course	Hrs/Week :02
Course Code	U6R3CHSEC7:2	Total Inst. Hrs: 30
Nature of the Course	Entrepreneurship	Sem:VI Credit: 02

Objectives: To make students learn

1. *ionic crystals and solid electrolytes*
2. *about magnetic materials and insulating material*
3. *about metallic glasses and biomaterials*
4. *nanophase materials*
5. *the applications of nanomaterials*

Unit-I: Ionic Conductivity and Solid Electrolytes

(06 Hrs)

Types of ionic crystals—alkali halides – silver chloride-alkali earth fluovider –simple stoichiometric oxides. Types of ionic conductors – halide ion conductors – oxide ion conductors – solid electrolytes – applications of solid electrolytes. **Electrochemical cell** – principles – batteries, sensors and fuel cells – crystal defects in solids – line and plane defects – point defects - schottky and frenkel defects. **Electronic properties and band theory**;metals, semiconductors – Inorganic solids – colour, magnetic and optical properties, luminescence

Unit II: Magnetic Materials

(06 Hrs)

Introduction – types of magnetic materials – diamagnetism – paramagnetism, ferromagnetism. Ferrites : Preparation and their applications in microwave –floppy disk – magnetic bubble memory and applications. **Insulating Materials**:Classification on the basis of temperature – Blymer insulating materials and ceramic insulating materials. Ferro electric materials: examples – applications of ferroelectrics.

Unit III: Modern Engineering Materials

(06 Hrs)

Metallic glasses-introduction –composition, properties and applications. Shape memory alloys:introduction–examples–application of SMA–advantages and disadvantages. **Biomaterials**:Introduction –metals and alloys in biomaterials –ceramic biomaterials, composite biomaterials-polymer biomaterials.

Unit IV : Nanophase Materials**(06 Hrs)**

Introduction–techniques for synthesis of nanophase materials-sol-gel synthesis-electrodeposition –inert gas condensation-mechanical alloying. **Properties of nanophase materials**–applications of nanophase materials, composite materials: **Introduction** –types.

Unit V: Nano Technology**(06 Hrs)**

Introduction-importance - various stages of nanotechnology -nanotube technology - nanoparticles - fullerenes-nano dendrimers - nanopore channels, fibres and scaffolds – CVD dismond technology –FCVA technology and its applications – nano imaging techniques.

Reference Books:

1. A. R. West, Solid state chemistry and its applications, John wiley and sons, 2nd Edition (2014).
2. V. R. Raghavan, Materials Science and Engineering, Printice Hall (India) Ltd.,5th Edition (2011).
3. K. J. Klabunde, Nanoscale materials in chemistry, A. John Wiley and Sons Inc. Publication,1st Edition, (2001).

CO No.	CO-Statements	K-Level
On Successful completion of the course, students will be able to		
CO-1	Know about the solid electrolytes and their applications	K1
CO-2	understand magnetic material and their properties	K2
CO-3	understand modern nanotechnology and its application	K2
CO-4	Get knowledge on preparatory methods of nanophase material	K4
CO-5	appreciate the commercial potential of nanomaterial	K5

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: MATERIAL CHEMISTRY AND NANOTECHNOLOGY							Course Code: U6R3CHSEC7:2				
Course Outcomes (Cos)	Programme Outcomes(POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	1	2	2	2	3	2	2	3	2.3
CO2	3	3	1	2	3	3	2	3	3	3	2.6

CO3	2	3	3	1	2	3	3	2	3	3	2.5
CO4	3	2	1	2	3	2	3	3	3	3	2.5
CO5	3	1	3	3	2	3	2	3	3	3	2.6
Mean Overall Score											2.50
Result											High

Title of the Course :	CHEMISTRY-I	Marks: CIA:25 + Ext:75=100
Category of the Course:	DSE	Hrs/Week :05
Course Code :	U1R3BCDSE1	Total Inst. Hrs: 80
Nature of the Course :	Skill Development	Sem: I Credit: 05

Objectives: This course aims at providing knowledge on

1. Basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry
2. Nuclear chemistry and industrial chemistry
3. Importance of speciality drugs.
4. To learn about separation and purification techniques.
5. Understand the concepts of analytical techniques.

