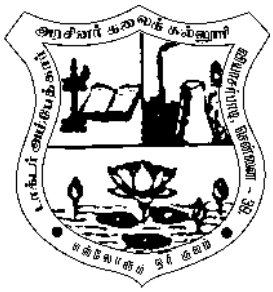
Dr. AMBEDKAR GOVERNMENT ARTS COLLEGE
(AUTONOMOUS)
CHENNAI - 600 039

(Accredited by NAAC at level "B")



B. Sc., CHEMISTRY SYLLABUS

Under Choice Based Credit System

LEARNING OUTCOME BASED CURRICULUM FRAMEWORK (LOCF)

(FOR CANDIDATES ADMITTED FROM 2022-23 ONWARDS)

PG & RESEARCH DEPARTMENT OF CHEMISTRY

Based on UGC – Learning Outcomes-Based Curriculum Framework

B.Sc Course Structure under Choice Based Credit System

(For the candidates admitted from the academic year 2022-2023 onwards)

Sem. No	Part No.	Course	Subject code	Course Title	Ins. Hrs/Week	Credit	Exam Hrs	Marks		Total
								Int	Ext	
I	I	LC – I	22UAFTA1	General Tamil – I	6	3	3	25	75	100
	II	ELC – I	22UACEN1	Communicative English – I	4	3	3	50	50	100
	III	CC – I	22UACHC1	General Chemistry I	6	4	3	25	75	100
	III	CCP*	Even Sem.	**Volumetric Analysis Practical**	3	-	-	40	60	100
	III	AC – I	22UAMAA1 / 22UAAZA1	Allied Mathematics – I / Allied Zoology – I	7 / 4	5 / 3	3	25	75	100
	III	ACP *	Even Sem.	**Practical - Allied Zoology**	3	-	-	40	60	100
	IV	NME – I	22UACHN1	One from the NME Subjects	2	2	3	25	75	100
	IV	SBE – I	22UAPPS1	Professional English for Physical Science – I	2	3	3	50	50	100
				Total	**30**	**20/18**				
II	I	LC – II	22UBFTA2	General Tamil – II	6	3	3	25	75	100
	II	ELC – II	22UBCEN2	Communicative English – II	4	3	3	50	50	100
	III	CC – II	22UBCHC1	General Chemistry II	6	4	3	25	75	100
	III	CCP – I	22UBCHC2	**Volumetric Analysis Practical**	3	3	3	40	60	100
	III	AC – II	22UBMAA2 / 22UBAZA2	Allied Mathematics – II / Allied Zoology – II	7 / 4	5 / 3	3	25	75	100
	III	ACP-III	22UBAZA3	**Practical - Allied Zoology**	3	4	3	40	60	100
	IV	NME – II	22UBCHN2	One from the NME Subjects	2	2	3	25	75	100
	IV	SBE – II	22UBPPS2	Professional English for Physical Science – II	2	3	3	50	50	100
				Total	**30**	**27/25**				
III	I	LC – III	22UCFTA3	General Tamil – III	6	3	3	25	75	100
	II	ELC – III	22UCLTS1	Language Through Literature - I	4	3	3	50	50	100
	III	CC – IV	22UCCHC1	General Chemistry III	6	4	3	25	75	100
	III	CCP*	Even Sem.	**Inorganic Qualitative Analysis**	3	-	-	40	60	100
	III	AC – IV	22UCPHA1	Allied Physics – I	4	3	3	25	75	100
	III	ACP**	Even Sem.	**Practical - Allied Physics**	3	-	-	40	60	100
	IV	EVS	22UCEVS1	Environmental Studies	2	2	3	25	75	100
	IV	SBE – III	22UCSBE3	SS III – Personality Enrichment	2	3	3	40	60	100
				Total	**30**	**18**				
IV	I	LC – IV	22UDFTA4	General Tamil – IV	6	3	3	25	75	100
	II	ELC – IV	22UDLTS2	Language Through Literature - II	4	3	3	50	50	100
	III	CC – V	22UDCHC1	General Chemistry IV	6	4	3	25	75	100
	III	CCP – II	22UDCHC2	**Inorganic Qualitative Analysis**	3	3	3	40	60	100
	III	AC – V	22UDPHA2	Allied Physics – II	4	3	3	25	75	100
	III	ACP -VI	22UDPHA3	**Practical - Allied Physics**	3	4	3	40	60	100
	IV	VBE	22UDVBE1	Value Based Education	2	2	3	25	75	100

	IV	SBE – IV	22UDSBE4	SS IV- Computer Basics and Office Automation / Android Programming (for CS)	2	3	3	40	60	100
	V	Extension	22UDEXT1	Extension Activities	-	1	-	-	-	-
				Total	**30**	**26**				
V	III	CC – VII	22UECHC1	Organic Chemistry I	5	4	3	25	75	100
	III	CC – VIII	22UECHC2	Inorganic Chemistry I	5	4	3	25	75	100
	III	CC – IX	22UECHC3	Physical Chemistry I	5	4	3	25	75	100
	III	CCP*	Even Sem.	**Physical Chemistry Practical**	3	-	-	40	60	100
	III	CCP*	Even Sem.	**Gravimetric Estimation Practical**	3	-	-	40	60	100
	III	CCP*	Even Sem.	**Organic Analysis Practical**	4	-	-	40	60	100
	III	CEC – I	22UECHE1A	One from the Elective-I Subjects	5	5	3	25	75	100
				Total	**30**	**17**				
VI	III	CC – X	22UFCHC1	Organic Chemistry II	5	4	3	25	75	100
	III	CC – XI	22UFCHC2	Inorganic Chemistry II	5	4	3	25	75	100
	III	CC – XII	22UFCHC3	Physical Chemistry II	5	4	3	25	75	100
	III	CCP-III	22UFCHC4	**Physical Chemistry Practical**	3	4	3	40	60	100
	III	CCP-IV	22UFCHC5	**Gravimetric Estimation Practical**	3	4	3	40	60	100
	III	CCP- V	22UFCHC6	**Organic Analysis Practical**	3	4	3	40	60	100
	III	CEC – II	22UFCHE2B	One from the Elective-II Subjects	3	5	3	25	75	100
	III	CEC – III	22UFCHE3A	One from the Elective –III Subjects	3	5	3	25	75	100
				Total	**30**	**34**				
				Total Credits	**180**	**142**				

*** Practical Exam at the end of second semester**

**** Practical Exam at the end of fourth semester**

CORE ELECTIVE COURSES:

Elective-I (Any one subject of the following Core Elective chosen by the candidate)		**Elective-II** (Any one subject of the following Core Elective chosen by the candidate)		**Elective-III** (Any one subject of the following Core Elective chosen by the candidate)	
***Sub. Code**	**Core Elective Courses**	**#Sub. Code**	**Core Elective Courses**	**##Sub. Code**	**Core Elective Courses**
22UECHE1A	Agricultural Chemistry	22UFCHE2A	Forensic Chemistry	22UFCHE3A	Analytical Chemistry
22UECHE1B	Food Chemistry	22UFCHE2B	Pharmaceutical Chemistry	22UFCHE3B	Bio Chemistry

The Department ofChemistry offers non-major elective to other department:

NON- MAJOR ELECTIVE COURSE:

I Semester (Any one subject of the following Non Major Elective chosen by the candidate)		II Semester (Any one subject of the following Non Major Elective chosen by the candidate)	
@Sub. Code	**Non Major Elective**	**@@Sub. Code**	**Non Major Elective**
22UACHN1A	Chemistry in Everyday life	22UBCHN2A	Industrial Chemistry
22UACHN1B	Dairy chemistry	22UBCHN2B	Applied Chemistry

ALLIED CHEMISTRY FOR MATHS AND PHYSICS

Course code	Name of the paper
22UACHA1/ 22UCCHA1	Allied Chemistry for Maths-I/Allied Chemistryfor Physics- I
22UBCHA2/ 22UDCHA2	Allied Chemistryfor Maths-II/ Allied Chemistryfor Physics- II
22UBCHA3	Allied Chemistry Practical

ALLIED CHEMISTRY FOR ZOOLOGY,BOTANY AND HOME SCIENCE

Course code	Name of the paper
	Allied Chemistry for Home Science-I/Allied chemistry for Zoology
	Allied Chemistry-II

SEMESTER I

B.Sc. Degree Programme in Chemistry

FIRST SEMESTER				
Course Title		GENERAL CHEMISTRY – I		
Course Code		22UACHC1		
Course No.	Course Category Core/Elective	No. of Credits	No. of hours/week	Total Marks (Int + Ext)
CC – I	Core	4	6	25 + 75 = 100

Course Objectives

- To learn the shape of atomic orbitals, various type of quantum numbers and learn trend of the periodic properties of elements.
- To understand the theories of chemical bonding, nature of covalent and ionic bonds; concept of hybridization and shapes of simple inorganic molecules.
- To understand and gain the basic knowledge on the classification and IUPAC nomenclature of organic compounds.
- To study about hybridization and geometry of organic molecules; Molecular forces of interaction in organic molecules and influence of electronic effects.
- To understand the theories and concepts behind various atomic models, evolution of quantum theory and wave mechanical concept.

Unit-I: Periodic Properties 15 Hours

Atomic orbitals - Quantum numbers- Principal, Azimuthal, Magnetic and Spin quantum numbers and their significance - principles governing the occupancy of electrons in various quantum levels- Pauli's exclusion principle – Hund's rule- Aufbau Principle, (n+1) rule- Stability of half-filled and completely filled orbitals- inert pair effect.
Periodic properties – atomic volume – atomic and ionic radii – ionization potential – electron affinity and electro negativity - factors affecting the periodic properties. Periodic table anomalies and variations in atomic radius, ionic radius, electronic configuration, electron affinity, electro negativity, ionization energy and metallic character of elements along the group and periods.

Unit-II: Chemical Bonding **1**5 Hours

Ionic bond – Properties of ionic compounds, factors favouring the ionic compounds - ionization potential – electron affinity – electronegativity – Lattice energy – Born-Haber Cycle – Polarizing power and Polarizability – Partial ionic character from electronegativity. Covalent character of ionic compounds – Fajan's rules – Covalent bond – structure and bonding of homo and heteronuclear molecules – Hydrogen bonding – Its nature, types, effect on properties – Intermolecular forces – London forces and van der Waals forces – ion dipole-dipole interactions. VSEPR Theory – Principles and hybridization- Shapes of simple inorganic molecules ($BeCl_2$, BF_3, $SiCl_4$, PCl_5, SF_6, IF_7, H_2O, NH_3, XeF_6) – MO Theory –Bonding and anti-bonding orbitals – Applications of MO theory H_2, He, N_2, O_2, HF and CO molecules – Comparison of VB and MO Theories.

Unit-III: Classification and Nomenclature of Organic Compounds 15 Hours

Classification of organic compounds - based on the nature of carbon skeleton and functional groups - classification of C and H atoms of organic compounds (primary/secondary/tertiary) - IUPAC system of nomenclature of common organic compounds (upto C-10) - alkanes, alkenes, alkynes, cycloalkanes, bicycloalkanes with and without bridges and aromatic compounds - Naming of organic compounds with one functional group - halogen compounds, alcohols, phenol, aldehydes, ketones, carboxylic acids and its derivatives, cyano compounds, amines, nitro compounds (Both aliphatic and aromatic) - Naming of compounds with two functional groups - naming of compounds with more than one carbon chain .

Unit-IV: Bonding in Organic Compounds 15 Hours

Hybridization and geometry - bond angle, bond length, bond strength of C-H and C-C bonds -Van der Waal's interactions, Inter & Intra molecular forces and their effects on physical properties - Electronic effects - inductive effect, resonance effect - drawing of resonance structures - conditions for resonance - stability of resonance structures, hyper conjugation, electromeric effect, steric effect - steric inhibition of resonance - Dissociation of bonds - homolysis and heterolysis - radicals, carbocations, carbanions - electrophiles and nucleophiles - Influence of electronic effects - dipole moment - relative strengths of acids and bases - stability of olefins - stability of radicals, carbocations and carbanions.

Unit-V: Atomic Structure 15 Hours

Planck's quantum theory - Photoelectric effect, Compton effect, Bohr's model of hydrogen atom (no derivation), Wave particle duality, de Broglie equation, Heisenberg uncertainty principle - Eigen function and Eigen value - Postulates of Quantum mechanics - Schrodinger's time independent wave equation (no derivation), wave functions and its physical properties.

Textbooks:

Madan R.D., Modern Inorganic Chemistry 3rd Ed., S. Chand & Company Ltd., Reprint 2014.

Arun Bahl and Bahl B.S., A Text Book of Organic Chemistry, 22nd ed., S. Chand & Company, 2016.

Reference Books:

1. Puri B.R., Sharma L.R and Pathania M.S., Principles of Physical Chemistry. 47th ed., Vishal Publishing Co., 2017.

2.Soni P.L., Text Book of Inorganic Chemistry, 20th ed., Sultan Chand & Sons, 2000.

Chang Raymond, Chemistry, 10th ed., McGraw Hill, New York, USA., 2010.

Morrison R.T., Boyd R.N. and Bhattacharjee S.K., Organic Chemistry, 7th ed., Pearson Education Asia, 2010.

Finar I.L., Organic Chemistry Vol-1& 2, 6th ed., Pearson Education Asia., 2004.

Web Resources:

https://www.khanacademy.org/

https://www.masterorganicchemistry.com/

Methodology of teaching

Classroom Lectures, Group Discussion, Seminars and Assignment

Course Outcomes (COs):

Upon completion of this course, the students will be able to

CO Code	Couse Outcome	K-Level
CO1	Gain knowledge about various quantum numbers and occupancy of electrons on various quantum levels; Understand the variation of periodic properties of elements.	K1, K2, K4
CO2	Get idea behind the structure and bond type of simple inorganic molecules.	K1, K2, K3
CO3	Learn to classify organic compounds with various functional groups and naming of organic compounds based on IUPAC rules	K2, K3,
CO4	Gain the knowledge on hybridization and interpret geometry of organic molecules;	K2, K3, K4
CO5	Gain knowledge on various atomic models and basic concepts and theories behind the development of quantum theory of atoms.	K1, K2, K3
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6–Creating		

CO-PSO Mapping (Course Articulation Matrix)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	2	1	2
CO2	2	2	2	2	2	3
CO3	2	3	2	3	2	3
CO4	3	2	3	2	3	2
CO5	2	3	3	3	2	2
Average	2.3	2.3	2.2	2.4	2.0	2.4

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

FIRST AND SECOND SEMESTER				
Name of the course		VOLUMETRIC ANALYSIS PRACTICAL		
Subject code		22UBCHC2		
Course no	Couse category Core/Elective	No of credit	No of hours /week	Total marks (Int+Ext)
CCP-I	Core	3	3	40+60=100

Course Objectives

- This course aims to understand and gain the basic knowledge of volumetric analysis.
- Students can easily understand the basic concepts of Acidimetry-Alkalimetry, permanganametry, and complexometric titrations.
- Students can gain the knowledge to prepare stock solutions.

Unit I Principles of volumetric analysis and Preparation of stock solutions

Principles of Volumetric Analysis:

Types of titrations. Requirements for titrimetric analysis. Concentration systems: Molarity, molality, formality, normality, weight %, ppm. Limitation of volumetric analysis, endpoint and equivalence point. Neutralization-titration curve, theory of indicators, choice of indicators.

UNIT II: Preparation of stock solutions :

Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of HCl, NaOH,$KMnO_4$,Oxalic acid,Ferroussulphate,Borax and EDTA.

Unit II :Estimation of the given solutions:

1 Estimation of hydroxide.

Estimation of hydrochloric acid using standard oxalic acid .

2 Estimation of sodium hydroxide.

Estimation of sodium hydroxide using standard sodium carbonate .

3 Estimation of ferrous sulphate

Estimation of ferrous sulphate using standard ferrous ammonium sulphate**.**

4 Estimation of oxalic acid

Estimation of oxalic acid using standard ferrous sulphate

5 Estimation of Borax

Estimation of Borax using standard sodium carbonate.

6 Estimation of potassium permanganate

Estimation of Potassium Permanganate using standard sodium hydroxide.

7 Estimation of Magnesium

Estimation of magnesium using standard EDTA **.**

8 Estimation of Hardness of water

Estimation of hardness of water using standard EDTA.

Books for Reference

Sundaram, Krishnan, Ragavan, Practical chemistry (Part II), S.Viswanathan Co. Pvt Ltd.1996.

COURSE OUTCOMES:

On completion of the course the student will be able to:

CO No	COURSE OUTCOME	KNOWLEDGE LEVEL
CO1	Acquire the knowledge on basic principles of volumetric analysis and perform the process methodically	K1,K2,K3,K4
CO2	Apply the skills to pursue higher studies and work with professional ethics in industries and research laboratories.	K2,K3,K4
CO3	Apply the concepts and develop the skills to perform quantitative estimation of the given solutions. Understand the laboratory skills.	K1,K3,K4
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5– Evaluating , K6–Creating		

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	2	3
CO3	2	3	2	3	3
Average	2.3	3.0	2.3	2.3	3.0

SEMESTER II

SECOND SEMESTER				
Course Title		GENERAL CHEMISTRY - II		
Course Code		22UBCHC1		
Course No.	Course Category Core/Elective	No. of Credits	No. of hours/week	Total Marks (Int + Ext)
CC-II	Core	4	6	25 + 75 = 100

Course Objectives

- To understand the chemistry of s - block elements and their compounds; To enable the students to acquire knowledge in the theory behind the volumetric analysis which may lead to develop the knowledge to prepare solutions quantitatively; Distinguish primary and secondary standards.
- To know about various operations and steps involved metallurgical processes.
- To learn the preparation, properties and importance of aliphatic hydrocarbons.
- To study the synthesis, reactions, stability and significance of alicyclic compounds.

Unit-I: s-Block Elements: 15 Hours

(1) s-Block Elements: General characteristics of s – block elements – Compounds of s-block metals – oxides, hydroxides, peroxides, superoxide -preparation and properties. Anomalous behaviour of Li and Be – extraction of beryllium – physical and chemical properties of Be – Uses Complexes of s-block metals – complexes with crown ethers.

Unit-II: Metallurgy 15 Hours

Occurrence of metals –basic metallurgical operations and metallurgy process – General methods involved in extraction of metals- concentration of ores – froth floatation, magnetic separation, calcination, roasting, smelting, flux, aluminothermic process. Extraction processes – Chemical reduction – electrolytic reduction – metal displacement – refining methods – distillation – fractional crystallization – electrolysis. zone reining – Van Arkel de Boer methods – electrolytic refining – ion exchange method .

Unit-III: Aliphatic Compounds 15 Hours

Alkanes - preparations, physical properties, reactions, reactions with radical mechanism for substitution reaction - cracking - Alkenes: Preparation from alcohol, haloalkane, dihaloalkanes and alkynes - reactions of alkenes - mechanisms involved in addition of hydrogen, halogen, hydrogen halide, water, hydroboration, hydroxylation, ozonolysis and epoxidation - peroxide effect - allylic substitution, oxidation by $KMnO_4$. Alkynes: preparation, reactions - addition of hydrogen, halogen, hydrogen halide, water, HCN, CH_3COOH, hydroboration - acidity of terminal alkynes.

Unit-IV: Alicyclic Compounds 15 Hours

Cycloalkanes: Preparation (small, medium & large ring compounds) - reactions - cycloaddition, dehalogenation, pyrolysis of calcium salt of dicarboxylic acid - Wurtz reaction - stability of cycloalkanes - Baeyer's strain theory. Cycloalkenes: Preparation and reactions of cycloalkenes - Preparation of conjugate dienes - reactions - 1,2 and 1,4 addition and Diels-Alder reaction - Application in the synthesis of following molecules -

trans 2-chlorocyclopentanol, trans-2 methylcyclopentanol, cis and trans 1,2 cyclohexanediol, cyclohexene, 2,3-butanedione and adipic acid.

Unit-V: Gas and Liquid State 15 Hours

Ideal gas: Kinetic theory of gases - Gas laws – Maxwells distribution of molecular velocities - Types of molecular velocities - Expansivity and compressibility – collision diameter – collision frequency – mean free path. Behaviour of real gas – Vander Waals equation of state – Boyle temperature – Virial equation of state – critical constants of gas. Liquid state: Physical properties – vapour pressure – Trouton's rule – surface tension – Effect of temperature on surface tension – viscosity – effect of pressure and temperature. Liquid crystals:– classification of liquid crystals – nematic, smectic and cholesteric liquid crystals with examples.

Textbooks:

1. Madan R.D., Modern Inorganic Chemistry 3rd Ed., S. Chand & Company Ltd., Reprint 2014.
2. Arun Bahl and Bahl B.S., A Text Book of Organic Chemistry, 22nd ed., S. Chand & Company, 2016.
3. Vogel A.I., A Textbook of Quantitative Inorganic Analysis, ELBS and Longman, London, 1975

Reference Books:

1. Puri B.R., Sharma L.R and Pathania M.S., Principles of Physical Chemistry. 47th ed., Vishal Publishing Co., 2017.
2 Soni P.L., Text Book of Inorganic Chemistry, 20th ed., Sultan Chand & Sons, 2000.
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5. Finar I.L., Organic Chemistry Vol-1& 2, 6th ed., Pearson Education Asia., 2004.

Web Resources:

https://www.khanacademy.org/
https://www.masterorganicchemistry.com/
https://iupac.org/
https://www.chemistryguide.org/

METHODOLOGY OF TEACHING

Classroom Lectures, Group Discussion, Seminars and Assignments

Course Outcomes (COs):

Upon completion of this course, the students will be able to

CO Code	Couse Outcome	K-Level
CO1	acquire knowledge on s-block elements and its compounds.	K1, K2, K3, K4
CO2	know on the various steps involved in metallurgical processes and the applications of metals in daily life	K1, K2, K3, K4
CO3	Explain preparation, properties and some synthetic applications of aliphatic hydrocarbons	K1, K2, K3
CO4	Learn the structural strains in the compounds and their impact on properties.	K1, K2, K3
CO5	Get knowledge on fundamental theories governing the gaseous and liquid states of matter and their correlation.	K1, K2, K3, K4
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6–Creating		

CO-PSO Mapping (Course Articulation Matrix)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	1	2	2	3	2
CO2	1	2	1	1	2	2
CO3	2	2	3	2	2	3
CO4	2	1	2	3	2	2
CO5	3	3	2	2	3	3
Average	2.2	1.8	2.0	2.0	2.4	2.4

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

SEMESTER III

THIRD SEMESTER				
Course Title		GENERAL CHEMISTRY - III		
Course Code		22UCCHC1		
Course No.	Course Category Core/Elective	No. of Credits	No. of hours/week	Total Marks (Int + Ext)
CC-IV	Core	4	6	25 + 75 = 100

Course Objectives

- To understand the characteristics of elements of Group III A and IV A and the chemistry of silicones
- To provide the detailed chemistry about p-block elements especially nitrogen and oxygen family.
- To know about aromaticity, aromatic electrophilic substitution and synthesis of some important aromatic compounds.
- To understand the basics of first law of thermodynamics and the laws of thermochemistry
- To understand the theory of colloids and nanomaterials

Unit-I: p-Block elements – Boron and Carbon family 15 Hours

General characteristics of elements of Group III A .Physical and chemical properties of Boron – compounds of boron – Borax, Boric acid, Diborane, Boron nitride – Extraction of Al – Physical and Chemical properties - uses – compounds of aluminium – Al_2O_3, $AlCl_3$, alums – Alloys of aluminium. General characteristics of elements of Group IV A – Allotropic forms of carbon – Chemistry of charcoal – chemistry of oxides of carbon-preparation of Silicon – Physical and chemical properties of Si – Uses – Oxides of silicon – structures of silicates. Chemistry of silicones – Manufacture of glass – types of glasses – ceramics.