UNIT I :Chemical Bonding and Nuclear Chemistry (16 Hrs)

Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M.O diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. Nuclear Chemistry: Fundamental particles-Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions- group displacement law. Nuclear binding energy -mass defect-calculations. Nuclear fission and nuclear fusion – differences Stellar energy. Applications of radioisotopes – carbon dating, rock dating and medicinal applications.

Unit II: Industrial Chemistry (16 Hrs)

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

UNIT III: Fundamental Concepts in Organic Chemistry (16 Hrs)

Hybridization: Orbital overlap hybridization and geometry of CH₄, C₂H₄, C₂H₂ and C₆H₆. Polar effects: Inductive effect and consequence on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyperconjugation and steric-examples and explanation. Reaction mechanisms: Types of reactions- aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

UNITIV: Drugs and Speciality Chemicals (16 Hrs)

Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon.

UNITV: Analytical Chemistry (16 Hrs)

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

Reference Book

1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, 20th Edition, 2007.
2. B.K.Sharma, Industrial Chemistry; GOEL publishing house, Meerut, 6th Edition, 2014.
3. Jayashreegosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.

Course Outcomes

Course Name: CHEMISTRY-I		Course Code: U1R3BCDSE1	K-Level
On Successful completion of the course, students will be able to			
CO-1	State the theories of chemical bonding, nuclear reactions and its application		K3
CO-2	Evaluate the efficiencies and use of various fuels and fertilizers.		K4
CO-3	Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.		K2
CO-4	Demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.		K5
CO-5	Analyse various methods to identify an appropriate method for the separation of Chemical components.		K3

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: Chemistry-I										Course Code: U1R3BCDSE1					
Course Outcomes (COs)	PO										PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	2	2	2	3	3	3	3	3

CO3	3	3	3	2	3	3	3	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
CO5	3	2	3	3	3	3	3	2	2	3	3	3	3	3	3
Weightage											15	15	15	15	15
Weighted percentage of Course Contribution to Posss											3.0	3.0	3.0	3.0	3.0

Title of the Course :	CHEMISTRY-II	Marks: CIA:25 + Ext:75=100
Category of the Course :	DSE	Hrs/Week :05
Course Code :	U2R3BCDSE2	Total Inst. Hrs: 80
Nature of the Course :	Skill Development	Sem: II Credit: 05

Objectives: The course aims at giving an overall view of the

1. Nomenclature of coordination compounds and carbohydrates.
2. Amino Acids and Essential elements of biosystem
3. Understand the concepts of kinetics and catalysis
4. Provide fundamentals of electrochemistry and photo chemistry
5. Improve for water based techniques.

UNITI:Co-ordination Chemistry and Water Technology (16 Hrs)

Co-ordination Chemistry: **Definition of terms – IUPAC** Nomenclature- Werner's theory- EAN rule Pauling's theory – Postulates – Applications to $[\text{Ni}(\text{CO})_4]$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Co}(\text{CN})_6]^{3-}$ Chelation-Biological role of Hemoglobin and Chlorophyll (elementary idea) –Applications in qualitative and **quantitative analysis**. **Water Technology**: Hardness of water, determination of hardness of water using EDTA method, zeolite method –Purification techniques–BOD and COD.

Unit II:Carbohydrates (16 Hrs)

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

Unit III: Amino Acids and Essential elements of biosystem (16 Hrs)

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

UNIT IV : Electrochemistry (16 Hrs)

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

UNIT V:Photochemistry (16 Hrs)

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

Reference Book

1. Arun Bahl,B.S.Bahl, Advanced Organic Chemistry;S.Chand and Company,New Delhi, 23rd edition,2012.
2. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons,New Delhi, 29th edition,2007.
4. B.R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co.,New Delhi,47th edition,2018.
5. B.K,Sharma, Industrial Chemistry; GOEL publishing house,Meerut.