Unit-II: p-Block elements – Nitrogen and Oxygen family 15 Hours

General characteristics of elements of V-A Group – Preparation of nitrogen – Physical and chemical properties of nitrogen – uses – Chemistry of some compounds of nitrogen – hydrazine, hydroxylamine, hydrazoic acid, nitric acid – nitrogen cycle. Preparation of phosphorus – Physical and chemical properties of phosphorus – uses – chemistry of PH_3, PCl_3, PCl_5, $POCl_3$, P_2O_5 and oxy acids of phosphorous – fertilizers – Oxides of nitrogen and Phosphorous – oxoacids of nitrogen and phosphorus. Anomalous behavior of oxygen – Structure and allotropy of elements, ozone, oxides – peroxides, suboxides, basic oxides, amphoteric oxides, acidic oxides, neutral oxides – Oxides of Sulphur – oxoacids of sulphur.

Unit-III: Aromatic Compounds 15 Hours

Aromaticity - definition - Huckel's rule - consequence of aromaticity - stability, carbon-carbon bond lengths in benzene ring, resonance energy - Aromatic electrophilic substitution - mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction - Activating and deactivating substituents - orientation in mono substituted benzenes - reactions of aromatic side chain - halogenation and oxidation - Methods of formation and chemical reactions of alkylbenzenes, biphenyl, naphthalene and Anthracene - Synthesis of 3-nitrotoluene, 4-bromonitro

benzene, 4-bromoacetophenone, 3-(4-nitrophenyl)prop-1-ene, 3-nitrostyrene.

Unit-IV: Thermodynamics I 15 Hours

System-surrounding-Intensive and extensive variables; state and path functions; isolated, closed and open systems-zeroth law of thermodynamics. First law of thermodynamics-mathematical form- Heat capacity, relation between C_P and C_V. Isothermal process: Calculations of w, q, dE and dH for the reversible expansion of ideal gases under isothermal and adiabatic conditions. Joule- Thomson effect-derivation of Joule- Thomson coefficient for ideal gases and real gases, inversion temperatures. Variation of enthalpy change of reaction with temperature (Kirchoff's equation). Hess's law of constant heat of summation- Bond energy and its calculations.

Unit-V: Colloids 15 Hours

Colloids - Distinguishing characteristics of colloids, suspensions and solutions- Types of colloidal dispersions-Optical properties-Tyndall effect– Kinetic properties – Brownian motion-Electrical properties–Helmholtz and diffuse double layers – electro kinetic or zeta potential – electrophoresis and its applications Coagulation – methods of coagulation – Hardy Schultz law – Protective colloids – protective action – gold number – applications- Emulsions – classification, preparation, Gels – preparation – properties.

Textbooks:

1. Madan R.D., Modern Inorganic Chemistry 3rd Ed., S. Chand & Company Ltd., Reprint 2014.
2. Arun Bahl and Bahl B.S., A Text Book of Organic Chemistry, 22nd ed., S. Chand & Company, 2016.
3. Arun Bahl, Bahl B.S., Tuli. G.D., Essentials of Physical Chemistry 28th ed., S. Chand and Co., 2020

Reference Books:

1. Puri B.R., Sharma L.R and Pathania M.S., Principles of Physical Chemistry. 47th ed., Vishal Publishing Co., 2017.
2. Soni P.L., Text Book of Inorganic Chemistry, 20th ed., Sultan Chand & Sons, 2000.
3. Morrison R.T., Boyd R.N. and Bhattacharjee S.K., Organic Chemistry, 7th ed., Pearson Education Asia, 2010.

Web Resources:

https://www.khanacademy.org/
https://www.masterorganicchemistry.com/
https://iupac.org/
https://www.chemistryguide.org/

METHODOLOGY OF TEACHING

Classroom Lectures, Group Discussion, Seminars and Assignments

Course Outcomes (COs):

Upon completion of this course, the students will

CO Code	Couse Outcome	K-Level
CO1	Gain knowledge about compounds of boron and carbon family and their industrial applications	K1, K2, K3
CO2	Gain knowledge about compounds of nitrogen and oxygen family and their industrial applications	K1, K2, K3, K4
CO3	Know the basic knowledge of aromaticity, aromatic electrophilic substitution and synthesis of some important aromatic compounds	K1, K2, K3
CO4	Gain knowledge about concept of First law of Thermodynamics and its applications and also explain the laws of Thermochemistry	K1, K3, K4
CO5	Learn the theory of colloids and nanomaterials	K1, K2, K3, K4
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6–Creating		

CO-PSO Mapping (Course Articulation Matrix)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	1	2	2	2
CO2	2	1	2	2	2	1
CO3	2	3	2	3	3	3
CO4	3	2	2	3	3	2
CO5	3	2	3	2	2	3
Average	2.4	2.0	2.0	2.4	2.4	2.2

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

THIRD AND FOURTH SEMESTER				
Course Title		INORGANIC QUALITATIVE ANALYSIS PRACTICALS		
Course code		22UDCHC2		
Course No	CourseCategory Core / Elective/	No of Credits	No of hrs/week	Total marks (Int+Ext)
CCP -II	**Core**	**3**	**3**	**40+ 60=100**

Qualitative Analysis

Qualitative analysis of a mixture containing two cations and two anions of which one will be an interfering ion. Semi micro methods using the conventional scheme with hydrogen sulphide may be adopted.

Cations to be studied: Lead, Copper, Bismuth, Cadmium, Iron, Aluminum, Zinc, Manganese, Cobalt, Nickel, Barium, Calcium, Strontium, Magnesium and Ammonium.

Anions to be studied: Carbonate, Sulphate, Nitrate, Chloride, Bromide, Fluoride, Borate, Oxalate, and Phosphate.

COURSE OUTCOMES:

On completion of the course the student will be able to:

CO Code	COURSE OUTCOME	KNOWLEDGE LEVEL
CO1	Understand the basic principle inorganic reactions and analyse the inorganic salt systematically	K1,K2,K3,K4
CO2	Acquire analytical skill to identify the unknown inorganic salt cntaining cation and anion.	K1,K2,K3,K4
CO3	Apply the skills to pursue higher studies and work with professional ethics in industries and research laboratories.	K2,K3,K4
Kl-Knowledge, K2-Understand, K3-Apply, K4-Analyze		

CO-PSO Mapping (Course Articulation Matrix)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	1	2	2	2
CO2	2	1	2	2	2	1
CO3	2	3	1	3	3	3
Average	2.0	2.0	1.3	2.3	2.3	2.0

THIRD SEMESTER				
Course Title		**Environmental Studies**		
Course Code		**22UCEVS1**		
Course No	Course Category Core / Elective Theory / Practical	No of Credits	No of hrs /week	Total marks (Internal + External)
EVS	**Theory**	**2**	**2**	**25 + 75 = 100**

Course Objectives

Students gain knowledge on the fundamental concepts, mechanism and importance of environment and ecosystem. This course provides the consciousness and awareness about the significance of our environment, to save and protect the nature.

Unit I: Scope and importance of Environmental Science : 6 Hours

Definition, Multidisciplinarynature of environmental science, scope and importance; global environmental problems.

Unit II: Ecosystems: 6 Hours

Concept of an ecosystem. Structure and function of an ecosystem.producers, consumers and decomposers. Energy flow in the ecosystem. Food chains, food webs and ecological pyramids.

Unit III: Biodiversity and its conservation: 6 Hours

Introduction - Definition: Value ofbiodiversity: consumptive use, productive use. India as a mega-diversity nation, Hot-spots ofbiodiversity. Brief account on biodiversity conservation.

Unit 4: Environmental Pollution: 6 Hours

Definition- Cause, effects and control measures of:- a)Air pollution, b) Water pollution Solid waste Management : Causes, effects and controlmeasures of urban and industrial wastes. Role of an individual in prevention of pollution.

Unit 5: Social Issues and the Environment: 6 Hours

Water conservation, rain water harvesting. Climate change, global warning, acid rain, ozone layer depletion, nuclear accidents. Waste land reclamation. ·

Text Books:

1. Arindam Ghosh, 2022, Environmental Studies, Generic publications
2. Chauhan, B.S., 2015. Environmental studies, Second edition. Laxmi publications
3. Erach Bharucha, 2021, Textbook of Environmental Studies for Undergraduate Courses, Orient Blackswan Pvt Ltd
4. Rajagopalan, R. 2015., Environmental Studies, Oxford University Press
5. Sharma, PD., 2017. Ecology and Environment, Rastogi Publications

Reference Books:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publications Ltd. Bikaner.
2. Bharucha Brach, 2017, The Biodiversity of India, Mapin Publishing Pvt. Ltd
3. Cunningham, W. P., Cunningham, M.A. and Saigo, B. W., 2006. Environmental sciences, Nineth edition. Mc Graw- Hill higher education,
4. Odum, E.P., 1971. Fundamentals of ecology, Third edition. W.B. Saunders company, Philadelphia
5. Subramanyam, N.S. and Sambamurthy, A.V., 2000. Ecology. Narosa publishing house,

Web resources:

1. 1.https://www.sbsc.in/pdf/resources/1588750812_Unit_1_Introduction_to_environmental_studies.pdf
2. https://nitsri.ac.in/Department/CHEMISTRY/EVS_MATERIAL_2.pdf
3. 3.https://www.tripurauniv.ac.in/Content/pdf/StudyMaterialsDetail/BA%203rd%20Semester/BA-3RD(FNDC)-Environmental%20Studies.pdf
4. https://aissmschmct.in/wp-content/uploads/2020/08/BSC-HS-Sem-III-Environment-Science-I-HS-307-Chapter-1.pdf

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignment

Course Outcomes (COs):

Upon completion of this course, the students

CO code	Course Outcomes	K-levels
CO1	Explain the structure, functions andRecallthe energy flow in the ecosystem.	**K1 and K2**
CO2	Demonstrate the interactions among the physical, chemical and biological components.	**K2**
CO3	determine the types, distribution of Biodiversity in India and its benefits on society and methods adopted for biodiversity conservation.	**K3**
CO4	Identify the sources, effects and control measures of various types of Pollution.	**K3**
CO5	Outline the environment legislations in India for sustainable development.	**K2**

CO- PSO Mapping (Course Articulation Matrix)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	1	2	1	2
CO2	3	2	1	1		2
CO3	3	3	2	2	1	3
CO4	3	2	3	3	2	3
CO5	3	2	2	3	2	3
Average	3	2.4	1.8	2.2	1.2	2.6

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

SEMESTER IV

FOURTH SEMESTER				
Course Title		GENERAL CHEMISTRY - IV		
Course Code		22UDCHC1		
Course No.	Course Category Core/Elective	No. of Credits	No. of hours/week	Total Marks (Int + Ext)
CC-V	Core	4	6	25 + 75 = 100

Course Objectives

- To provide the detailed chemistry about halogen family and noble gases; To understand and gain knowledge towards Acid Base chemistry and non-aqueous solvents.
- To study the preparation and chemical reactions of alkyl and aryl halides with mechanism and to apply the knowledge in the synthesis.
- To study the preparation and properties of alcohols, Phenols Ethers and epoxides with mechanisms and to apply the knowledge in the synthesis of alcohol derivatives.
- To study the second law of thermodynamics, the concept of entropy, concept of Gibbs Free energy and their applications.
- To understand the kinetics and the theories of reaction rate

Unit-I: Halogen family ,Noble gases and protic - aprotic solvents 15 Hours

General characteristics of halogen with reference of electro negativity, electron affinity, oxidation states, and oxidizing power – peculiarities of fluorine. Interhalogen compounds preparation, properties and structure of interhalogen compounds - Inert gases – position in the periodic table – isolation from atmosphere – General characteristics – Structure and shape of xenon compounds – XeF_2, XeF_4, XeF_6, $XeOF_2$, $XeOF_4$ – uses of noble gases.

Non-aqueous solvents: Classification of solvents – General properties of ionizing solvents- Water, liquid ammonia and liquid SO_2,

pH of strong and weak acid solutions. Buffer solutions. Henderson equations. Preparation of acidic and basic buffers. Relative strength of acids and bases from K_a and K_b values.

Unit-II: Haloalkanes and Haloarenes 15 Hours

Classification of alkyl halides - Hunsdiecker reaction, Finkelstein reaction and Swart's reaction - nucleophilic substitution reactions - mechanisms of nucleophilic substitution reactions - S_N1 and S_N2 reactions with energy profile diagrams - dehydrohalogenation with mechanism - Saytzeff's rule - reaction with metals -Wurtz reaction and formation of Grignard reagent - Methods of formation of aryl halides - nucleophilic substitution reactions of aryl halides - electrophilic substitution -Ullmann reaction – Wurtz-Fittig reaction - Relative reactivities of alkyl, allyl, vinyl and aryl halides - Synthesis and uses of DDT and BHC.

Unit-III: Alcohols, Phenols and Ethers 15 Hours

Preparation of alcohols through reduction, hydroboration, hydration, oxymercuration and Grignard reaction. Reactions of alcohol - with metals, esterification, oxidation, dehydration, conversion to alkyl halides. Preparation of phenols - acidity of phenol vs alcohols - relative acid strength of substituted phenols - reactions of phenols - esterification, oxidation, Kolbe's, Reimer-

Tiemann, Gattermann, electrophilic substitution reactions. Ethers – preparations, reactions - epoxide - Synthesis of aspirin, 3 and 4-nitro phenol, t-butylmethyl ether and 1-methyl-1-cyclohexanol.

Unit-IV: Thermodynamics – II 15 Hours

Second law of thermodynamics – Need for second law – statements of Second law - Carnot theorem, Carnot cycle – Efficiency of heat engine. Concept of entropy – State function – entropy change in isothermal expansion of ideal gas - Entropy change in reversible and irreversible process – Entropy change accompanying by change of phase – calculation of entropy change of an ideal gas with changes in pressure, volume and temperature – Entropy of mixing – Physical significance of entropy. Gibbs free energy – Work function – Variation of free energy change with temperature and pressure – Maxwell's relationship – Criteria for spontaneity – Gibbs Helmholtz equation – Partial molar properties – Clapeyron Clausius equation and its applications Third law of thermodynamics – Nernst heat theorem – statement of third law – Determination of absolute entropies of solids, liquids and gases.

15 Hours

Unit-V: Chemical kinetics

Definition of order and molecularity – rate of reaction - derivation of rate constant of a first, second order reaction - second order reaction (i) When reactants are taken at same initial concentration (ii) When reactants are taken at different initial concentration – derivation of third order rate constant when the reactants are taken at same initial concentration – derivation of half-life period. Effect of temperature on reaction rate – Arrhenius equation – concept of activation energy. Collision theory – derivation of rate constant of a bimolecular reaction – failures of CT – Lindemann theory of unimolecular reaction. Theory of absolute reaction rate – derivation of rate constant of a bimolecular reaction – comparison between ARRT and CT – Significance of free energy of activation and entropy of activation- Consecutive, parallel and reversible reactions (only definition and example)

Textbooks:

1. Madan R.D., Modern Inorganic Chemistry 3rd Ed., S. Chand & Company Ltd., Reprint 2014.
2. Arun Bahl and Bahl B.S., A Text Book of Organic Chemistry, 22nd ed., S. Chand & Company, 2016.
3 Arun Bahl, Bahl B.S., Tuli. G.D., Essentials of Physical Chemistry 28th ed., S. Chand and Co., 2020

Reference Books:

1. Puri B.R., Sharma L.R and Pathania M.S., Principles of Physical Chemistry. 47th ed., Vishal Publishing Co., 2017.
2. Soni P.L., Text Book of Inorganic Chemistry, 20th ed., Sultan Chand & Sons, 2000.
3. Chang Raymond, Chemistry, 10th ed., McGraw Hill, New York, USA., 2010.
4. Morrison R.T., Boyd R.N. and Bhattacharjee S.K., Organic Chemistry, 7th ed., Pearson Education Asia, 2010.
5. Finar I.L., Organic Chemistry Vol-1& 2, 6th ed., Pearson Education Asia., 2004.

Web Resources:

https://www.khanacademy.org/
https://www.masterorganicchemistry.com/

Methodology of teaching:

Classroom Lectures, Group Discussion, Seminars and Assignment

Course Outcomes (COs):

Upon completion of this course, the students will be able to

CO Code	Couse Outcome	K-Level
CO1	Gain clear knowledge about halogen family, noble gases and their applications	K1, K2, K3, K4
CO2	Understand important name reactions with mechanism involved in both the preparations and properties of alkyl and aryl halides.	K1, K2, K3, K5
CO3	Get idea on the reactions of alcohols, phenols ethers and epoxides and their reaction mechanisms.	K1, K2, K3, K5, K6
CO4	Acquire knowledge about the theoretical and mathematical concept second and third law of thermodynamics and their applications in day-to-day life	K1, K2, K3, K4, K5
CO5	Gain knowledge about kinetics and its theories and can solve the problems related to kinetics	K1, K2, K3
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6–Creating		

CO-PSO Mapping (Course Articulation Matrix)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	1	1	1	2	2
CO2	2	2	2	2	2	1
CO3	2	2	3	1	2	3
CO4	3	3	2	3	3	2
CO5	3	3	2	3	3	3
Average	2.4	2.2	2.0	2.0	2.4	2.2

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) or (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
			Grand Total	**75**

SEMESTER V

FIFTH SEMESTER				
Course Title		ORGANIC CHEMISTRY I		
Course code.		22UECHC1		
Course No	Course Category Core / Elective /	No.of Credits	No of hrs /week	Total marks (Int+Ext)
CC VII	Core	4	5	25+75 =100

Course Objectives

- ✓ To understand the basic concepts of structural isomerism and stereo chemistry.
- ✓ To gain a good knowledge on the synthesis of aldehydes/ketones/carboxylic acids.
- ✓ To gain knowledge of preparation, properties and applications of Nitrogen containing compounds.
- ✓ To acquire thorough knowledge of synthesis, reactions uses and important features of heterocyclic compounds.
- ✓ To gain knowledge of rearrangement reactions.

Unit-I: Isomerism 15 hours

Structural isomerism - Stereochemistry - Representation of molecules in saw horse, Fischer, flying-wedge and Newman formulae and their inter translations. Symmetry elements - chirality – asymmetric molecules and molecular dissymmetry-pseudo asymmetry. Optical rotation – specific rotation -optical purity - methods of racemization - Optical isomers - enantiomers - diastereomers – epimers - notation of optical isomers - Cahn-Ingold-Prelog rules, R and S notations for optical isomers with one and two asymmetric carbon atoms - erythro and threo representations - D and L representations. Geometrical isomerism – nomenclature of geometrical isomers – cis/trans, E-Z notation and syn-anti for C=C, Methods to assign configurations.

Conformational Analysis - Conformation - Conformational nomenclature: eclipsed, staggered, gauche and anti; dihedral angle, torsion angle, energy barrier of rotation - potential energy diagram. Conformational analysis of ethane, propane, n-butane, cyclohexane.

Unit-II: Carbonyl Compounds and their Derivatives: 15 hours

Common methods for the synthesis of aldehydes and ketones - synthesis of aldehydes from acid chlorides, Stephen's reduction - Gattermann-Kosch and Etard reactions - synthesis of ketones from nitriles, dialkylcadmium, alkyl lithium and lithium dialkylcuprate and Friedel-Crafts and Hoesch reactions. Mechanism of nucleophillic additions to carbonyl group - addition of HCN, alcohols, thiols, sodium bisulfite, Grignard

reagents -condensation with ammonia and its derivatives - Aldol, Perkin, Benzoin, Knoevenagel condensations and Cannizaro reaction.

Oxidation by Tollen's reagent, $KMnO_4$, hypohalite, SeO_2 and peracids. Reduction by H_2/Ni, H_2-Pd-C, $NaBH_4$, $LiAlH_4$, MPV, Clemmenson and Wolff-Kischner reductions. α, β unsaturated aldehydes and Ketones – preparation and reactions.

Preparation of carboxylic acids, acidity of carboxylic acids, effects of substituents on acid strength, acidity of aliphatic vs aromatic acids. Reactions of carboxylic acids - Hell-Volhard-Zelinsky reaction, Synthesis of acid chlorides, esters and amides, Reduction of carboxylic acids, methods and mechanism of decarboxylation. Synthesis of active methylene compounds – diethyl malonate and ethyl acetoacetate.

Unit-III: Nitrogen-Containing Compounds 15 hours

Preparation of nitroalkanes and nitroarenes - Chemical reactions of nitroalkanes and nitroarenes - reductions in acidic, neutral and alkaline media.

Methods of preparation of alkyl and aryl amines - Gabriel phthalimide reaction and Hofmann reaction - separation of a mixture of primary, secondary and tertiary amines - Hinsberg's and Hofmann's method - Structural features affecting basicity of amines - basicity of aliphatic and aromatic amines -reactions of amines. Aryl diazonium salts - preparation, stability, reactions and synthetic transformations.

Amino acids - essential and nonessential - methods of preparation - zwitterions formation - isoelectric point - chemical reactions of amino acid. Polypeptides and proteins - solution phase and solid phase synthesis - classification - primary, secondary, tertiary and quaternary structure of proteins - determination of primary structure with end group analysis.

Unit-IV: Heterocyclic Compounds 15 hours

Preparation properties and uses of pyrrole, furan, thiophene and pyridine - Comparison between basicity of pyridine, piperidine and pyrrole. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution and mechanism of nucleophilic substitution reaction in pyridine derivatives. Preparation and reactions of indole, quinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis.

Unit-V: Rearrangements 15 hours

Rearrangement to electron-deficient carbon - 1,2 shift (Wagner-Meerwein rearrangement, pinacol rearrangement, dienone-phenol; Wolff rearrangement, benzil-benzilic acid rearrangement). Aromatic rearrangements from oxygen to ring carbon – Fries, Claisen and benzidine rearrangement. Rearrangement to electron-deficient nitrogen – Beckmann, Schmidt, Hofmann, Lossen, Curtius rearrangement). Rearrangement to electron-deficient oxygen: Baeyer-Villiger oxidation, hydroperoxide rearrangement, cumenehydroperoxide-phenol rearrangement, Dakin reaction.