Course Outcomes

Course Name: CHEMISTRY-II	Course Code: U2R3BCDSE2	K-Level
On Successful completion of the course, students will be able to		

CO-1	Write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology.	K3
CO-2	Explain the preparation and property of carbohydrate.	K4
CO-3	Enlighten the biological role of transition metals, aminoacids and nucleicacids.	K2
CO-4	Apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.	K5
CO-5	Outline the various type of photochemical process.	K3

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Title of the Course: Chemistry-II							Course Code: U2R3BCDSE2								
Course Outcomes (COs)	PO										PSO				
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	2	2	2	3	3	3	3	3
CO3	3	3	3	2	3	3	3	2	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
CO5	3	2	3	3	3	3	3	2	2	3	3	3	3	3	3
Weightage											15	15	15	15	15
Weighted percentage of Course Contribution to POs											3.0	3.0	3.0	3.0	3.0

Title of the Course :	ALLIED CHEMISTRY-I (For Physics)	Marks: CIA:25 + Ext:75=100
Category of the Course :	Core Course	Hrs/Week :05
Course Code :	U3R3PHDSE3	Total Inst. Hrs: 80
Nature of the Course :	Skill Development	Sem: III Credit: 05

Objectives: This course aims at providing knowledge on

1. Basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry
2. Nuclear chemistry and industrial chemistry
3. Importance of speciality drugs.
4. Basics and applications of kinetics and catalysis
5. Understand the concepts of analytic techniques.

UNIT-I : Chemical Bonding and Nuclear Chemistry (16 hours)

Chemical Bonding: Molecular Orbital Theory- bonding, antibonding and non-bonding orbitals. M.O diagrams of Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. Nuclear Chemistry: Fundamental particles- Isotopes, Isobars, Isotones and Isomers- Differences between chemical reactions and nuclear reactions- group displacement law. Nuclear binding energy –mass defect- calculations. Nuclear fission and nuclear fusion- differences– Stellar energy. Applications of radioisotopes- carbon dating, rock dating and medicinal applications.

Unit-II: Industrial Chemistry (16 hours)

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

UNIT-III: Fundamental Concepts in Organic Chemistry (16 hours)

Hybridization: Orbital overlap hybridization and geometry of CH_4 , C_2H_4 , C_2H_2 and C_6H_6 . Polar effects: Inductive effect and consequences on K_a and K_b of organic acids and bases,

electromeric, mesomeric, hyperconjugation and steric-examples and explanation. Reaction mechanisms: Types of reactions- aromaticity-aromatic Electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

UNIT-IV: Kinetics and Catalysis

(16 hours)

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

UNIT-V: Analytical Chemistry

(16 hours)

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

Recommended Text

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

Reference Book

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

Course Learning Outcomes

CO-1 : State the theories of chemical bonding, nuclear reactions and its application (K3)

CO2 : Evaluate the efficiencies and uses of various fuels and fertilizers. (K2)

CO-5 : Analyse various methods to identify an appropriate method for the separation of Chemical components. (K5)

[illegible]

Title of the Course :	ALLIED CHEMISTRY II PRACTICAL (For Physics)	Marks: CIA:40 + Ext:60=100
Category of the Course:	Core Course	Hrs/Week :04
Course Code :	U4R3PHDSE4P	Total Inst. Hrs: 60
Nature of the Course :	Skill Development	Sem: IV Credit: 03

Objectives: This course aims at providing knowledge on

1. Basics of preparation of solutions.
2. Principles and practical experience of volumetric analysis
3. Identification of organic functional groups
4. Different types of organic compounds with respect to their properties.
5. Determination of elements inorganic compounds..

VOLUMETRIC ANALYSIS (30 hours)

1. Estimation of sodium hydroxide using standard sodium carbonate.
2. Estimation of hydrochloric acid using standard oxalic acid.
3. Estimation of ferrous sulphate using standard Mohr's salt.
4. Estimation of oxalic acid using standard ferrous sulphate.
5. Estimation of potassium permanganate using standard sodium hydroxide.
6. Estimation of magnesium using EDTA.
7. Estimation of ferrous ion using diphenylamine as indicator.

SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS (30 hours)

The analysis must be carried out as follows:

- (a) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose].
- (b) Detection of elements (N, S, Halogens).
- (c) To distinguish between aliphatic and aromatic compounds.
- (d) To distinguish– Saturated and unsaturated compounds.