Reference Books:

1 R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th edition, prentice hall,1992.

2. I. L. Finar, Organic Chemistry Vol-1, 6thedn, Pearson Education Asia, 2004.

3. Ernest L. Eliel, Samuel H. Wilen, and Lewis N. Mander. Stereochemistry of Organic Compounds. New York: Wiley, 1994.

Web resources

https://en.wikipedia.org/wiki/Stereoisomerism

METHODOLOGY OF TEACHING:

Class lectures, Group discussions, and Assignments

COURSE OUTCOMES:

On completion of the course the student will be able to:

CO No	Course outcome	Knowledge level
CO1	Understand the basic concepts of isomerism and stereo chemistry. Apply Cahn-Ingold-Prelog rules to assign configurations.	K1, K2, K3, K4
CO2	Gains a good knowledge on the synthesis of aldehydes/ketones/carboxylic acids. interpret the mechanism of nucleophilic reactions and oxidation-reduction reactions.	K1. K2
CO3	Gains knowledge ofpreparation, properties and applications of N-containing compounds. classify primary, secondary, and tertiary amines.	K1, K2, K3, K4
CO4	Acquire thorough knowledge of synthesis, reactions,mechanism, uses and important features of heterocyclic compounds.	K1, K2, K3
CO5	Gains knowledge of rearrangement reactions. Understand the types of rearrangement and its synthetic applications.	K1, K2, K3
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5– Evaluating , K6–Creating		

CO-PSO Mapping (Course Articulation Matrix)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	3
CO2	3	3	2	2	3
CO3	3	3	2	2	3
CO4	3	3	2	2	3
CO5	3	3	2	2	3
Average	15	15	10	10	15

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

FIFTH SEMESTER				
Course Title		INORGANIC CHEMISTRY I		
Course code		22UECHC2		
Course No.	Course Category Core/Elective	No. of credits	No. of hrs/week	Total marks (Int+Ext)
CC - VIII	Core	4	5	25+75=100

Course Objectives:

- To introduce the students to the transition and inner transition elements about general characteristics and comparison of groups.
- To expose the students to the basic concepts of coordination complexes and their heories and properties.
- To understand the facts of various reaction mechanisms involved in complexes.
- To gain knowledge in the chemistry of bioinorganic compounds.To make sense of bonding in organometallic compounds and the photochemistry of organometallic compounds.

UNIT -I: d-block & f-block elements 15 hrs

Chemistry of transition elements – electronic configuration – group study of titanium, vanadium, chromium, manganese, and iron metals – a comparative study of zinc group metals – Important uses of transition metals and their alloys. Horizontal comparison with Fe, Co, Ni groups – toxicity of Cd and Hg – oxides, mixed oxides, halides, and oxohalides of transition metals – synthesis and reactivity of vanadates, chromates, dichromate, molybdates, tungstates, tungsten bronzes, manganate, permanganate – polycations – Interstitial compounds – nitrides, carbides, hydrides, borides of Ti, V, Cr, W, and their industrial uses. General characteristics of f-block elements – comparative account of lanthanides and actinides – lanthanide series – separation by ion exchange and solvent extraction methods – lanthanide contraction – actinide series – separation of actinides – oxidation states and general properties – Uranium – occurrence and metallurgy – chemical properties of oxides, hydrides and halides.

UNIT – II: Coordination Chemistry I 15 hrs

IUPAC nomenclature - theories of coordination compounds -Werner, Sidgwick, Valence bond, Crystal Field theory. Crystal field splitting in octahedral, tetrahedral, and square planar fields – factors influencing the magnitude of crystal field splitting – CFSE in weak and strong fields calculations; pairing energy. Jahn-Teller distortion. Magnetism and Colour: Orbital and spin magnetic moments, spin only moments of d^n ions and their correlation with effective magnetic moments, including orbital contribution; quenching of magnetic moment.

UNIT – III: Coordination Chemistry II 15 hrs

Stability of complexes -factors affecting the stability of complexes - Kinetic versus thermodynamic stability. Experimental determination of stability constant and composition of complexes. Isomerism of coordination complexes- Determination of configuration of cis- and trans- isomers by chemical methods. Labile and inert complexes, substitution reaction on square planar complexes, trans effect– theories (example and applications). Reaction mechanism – substitution reactions in octahedral complexes – Acid hydrolysis: S_N1 and S_N2 mechanisms

UNIT – IV: Bioinorganic Chemistry 15 hrs

Metal ions in biology and their vital role in the active site, Structure, and functions of Metalloproteins and enzymes. Structures and characteristic features of Haemoglobin and myoglobin – Vitamin B_{12}. Biological functions of hemoglobin and myoglobin, cytochromes and ferredoxins, carbonate bicarbonate buffering system, and carbonic anhydrase. Biological nitrogen fixation, Photosynthesis: Photosystem-I

UNIT – V: Organometallic Chemistry 15 hrs

Introduction – Structure, and application -metal carbonyls -mono and polynuclear carbonyls of Ni, Fe, Cr, Co, and Mn -synthesis and structure -nitrosyl compounds - classification, preparation, and properties –the structure of nitrosyl chloride and sodium nitroprusside.

Nomenclature of organometallic compounds, 16- and 18- electron rule. Structure and bonding in transition metal carbonyls, polynuclear carbonyls, bridging and terminal carbonyls, transition metal alkyls, carbenes, and carbynes, and metallocenes. Photochemistry of organometallic compounds -Wilkinson's catalyst and alkene hydrogenation, hydroformylation, Monsanto acetic acid process, Ziegler – Natta catalyst, and polymerization of olefins.

Text Books

1. Soni, P.L. and Mohan Katyal, Textbook of inorganic chemistry, 20th ed., New Delhi, Sultan Chand & Sons, 2006

2. Puri B.R., Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, New Delhi, 2002

Reference books

1. Lee J.D., Concise Inorganic Chemistry, ELBS Edition

2. Madan R.D., Tuli G.D., and Malik S.M., Selected Topics in Inorganic Chemistry, S.Chand& Co, New Delhi, 2006

Web resources: https://edurev.in>studytube>classification-of- ligands

Course outcome (COs):

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

CO code	Course Outcomes	K-levels
CO1	Acquire knowledge of transition elements' chemistry and electronic configurations, and compare the group elements like Zn, Fe, Co, Ni.	K1, K2
CO2	Recognize IUPAC nomenclature of coordination complexes. Description of theories of CFT with various geometries. Relating pairing energy and CFSE. The concept of Jahn-teller distorting and spectral properties.	K1, K2, K3
CO3	Understand the concepts of stability constants of coordination compounds with illustrations. Comparative knowledge of kinetic and thermodynamic studies.	K1, K2, K3
CO4	Recognize the metal ions in biology, functions, and correlating structure of Metalloproteins and enzymes. Required knowledge of the structure of Haemoglobin and myoglobin. Interpretation of	K1, K2, K3

	Photosynthesis and biological nitrogen fixation.	
CO5	Synthesis and classification of organometallic compounds. Identify organometallic compounds using the 16 and 18 electron rules. The concept of photochemistry by applying Wilkinsons catalysts, hydroformylation reaction, and Zeigler-Natta catalysts.	K1, K2
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6–Creating		

CO-PSO Mapping (Course Articulation Matrix)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	1	2
CO2	3	3	1	3	1	1
CO3	3	2	2	2	-	-
CO4	3	2	2	2	1	1
CO5	3	3	2	1	2	1
Average	3	2.6	1.8	2	1	1

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

FIFTH SEMESTER				
Course Title		PHYSICAL CHEMISTRY I		
Course code		22UECHC3		
Course No	CourseCategory Core / Elective/	No of Credits	No. Of hrs/week	Total marks (Int+Ext)
CC IX	Core	4	5	25 + 75=100

Course objectives:

- To know the fundamental concepts of conductance studies
- To understand theory of strong electrolytes:
- To learn the fundamentals of electro chemical cells and the calculations of cell potential
- To know about the electrodes and electro chemical series and its applications
- To understand various applications of EMF measurement
- To study about the storage cells and fuel cells

UNIT I: Electrical Conductance and Transference 15hrs

Metallic and electrolytic conductors – specific, equivalent and molar conductance – measurement of molar conductance – variation of molar conductance with dilution for strong and weak electrolytes (qualitative explanation). Transport number and its determination by Hittorff and moving boundary method – effect of temperature and concentration – ionic mobility and ionic conductance – Kohlrausch law and its applications – Applications of conductivity measurements – degree of hydrolysis, solubility product and conductometric titrations. Theory of strong electrolytes – Debye-Huckel-Onsager theory – verification of Onsager equation – Wein effect and Debye-Falkenhangen effect – ionic strength – activity and activity coefficients of strong electrolytes.

UNITII: Galvanic Cells and Applications 15hrs

Galvanic cells – reversible and irreversible electrodes and cells – standard cell-emf and its measurement – types of electrodes – electrode reactions – electrode potentials - reference electrodes – standard electrode potentials. Derivation of Nernst equation for electrode potential and cell emf – sign conventions – electrochemical series and its applications – formation of cells – electrode and cell reactions – cell emf. Chemical cells and concentration cells with and without transference – examples and derivation of expressions for their emfs – liquid junction potential.

UNIT III: Applications of emf measurements 15hrs

Applications of emf measurement – calculation of G, H, S and equilibrium constants – determination of pH using quinhydrone and glass electrodes – potentiometric titrations. Applications of concentration cells – determination of valency of ions – transport number – equilibrium constant – solubility product – activity coefficients of electrolytes. Polarization – decomposition potential – over-voltage – storage cells – lead acid battery, Ni-Cd, Li-Fe battery – mechanism of discharging and recharging – fuel cells (H_2-O_2).

UNIT IV: Group theory 15 hrs

Symmetry elements – symmetry operations– various point groups with examples – point groups – identification and determination – group multiplication table of C_{2V} and C_{3V} Point groups -Matrix representation of symmetry operations.

UNIT V:Spectroscopy 15 hrs

Regions of electromagnetic spectrum – properties of electromagnetic radiation - concept of frequency, wavelength, wave number, energy, energy levels, quantization. Interaction of electromagnetic radiation with matter. Basic principles of atomic and molecular spectroscopy. Statement of Born-Oppenheimer approximation. Diatomic molecules - Energy levels of a rigid rotor, selection rules, spectral intensity. Distribution using population distribution (Maxwell-Boltzmann distribution) - determination of bond length - qualitative description of non-rigid rotor - isotope effect.

Reference Books:

1. Puri B.R., Sharma L.R and Pathania M.S., Principles of Physical Chemistry, 47th ed., Vishal Publishing Company, 2016
2. Sharma .K.K, Sharma.L.K. A Text book on physical Chemistry, 6th ed., Sultan Chand, 2016.
3. Maron S.H.andLando J.B. Fundamentals of Physical Chemistry, Macmillan.
4. Glasstone S. and Lewis. D., Elements of Physical Chemistry. Macmillan

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignments, Field-based learning.

Course Outcomes (COs):

Upon completion of this course, the students

CO code	Course Outcomes	K-levels
CO1	Understand the fundamental concepts of conductance studies	Kl,K2,K3
CO2	Acquire knowledge the fundamentals of electro chemical cells Understand the EMF calculations of cells	Kl,K.2,K3
CO3	Apply the methods of determination of pH, Understand the basic concepts of storage cells and fuel cells ..Understand the basic principles of polarography.	K.2,K3,K4
CO4	Understand the basic concepts of symmetrical elements. knowledge to write Point groups. Construct the group multiplication table C2Vand C3V point groups - ApplyingMatrix representation of symmetry operations.	Kl,K.2,K3
CO5	gain knowledge on general basic principles of spectroscopy acquire knowledge on rotational spectroscopy and its applications Analyze the bond length, isotope effect.	Kl,K2,K4
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6–Creating		

CO-PSO Mapping (Course Articulation Matrix)

CO/PSO	PSOl	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	3	3
CO2	3	3	3	3	3	3
CO3 .	3	3	3	3	3	3
CO4	3	3	1	2	2	3
CO5	3	3	3	3	3	3
Average	3.0	3.0	2.6	2.7	2.7	3.0

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

FIFTH AND SIXTH SEMESTER				
Course Title		PHYSICAL CHEMISTRY PRACTICAL		
Course Code		22UFCHC4		
Course No.	Course Category Core/Elective	No. of Credits	No. of hours/week	Total Marks (Int + Ext)
CCP-III	Core	4	3	40 + 60 = 100

Chemical Kinetics

1) Determination rate constant of acid-catalysed hydrolysis of an ester.

Phase Rule

2) Determination of critical solution temperature of phenol-water system
3) Determination of concentration of an electrolyte using CST of phenol-water system
4) Phase diagram of simple eutectic system

Solutions

5) Determination of k_f and molecular weight of a solute using Rast's macro method

Electrochemistry

6) Determination of cell constant and equivalent conductance of a strong electrolyte at infinite dilution (Debye-Huckel-Onsager Equation)
7) Determination of dissociation constant of a weak electrolyte
8) Conductometric titration between a strong acid and a strong base

Adsorption

9) Adsorption by solid from solution - Freundlich adsorption isotherm

COURSE OUTCOMES:

On completion of the course the student will be able to:

CO Code	COURSE OUTCOME	KNOWLEDGE LEVEL
CO1	Acquire the knowledge on basic principles of physical Chemistry.	K1,K2,K3,K4
CO2	Apply the concepts and develop the skills to perform quantitative estimation of given sample.	K1,K2,K3,K4
CO3	Apply the skills to pursue higher studies and work with professional ethics in industries and research laboratories.	K2,K3,K4
Kl-Knowledge, K2-Understand, K3-Apply, K4-Analyze		

CO-PSO Mapping (Course Articulation Matrix)

CO/PSO	PSOl	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	1	3	3	1
CO2	3	3	3	3	3	2
CO3 .	3	3	2	1	2	3
Average	3.0	3.0	2.0	2.3	2.6	2.0

FIFTH AND SIXTH SEMESTER				
Course Title		GRAVIMETRIC ANALYSIS PRACTICAL		
Course code.		22 UFCHC5		
Course No	Course Category Core/Elective	No. of Credits	No of hrs/week	Total marks (Int+Ext)
CCP - IV	Core	4	5	40+60=100

Course objectives

- ✓ To understand the basic principles of precipitation, filtration and estimation of barium, calcium, nickel, lead by gravimetric analysis.
- ✓ To acquire skills in the various process of gravimetric analysis and calculate the amount of the substance present in the unknown .

List of experiments:

1. Estimation of Sulphate as Barium Sulphate.
2. Estimation of Barium as Barium Chromate.
3. Estimation of Lead as Lead Chromate.
4. Estimation of Calcium as Calcium Oxalate.
5. Estimation of Nickel as Nickel Dimethyl glyoximate.

Books for Reference

1. Venkateswaran V. Veeraswamy R. Kulandaivelu A.R., Basic Principles of Practical Chemistry, 2nd edition, New Delhi, Sultan Chand & Sons (1997)
2. A.I. Vogel., Textbook of Inorganic analysis

COURSE OUTCOMES:

On completion of the course the student will be able to:

CO Code	COURSE OUTCOME	KNOWLEDGE LEVEL
CO1	Acquire the knowledge on basic principles of gravimetric analysis and perform the process methodically	K1,K2,K3,K4
CO2	Apply the concepts and develop the skills to perform quantitative estimation of barium, lead, nickel, calcium etc; with precision using sintered and silica crucible. Understand the theory of various processes such as precipitation, filtration and incineration .	K1,K2,K3,K4
CO3	Apply the skills to pursue higher studies and work with professional ethics in industries and research laboratories.	K2,K3,K4
Kl-Knowledge, K2-Understand, K3-Apply, K4-Analyze		

CO-PSO Mapping (Course Articulation Matrix)

CO/PSO	PSOl	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	1	1	3	3	1
CO2	3	3	1	3	3	3
CO3 .	2	3	2	1	2	3
Average	2.6	2.3	1.3	2.3	2.6	2.3

FIFTH AND SIXTH SEMESTER				
Course Title		ORGANIC ANALYSIS PRACTICAL		
Course code.		22UFCHC6		
Course No	Course Category Core/Elective	No. of Credits	No of hrs/week	Total marks (Int+Ext)
CCP - V	Core	4	3	40+60=100

Course objectives

- ✓ To understand the basic reactions in organic analysis
- ✓ To acquire analytical skills to identify the unknown organic substance systematically

EXPERIMENTS IN ORGANIC ANALYSIS

Systematic analysis of an organic compound Preliminary tests, detection of elements present, Aromatic or Aliphatic, Saturated or unsaturated, nature of the functional group, confirmatory tests and preparation of derivatives - Aldehydes, Ketones, Amines, Amides, Diamide, Carbohydrates, Phenols, esters, acids and nitro compounds.

ORGANIC PREPARATIONS

1. Preparation of para- bromo acetanilide from acetanilide.
2. Preparation of benzoic acid from benzaldehyde.
3. Preparation of m- dinitro benzene from nitrobenzene.
4. Preparation of acetanilide from aniline.
5. Preparation of glucosazone from glucose.

Reference Books

1. Venkateswaran V. Veeraswamy R. Kulandaivelu A.R., Basic Principles of Practical Chemistry, 2nd edition, New Delhi, Sultan Chand & Sons (1997)
2. A.I .Vogel., Textbook of organic analysis

COURSE OUTCOMES:

On completion of the course the student will be able to:

CO No	COURSE OUTCOME	KNOWLEDGE LEVEL
CO1	Understand the basic principle organic reactions and analyse the organic substance systematically	K1,K2,K3,K4
CO2	Acquire analytical skill to identify the unknown organic substance based on aliphatic or aromatic and identify the various elements present such as nitrogen, halogen and sulphur present along with the functional groups.	K1,K2,K3,K4
CO3	Apply the skills to pursue higher studies and work with professional ethics in industries and research laboratories.	K2,K3,K4
Kl-Knowledge, K2-Understand, K3-Apply, K4-Analyze		

CO-PSO Mapping (Course Articulation Matrix)

CO/PSO	PSOl	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1	1	2	3	2	1
CO2	3	3	1	3	2	3
CO3 .	2	3	2	1	3	3
Average	2.0	2.3	1.6	2.3	2.3	2.3

FIFTH SEMESTER				
Course Title		AGRICULTURAL CHEMISTRY		
Course code		22UECHE1A		
Course No.	Course Category Core/Elective	No. of credits	No. of hrs/week	Total marks (Int+Ext)
CEC-1A	Elective	5	5	25+75=100

Course Objectives:

- **T**o help the students to understand the soil properties for plant growth.
- To know the role and function of fertilizers to improve agricultural product quality and quantity.
- To know the concepts and function of fertilizers naturally from wastes and production of compost to improve the agricultural yield.
- To expose the students to the concepts of pesticide usage and various modes of action towards different types of pests.
- To inculcate different types of attaching indulged by fungicides,rodenticides, and attractants.

UNIT – I Soil and its composition 15 hrs

Definition of soil - composition of the soil- physical properties –the significance of physical properties to plant growth. Soil chemical properties – inorganic colloids – clay minerals – amorphous – ion-exchange reactions – organic colloids – soil organic matter - humus formation – the significance of soil fertility.

UNIT – II Fertilizers 15 hrs

Fertilizer – definition – Nitrogenous fertilizer – effect of nitrogen on plant growth Phosphate fertilizer – effect of phosphorus on plant growth – super phosphate – bone meal Potassium fertilizer – effect of potassium on plant growth. Secondary and micronutrient fertilizers – complex and mixed fertilizers – manufacture, reactions in soils. Biofertilizers – rhizobium- bacteria-bacillus, pseudomonas, fungi-aspergillus, penicillium.

UNIT – III Manures 15 hrs

Agricultural, industrial and urban wastes – preparation of enriched farmyard manures – compost-Bangalore and Coimbatore type compost- oil cakes, fish meal, poultry manure. Preparation of slow-release fertilizer – the compatibility of fertilizers – preparation of different fertilizer mixtures.

UNIT – IV Plant protection 15 hrs

Pest management and control – Pesticides – definition and classifications – mode of action – the impact of pesticides in soil and plants – impact on the environment – safety measures in handling. Insecticides – Plant products – Nicotine, Pyrethrum, rotenone, petroleum oils. Inorganic pesticides – Arsenical fluorides, borates.

Organic pesticides – chlorine compounds – D.D.T., B.H.C., methoxychlor, chloredane, endosulfan. Organophosphorus compounds – carbamic acid derivatives – carbaryl – structure.

UNIT – V Fungicides 15 hrs

Fungicides – Inorganic – sulphur compounds – copper compounds. Organic –Bordeaux mixture-Herbicides –boron compounds - chlorates and sulphamates. Organic herbicides – nitro and chlorinated compounds -Propionic acid derivatives – urea herbicides. Rodenticides – Attractants – Repellants.

Textbooks

1. A.J. Daji, 1970, A Textbook of soil science – Asia publishing house – Madras.
2. Donahue, R.L. Miller R.W. and Shickluna, J.C. 1987, Soils- An Introduction to Soils and Plant Growth – Prentice Hall of India (P) Ltd., New Delhi.

Reference books

1. Colling G.H. 1955, Commerical Fertilizers – Mc Graw Hill Publishing Co., New York.
2. Tisdale S.L., Nelson, W.L. and Benton, J.D. 1990, Soil fertility and fertilizers, Mac Millan publishing company, New York.
3. Hesse, P.R., 1971, A textbook of soil chemical analysis, John Murray, New York.

Web resources:

http://www.ijcmas.com>

http://www.mdpi.com>

METHODOLOGY OF TEACHING

Class Lecturer, Group Discussion, Assignments, Field-based learning

Course outcome (COs):

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

CO code	Course Outcomes	K-levels
CO1	Definition and composition of the soil, Analyze the properties of soil for plant growth. Knowledge of colloids, soil texture, soil water, soil air, soil temperature, and its fertility	K1, K2
CO2	Outline the various types of fertilizers nitrogen, phosphorus, and potassium. Knowledge of fertilizers on plant growth to get better yield. Concept of secondary and micronutrients. Interpretation of complex fertilizers, mixed fertilizers, and bio-fertilizers	K1, K2
CO3	Required knowledge of manures from agriculture, industrial and urban wastes. Evaluate the usage of farm yarn, compost, oil cakes, bone meal, etc., Methods adopted to prepare different fertilizer mixers for plant growth.	K1, K2
CO4	Concepts of pest control and its management. Classification of usage of pesticides and their impact on the environment. Safety measurement in handling pesticides. Knowledge of natural occurring and synthesis of the inorganic-organic form of pesticides.	K1, K3
CO5	Knowledge of fungicides and herbicides to protect the plant. Compounds of inorganic and organic type preparation copper and sulphur compounds. Concepts of Rodenticides, Attractants, and	K1, K3

	repellents.	
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6–Creating		

\CO-PSO Mapping (Course Articulation Matrix

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	1	3	3
CO2	3	2	1	1	2	2
CO3	3	2	2	2	1	2
CO4	3	2	2	2	2	2
CO5	3	2	2	2	2	1
Average	3	2	1.8	1.6	2.0	2.0

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

FIFTH SEMESTER				
Course Title		FOOD CHEMISTRY		
Course Code		22UECHE1B		
Course No	Course Category Core / Elective /	No of Credits	No of hrs /week	Total marks (Int+Ext)
CEC 1B	Elective	5	5	25 + 75=100

Course objectives

- To learn about the food adulteration and food poison
- To know about the additives and preservatives.
- To get awareness about the soft drinks and their harmful effect.