Reference Book

1. V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.

Course Learning Outcomes

CO-5 : Analyze the chemical constituents in allied chemical products (K3)

[illegible]

Title of the Course :	ALLIED CHEMISTRY-I (For Botony)	Marks: CIA:25 + Ext:75=100
Category of the Course :	Core Course	Hrs/Week :05
Course Code :	U3R3BODSE3	Total Inst. Hrs: 80
Nature of the Course :	Skill Development	Sem: III Credit: 05

Objectives: This course aims at providing knowledge on

6. Basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry
7. Nuclear chemistry and industrial chemistry
8. Importance of speciality drugs.
9. Basics and applications of kinetics and catalysis
10. Understand the concepts of analytic techniques.

UNIT-I : Chemical Bonding and Nuclear Chemistry (16 hours)

Chemical Bonding: Molecular Orbital Theory- bonding, antibonding and non-bonding orbitals. M.O diagrams or Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. Nuclear Chemistry: Fundamental particles- Isotopes, Isobars, Isotones and Isomers- Differences between chemical reactions and nuclear reactions- group displacement law. Nuclear binding energy –mass defect- calculations. Nuclear fission and nuclear fusion- differences– Stellar energy. Applications of radioisotopes- carbon dating, rock dating and medicinal applications.

Unit-II: Industrial Chemistry (16 hours)

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

UNIT-III: Fundamental Concepts in Organic Chemistry (16 hours)

Hybridization: Orbital overlap hybridization and geometry of CH_4 , C_2H_4 , C_2H_2 and C_6H_6 . Polar effects: Inductive effect and consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyperconjugation and steric-examples and explanation. Reaction mechanisms: Types of reactions- aromaticity-aromatic Electrophilic substitution; nitration,

halogenation, Friedel-Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

UNIT-IV: Kinetics and Catalysis

(16 hours)

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

UNIT-V: Analytical Chemistry

(16 hours)

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

Recommended Text

5. V.Veeraiyan, Text book of Ancillary Chemistry; Highmount publishing house, Chennai, first edition, 2009.
6. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
7. S.ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.
8. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

Reference Book

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

Course Learning Outcomes

CO-1 : State the theories of chemical bonding, nuclear reactions and its application (K3)

CO2 : Evaluate the efficiencies and uses of various fuels and fertilizers. (K2)

CO-3 : Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions. (K3)

Title of the Course :	ALLIED CHEMISTRY II PRACTICAL (For Botony)	Marks: CIA:40 + Ext:60=100
Category of the Course:	Core Course	Hrs/Week :04
Course Code :	U4R3BODSE4P	Total Inst. Hrs: 60
Nature of the Course :	Skill Development	Sem: IV Credit: 03

Objectives: This course aims at providing knowledge on

1. Basics of preparation of solutions.
2. Principles and practical experience of volumetric analysis
3. Identification of organic functional groups
4. Different types of organic compounds with respect to their properties.
5. Determination of elements inorganic compounds..

VOLUMETRIC ANALYSIS (30 hours)

8. Estimation of sodium hydroxide using standard sodium carbonate.
9. Estimation of hydrochloric acid using standard oxalic acid.
10. Estimation of ferrous sulphate using standard Mohr's salt.
11. Estimation of oxalic acid using standard ferrous sulphate.
12. Estimation of potassium permanganate using standard sodium hydroxide.
13. Estimation of magnesium using EDTA.
14. Estimation of ferrous ion using diphenylamine as indicator.

SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS (30 hours)

The analysis must be carried out as follows:

- (e) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose].
- (f) Detection of elements (N, S, Halogens).
- (g) To distinguish between aliphatic and aromatic compounds.
- (h) To distinguish– Saturated and unsaturated compounds.