Unit: I Food Adulteration 15 Hrs

Sources of food,types,advantages and disadvantages. Food adulteration-contamination of Wheat,Rice ,Alial, Milk, Butter etc., with clay stones,water and toxic chemicals – Common adulterants, Ghee adulterants and their detection. Dtection of adulterated foods by simple amalytical methods.

Unit II Food Poison 15 Hrs

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

Unit III Food Additives 15 Hrs

Food additives – artificial sweetners – Saccharin – Cyclomate and aspartate.Food flavours – esters,aldehydes and heterocyclic compounds,Food colours – Emulsifying agents- preservatives – leavening agents,Baking powder –yeast- taste makers – MSG vinegar.

Unit IV Beverages 15 Hrs

Beverages- soft drinks – soda-fruit juices- alcoholic beverages-examples,carbonation – addition to alcohol – diseases of liver and social problems.

Unit V Edible oils 15 Hrs

Fats, 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 significances.

Text Books:

1. Swaminathan.M, Food science and experimental foods, Ganesh and company
2. Jayashree Ghosh, Fundamental concepts of Applied Chemistry,S.Chand&Co.Publishers.

Reference Books:

ThanlammaJacob,Text Books of applied chemistry for Home Science and allied Sciences,Macmillam publishers.

Web resources:

https://en.wikipedia.org/wiki/Food_

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignments, PPT presentation.

Course Outcomes (COs):

Upon completion of this course, the students are able to

CO code	Course Outcomes	K-levels
CO1	create awareness about the food aduteration.	K1, K2,K3.
CO2	Infer food poison and to illustrate first aid for poison consumed victims.	KI,K3,K4
CO3	Summarize food additives and harmful effect of artificial colours.	K2,K3,K5
CO4	Create awareness about the harmful effects of soft drinks	K2, K3,K6
CO5	Explain the sources of oil and its preservation	K2,K6
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6–Creating		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	3	3
CO2	3	2	3	3	2	3
CO3	3	3	2	2	3	3
CO4	3	2	3	3	3	3
CO5	3	3	2	3	2	3
Average	3.0	2.6	2.4	2.8	2.6	3.0

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

SIXTH SEMESTER

SIXTH SEMESTER				
Course Title		ORGANIC CHEMISTRY II		
Course code.		22UFCHC1		
Course No	Course Category Core / Elective /	No.of Credits	No of hrs /week	Total marks (Int+Ext)
CC – X	Core	4	5	25+75 =100

Course objectives

- ✓ To gain knowledge on the classification, reactions and stereochemistry of Carbohydrates.
- ✓ To gain a good knowledge of synthetic strategies and recognizes the terminologies involved in organic synthesis.
- ✓ To gain knowledge and learns about the classification, structure and properties of Alkaloids, Terpenoids, Steroids, Hormones, Amino acids and proteins.
- ✓ To understand the applied chemistry in the form of synthesizing Dyes and rubbers and enable the green chemistry that brings about eco-friendly green products.
- ✓ To gain a thorough knowledge of the basic concepts involved in UV, IR, NMR, and Mass spectroscopy spectroscopic techniques.

Unit-I: Carbohydrates 15 hrs

Stereochemistry of carbohydrates: D- and L- configurations - Erythro and threo diastereomers– Glucose - properties of glucose - Epimerisation of glucose - Anomers of glucose and mutarotation - Fructose and its properties - Conversion glucose into fructose and vice-versa - Formation of osazone and glycosides - Fischer open structure and evidences for open structure - Haworth projection cyclic structures (pyranose and furanose) and evidences for cyclic structures of glucose and fructose - Stepping up - Kiliani- Fischer synthesis and stepping down - Ruff degradation of monosaccharides - Disaccharides: α – and β – glucosidic linkages with suitable examples - 1,4’ and 1,6’ linkages with suitable examples - Structure and properties of sucrose- Polysaccharides: Cellulose.

Unit-II: Synthetic methodology and reagents 15 hrs

Synthetic terminology - Disconnection, synthon, synthetic equivalent (SE), Functional group interconversion (FGI), Target molecule (TM)- retro synthetic analysis - Linear, Convergent and Combinatorial syntheses. List of Nucleophilic reagents and electrophilic reagents.

Synthetic applications of malonic ester and ethylacetoacetate in the synthesis of a) monocarboxylic acids (propionic acid and n-butyric acid). b) dicarboxylic acids (succinic acid and adipic acid). Retrosynthesis of the following molecules 4-methyl acetophenone, methylcyclohex-3-enecarboxylate, phenylethylbromide, 2-methylcyclopentane and 2-allyl phenol. Role of following reagents in organic synthesis: DIBAL, Gilmann reagent, DCC, trimethylsillylchloride and methyllithium

Unit-III: Natural Products and Biochemistry 15 hrs

Alkaloids: Definition - classification with suitable examples for each class - properties - structural determination - Sources, isolation, physiological activities and structure of piperine, conine, cocaine and quinine. Terpenoids: definition, isoprene rule and classification with suitable examples - Isolation, properties, structure and uses of citral, geraniol and limonene. Steroids and Hormones: definition - classification - Occurrence, structure and physiological activities of cholesterol, estrogens and testosterone.

Unit-IV: Industrial Organic Chemistry 15 hrs

Dyes - theory of color and constitution - chromophore, auxochrome, classification according to application and structure - preparation and uses of azo dyes - methyl orange, triphenyl methane dyes - malachite green, indigo dyes - Indigotin, anthraquinone dyes - alizarin, phthalein dyes –fluorescein.

Polymers-definition- classification -mechanism of cationic, anionic and free radical polymerisation – preparation of Nylon 66, Nylon 6, Dacron, Bakelite, melamine, neoprene, Buna-N, Buna-S and biodegradable polymers - Green Chemistry - Definition, need and basic principles of green chemistry - green synthesis - Microwave and Ultrasound assisted green synthesis- green chemical synthesis of Paracetamol.

Unit-V: Applications of Spectroscopy 15 hrs

UV and Visible Spectroscopy: Possible electronic transitions in an organic compound. Selection rule. Solvent effect. Chromophore and auxochromes. Infrared spectroscopy:Various types of vibrations and number of vibrational degrees of freedom. Selection Rules. The characteristic ranges of absorption of IR radiation of various functional groups. Spin Resonance Spectroscopy:NMR active nuclei. Equivalent and non-equivalent protons and number of signals. Reference compound TMS. Relative signal intensities and number of hydrogens. Chemical shift and various factors influencing chemical shift. Spin-spin splitting, splitting constant, NMR spectrum of simple molecules. Mass Spectrometry: Basic principles Representation of mass spectrum. Molecular ion - identification of parent ion - isotopic peaks - meta stable peak. General fragmentation – McLafferty rearrangement Mass spectra of ethylbenzene.

Reference Books:

1 I. L. Finar, Organic Chemistry Vol-1, 6thedn, Pearson Education Asia, 2004.

2. R. Silverstein, M., Bassler, G. C., Morrill, T. C. Spectrometric Identification of Organic Compounds, John Wiley and Sons, INC, Fifth edition, 1991.

3. W. Kemp, Organic Spectroscopy, Palgrave, 1991.

4. J.R. Dyer, Application of Absorption Spectroscopy of Organic Compounds, Prentice-Hall of India Pvt.Ltd, 2010.

Methodology of teaching: Class lectures, Group discussions and Assignments.

COURSE OUTCOMES:

On completion of the course the student will be able to:

CO No	Course outcome	Knowledge level
CO1	Understand the stereo chemistry and different types of carbohydrates, interconversions and their structural properties.	K1, K2, K3,
CO2	Gain a good knowledge of synthetic strategies and recognizes the terminologies involved in organic synthesis.	K1, K2, K3
CO3	Gain knowledge and learn about the classification, structure and properties of Alkaloids, Terpenoids, Steroids, Hormones,Amino acids and proteins.	K1, K2,
CO4	Use the green route to synthesise the dyes and rubbers in the industry. Apply the Microwave and ultrasound methods to green synthesis.	K1, K2, K3
CO5	Understand the instrumentation techniquesofUV,IR ,NMR and Mass spectroscopy. Apply the spectroscopic techniques to identify the complex organic molecules.	K1, K2, K3, K4
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5– Evaluating , K6–Creating		

CO – PSO Mapping

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	2	3
CO3	3	3	2	2	3
CO4	3	3	1	2	3
CO5	3	3	3	3	3
Average	3.0	3.0	2.4	2.4	3.0

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

SIXTH SEMESTER				
Course Title		INORGANIC CHEMISTRY II		
Course code		22UFCHC2		
Course No.	Course Category Core/Elective	No. of credits	No. of hrs/week	Total marks (Int+Ext)
CC - XI	Core	4	5	25+75=100

Course objectives:

- The students are to get familiarized with the composition and stability of the nucleus and types of nuclear reactions.
- They are exposed to the basic concepts of the structure of solids, electrical and magnetic properties of solids.
- To receive knowledge on the day-to-day usage of solid material applicable to the function of conductors, superconductors, and solid-state materials.

Unit –I: Nuclear Chemistry I 16 hrs

Introduction – composition of the nucleus and nuclear forces – nuclear stability – mass defect – binding energy – packing fraction – N/P ratio – magic numbers – nuclear models – liquid drop – Shell and collective model. Isotopes – detection and separation – deviation of atomic weights from whole numbers – isobars, isotones, and isomers – Radioactive decay and equilibrium – nuclear isomerism – internal conversion. Nuclear Q-value – threshold energy – cross-sections.

Unit –II: Nuclear Chemistry II 16 hrs

Natural radioactivity – radioactive decay– Radioactive techniques – Geiger Muller and ionization counters. Detection and measurement of radioactivity – radioactive series including neptunium series – group displacement law – Rate of disintegration and half-life period – Average life period. Artificial radioactivity – induced radioactivity – radioactive series- uses of radioisotopes – hazards of radiations – nuclear energy – nuclear reactors – nuclear fission and fusion-fission products and fission yields – Spallation – photonuclear and thermonuclear reactions – energy source of the sun and stars – carbon dating – rock dating– applications of nuclear science in agriculture, biology and medicine – Atomic power projects in India.

Unit –III: Solid State Chemistry 15 hrs

Ionic bonding – lattice energy – Born equation-radius ratio rules – structures of some ionic crystals – Structure of solids – comparison of X-ray and Neutron diffraction – derivation of Bragg's equation. Spinels and inverse spinels – defects in solids, non-stoichiometric compounds – Electrical, Magnetic and optical properties of solids – band theory – semiconductors – superconductors. Solid-state electrolytes – Types of magnetic behavior, dia, para, ferro, antiferro, and ferrimagnetism – Hysteresis – Solid-state lasers – inorganic phosphors – ferrites.