Reference Book

2. V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.

Course Learning Outcomes

CO-1 : Gain understanding of the use of standard flask and volumetric pipettes, burette (K3)

CO-2 : Design, carryout, record and interpret the results of volumetric titration. (K4)

CO-3 : Apply the is skill in the analysis of water/ hardness. (K2)

CO-4: Apply their skill in the analysis of organic compounds (K5)

CO-5 : Analyze the chemical constituents in allied chemical products (K3)

Relationship Matrix for course Outcome, Programme Outcomes and Programme Specific Outcomes

Course Name: ALLIED CHEMISTRY II PRACTICAL						Course Code: U3R3BODSE4P					
	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Scores of COs
Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	3	3	3	3	3.0
CO2	2	3	3	3	2	3	3	3	3	3	2.8
CO3	3	3	3	2	3	3	3	3	3	3	2.9
CO4	3	3	3	3	3	3	3	3	3	3	3.0
CO5	3	2	3	3	3	3	3	3	3	3	2.9

Title of the Course :	ALLIED CHEMISTRY-I (For mathematics)	Marks: CIA:25 + Ext:75=100
Category of the Course :	Core Course	Hrs/Week :05
Course Code :	U3R3MADSE3	Total Inst. Hrs: 80
Nature of the Course :	Skill Development	Sem: III Credit: 05

Objectives: This course aims at providing knowledge on

11. Basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry
12. Nuclear chemistry and industrial chemistry
13. Importance of speciality drugs.
14. Basics and applications of kinetics and catalysis
15. Understand the concepts of analytic techniques.

UNIT-I : Chemical Bonding and Nuclear Chemistry (16 hours)

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

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

Unit-II: Industrial Chemistry

(16 hours)

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

UNIT-III: Fundamental Concepts in Organic Chemistry

(16 hours)

Hybridization: Orbital overlap hybridization and geometry of CH_4 , C_2H_4 , C_2H_2 and C_6H_6 . Polar effects: **Inductive effect** and consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyperconjugation **and steric-examples and** explanation. Reaction mechanisms: Types of reactions- aromaticity-aromatic Electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

UNIT-IV: Kinetics and Catalysis

(16 hours)

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

UNIT-V: Analytical Chemistry

(16 hours)

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

Recommended Text

9. V.Veeraiyan, Text book of Ancillary Chemistry; Highmount publishing house, Chennai, first edition, 2009.
10. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
11. S.ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company,

12. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; S ultan Chand & sons, New Delhi, twenty ninth edition,2007.

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

CO-1 : State the theories of chemical bonding, nuclear reactions and it application (K3)

CO2 : Evaluate the efficiencies and uses of various fuels and fertilizers. (K2)

CO-3 : Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions. (K3)

CO-4 : Identify the reaction rate, order for chemical reaction and explain the purpos catalyst. (K4)

CO-5 : Analyse various methods to identify an appropriate method for the separation of Chemical components. (K5)

[illegible]

Title of the Course :	ALLIED CHEMISTRY II PRACTICAL (For mathamatics)	Marks: CIA:40 + Ext:60=100
Category of the Course:	Core Course	Hrs/Week :04
Course Code :	U4R3MADSE4P	Total Inst. Hrs: 60
Nature of the Course :	Skill Development	Sem: IV Credit: 03

Objectives: This course aims at providing knowledge on

1. Basics of preparation of solutions.
2. Principles and practical experience of volumetric analysis
3. Identification of organic functional groups
4. Different types of organic compounds with respect to their properties.
5. Determination of elements inorganic compounds..

VOLUMETRIC ANALYSIS (30 hours)

15. Estimation of sodium hydroxide using standard sodium carbonate.
16. Estimation of hydrochloric acid using standard oxalic acid.
17. Estimation of ferrous sulphate using standard Mohr's salt.
18. Estimation of oxalic acid using standard ferrous sulphate.
19. Estimation of potassium permanganate using standard sodium hydroxide.
20. Estimation of magnesium using EDTA.
21. Estimation of ferrous ion using diphenylamine as indicator.

SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS (30 hours)

The analysis must be carried out as follows:

- (i) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose].
- (j) Detection of elements (N, S, Halogens).
- (k) To distinguish between aliphatic and aromatic compounds.
- (l) To distinguish– Saturated and unsaturated compounds.

Reference Book

3. V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.

CO-1 : Gain understanding of the use of standard flask and volumetric pipettes, burette (K3)
CO-2 : Design, carryout, record and interpret the results of volumetric titration. (K4)
CO-3 : Apply the is skill in the analysis of water/ hardness. (K2)
CO-4: Apply their skill in the analysis of organic compounds (K5)
CO-5 : Analyze the chemical constituents in allied chemical products (K3)

[illegible]