Unit –IV: Structure of Solids 15 hrs

Classification of solids – amorphous and crystalline solids – Van der Waals crystals – covalent crystals – Laws of crystallography – Elements of symmetry – Weiss and Miller indices – Crystal systems and Bravais lattices. Structure of ionic solids – crystal structures – Sodium chloride, Zinc blende, wurtzite, rutile, Cesium chloride, fluorite – antifluorite – Identification of simple cubic, bcc, fcc lattices and indexing of X-ray lines. Crystal defects – Schottky and Frenkel defects – F-center.

Unit –V: Material Chemistry 13 hrs

Introduction – techniques for synthesis of nanomaterials –sol-gel synthesis- electro deposition –inert gas condensation-mechanical alloying –properties of nanomaterials – applications of nanomaterials, Superconductivity – introduction– examples of superconducting oxides,– applications of superconducting materials.

Text Books

1. Soni, P.L. and Mohan Katyal, Textbook of inorganic chemistry, 20th ed., New Delhi, Sultan Chand & Sons, 2006

2. Puri B.R., Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, New Delhi, 2002

Reference books

1. Lee J.D., Concise Inorganic Chemistry, ELBS Edition

2. Madan R.D., Tuli G.D., and Malik S.M., Selected Topics in Inorganic Chemistry, S.Chand& Co, New Delhi, 2006

Web resources:

https://www.sas.upenn.edu>

https://nlos.ac.in>

Course outcome (COs):

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

CO code	Course Outcomes	K-levels
CO1	Outline of nuclear concepts, composition, forces, and stability. Illustrate the nuclear models, concepts of mass defects, and binding energy calculations. Knowledge of Q value and isotopic terms with examples	K1, K2
CO2	Analyze the radioactive techniques using Geiger-Muller counter Relationship of radioactive series, displacement laws, and rate of integration of nuclear reaction. Nuclear fission and fusion concepts specific application of fission reaction in Nuclear reactor to produce electricity. Utility of isotopes in various fields of everyday life.	K1, K2, K3
CO3	The concepts of the solid structure of ionic crystals. Require knowledge of X-ray and Neutron diffraction techniques. Analysis of the defects in solids and non-stoichiometric materials. Summarizing the optical, electrical, and magnetic properties of solids.	K1, K2
CO4	Defining the laws of crystallography. Classification and relating the types of solids. Interpreting the Weiss and Miller indices. Sketch the analyze the structure of Sodium chloride, Zinc Blende, rutile,	K1, K3

	Wurtzite cesium chloride, fluorite, etc.,	
CO5	Require knowledge of ionic conductors focusing applications on battery technology. Working and reactions of Na-S and Li batteries. Explanation of Nanomaterial methods of synthesis properties and applications in various fields. Citing the superconductor concepts.	K1, K2.K4
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6–Creating		

CO-PSO Mapping (Course Articulation Matrix)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	3	2
CO2	3	2	2	2	2	3
CO3	3	3	3	2	2	2
CO4	3	2	1	1	2	1
CO5	3	2	2	2	3	2
Average	3.0	2.2	2.0	2.0	2.4	2.0

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

SIXTH SEMESTER				
Course title		PHYSICAL CHEMISTRY II		
Course code		22UFCHC3		
Course No	CourseCategory Core / Elective	No of Credits	No of hrs /week	Total marks (Int+Ext)
CC XII	Core	4	5	25 + 75=100

Course objectives:

- To understand the principles of IR spectroscopy and its applications.
- To study the basics of Raman spectra and its applications
- To know the theory and instrumentation of NMR Can learn the principles of IR, Raman, NMR spectroscopic and instrumentation techniques and its applications
- To learn the nature the characteristics of catalysis and its types
- To study the phenomenon of adsorption and its applications

UNIT I: INFRA RED AND RAMAN SPECTROSCOPY 15hrs

IR Spectroscopy; Principle, Simple harmonic oscillator, selection rules, pure vibrational spectrum, Hooke's law, Zero point energy, anharmonicity, determination of force constant, fundamental vibrational frequency and overtone, vibrational modes of CO_2 and H_2O,IR instrumentation and identification of organic molecules from characteristic absorption bands**.** Raman spectroscopy: Rayleigh and Raman Scattering – Stokes and Anti- stokes lines – difference between IR and Raman- mutual exclusion principle- applications**.**

UNIT II::CATALYSIS AND ADSORPTION 15 hrs

Catalysis- characteristics- - different types-homogeneous-heterogeneous-acid-base catalysis-auto catalysis-theories of catalysis-intermediate compound formation theory and adsorption theory- kinetics of enzyme catalysis - MichaelisMenton equation. – applications of catalysis-Adsorption-definition- - physisorption and chemisorptions - factors influencing adsorption of gases on solids - Langmuir adsorption isotherm – BET equation (no derivation) - Applications of adsorption.

UNIT III: :PHASE EQUILIBRIA 15 hrs

Phase Rule: Concepts of phase, component and degrees of freedom, with examples. Gibb's phase rule – derivation. One-component system: Phase diagrams: Water and sulphur systems. Two component system: (i) Simple eutectic: Lead-silver system- Formation of compound with congruent melting point: Ferric chloride – water system. Clausius - Clapeyron equations and their applications to equilibria in phase transitions. (solid – liquid, liquid – vapour, solid – vapour).

UNIT IV: :SOLUTIONS AND COLLIGATIVE PROPERTIES 15 hrs

Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Henry's law- Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes. Partial miscibility of liquids: Critical solution temperature; effect

of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation. Nernst distribution law and its applications. Colligative properties- elevation of boiling point, depression in freezing point – Abnormal behavior of solutions of electrolyte.

UNIT V: :PHOTOCHEMISTRY 15 hrs

Laws of photochemistry - Grothus-Drapper law – Stark-Einstein law of photochemical equivalence – Quantum efficiency – determination of quantum efficiency – chemical actinometry – consequence of light absorption – *Jablonski* diagram – radiative and non-radiative transitions – photochemical reactions – kinetics of photochemical combination of H_2-Cl_2, H_2-Br_2 and decomposition of HI –sEnergy transfer in photochemical reaction – photosensitization - photosynthesis in plants – Theory of Fluorescence and Phosphorescence – Chemiluminescence and bioluminescence.

Text Books

1. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, 46th Edition, Vishal Publishing Company, New Delhi, 2013.
2. P.L. Soni, O.P. Dharmaha and U.N. Dash, Textbook of Physical Chemistry, 23rd Edition, Sultan Chand & Sons, New Delhi, 2011.
3. R.L. Madan, G. D. Tuli, Physical Chemistry, S. Chand, Revised edition,

Reference Books

4. S. Glasstone and D.H. Lewis, Elements of Physical Chemistry, 2nd Edition, Macmillan &Company, UK, 1962.
5. P.W. Atkins, J. D. Paula Elements of Physical Chemistry, Oxford University Press,2017

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignments, Field-based learning.

Course Outcomes (COs): On completion of this course, the students are able to

CO1	Summarize the principles of IR spectroscopy and its applications .Acquire knowledge about the basics of Raman spectra and its applications .Applying the theory and instrumentation of NMR	Kl,K.2,K3
CO2	Correlate the nature and the characteristics of catalysis and its types . Acquire knowledge in the concept of adsorption and its applications differentiate types of adsorption. Applying the theory of kinetics in enzyme catalysis. Solving Michaelis Menton equation.	Kl,K.2,K3
C03	Know about the Phase rule and its application to various systems Applying Clausius - Clapeyron equations for the various phase transitions. Explaining the phase-diagram for watersystem,sulphur system, Lead-Silver system	K.2,K3,K4
C04	Understand the Raoult's law, non-ideal solutions and Colligative properties , Gain knowledge of ideal and non-ideal solutions and reasons for deviations of non-ideal solutions from ideal behaviour. derive the thermodynamic relationship between vapour pressure	Kl,K.2,K3

	and Colligative properties.	
Co5	Explain the various types of photochemical process Acquire knowledge of various laws of photo chemistry and to draw *Jablonski*diagram.Ellucidate the kinetics of photochemical reactions in H_2-Cl_2 system, Analyzing energy transfer in photochemical reaction .Determining the Quantum efficiency of photochemical reaction.	Kl,K2,K4
Kl-Knowledge, K2-Understand, K3-Apply, K4-Analyze		

CO- PSO Mapping (Course Articulation Matrix)

CO/PSO	PSOl	PS02	PS03	PS04	PSO5	PSO6
CO1	3	3	3	3	3	3
CO2	3	3	3	3	3	3
CO3	3	3	3	3	3	3
CO4	3	3	1	2	2	3
CO5	3	3	3	3	3	3
Average	3.0	3.0	2.6	2.7	2.7	3.0

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

SIXTH SEMESTER				
Course Title		FORENSIC CHEMISTRY		
Course code		22UECHE2A		
Course No	Course Category Core / Elective /	No of Credits	No of hrs /week	Total marks (Int+Ext)
CEC IIA	Elective	5	3	25 + 75=100

Course objectives

- To learn about the food adulteration and food poison
- To know about the additives and preservatives.
- To get awareness about the soft drinks and their harmful effect.
- To learn about the oils and their sources.

Unit I Poison **9** Hrs

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

Unit II Crime Detection **9** Hrs

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 burn.

Unit III Forgery and counterfeiting 9 Hrs

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 jewels – authenticity of diamond.

Unit IV Tracks and traces **9** Hrs

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

Unit V Medicinal aspects **9** Hrs

Aids – causes and prevention – misuse of scheduled drugs – burns and their treatment by plasticsurgery.Metabolite analysis using mass spectrum – gas chromatography. Arson – natural fibres 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 books:

T.H.James,Forensic Sciences, Stanley Thornes Ltd.

Reference Book

Richard Criminalistics – An introduction to forensic Science (College Version), 8 thEdition , Prentice hall.

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignments, PPT presentation

Course Outcomes (COs):

Upon completion of this course, the students are able to

CO code	Course Outcomes	K-levels
CO1	Learn about poisons and their treatments.	K1, K2,K3.
CO2	Acquire knowledge about crime detection.	KI,K3,K4
CO3	Understand the methods of forgery.	K2,K3,K5
CO4	Know about the tracks and traces of crimes	K2, K3,K6
CO5	Explain the medical aspects	K2,K6
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6–Creating		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	3	3
CO2	3	2	3	3	3	3
CO3	3	3	2	2	3	3
CO4	2	2	3	3	3	3
CO5	3	2	2	2	2	3
Average	2.8	2.4	2.8	2.8	2.8	3

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

SIXTH SEMESTER				
Course Title		Pharmaceutical Chemistry		
Course code.		22UECHE2B		
Course No	Course Category Core/Elective	No. of Credits	No of hrs/week	Total marks (Int+Ext)
CEC - IIB	Elective	5	3	25+75=100

Course objectives:

- To impart basic knowledge regarding medicinal chemistry.
- To find out the symptoms and drugs for various chronic diseases.
- To know the value of indian medicinal plants.
- To obtain a vast knowledge about antiseptics and disinfectants.

Unit – I: Basic Pharmaceutical Chemistry 9 hrs

Definition of the following terms: Drug, Pharmacophore, Pharmacology, Pharmacopeia, bacteria, virus and vaccine. Causes, symptoms and drug for Anemia,Jaundice, Cholera,Malaria and Filariasis. Indian Medicinal plants and uses – Tulasi, Neem, Kizhanelli, Mango, Semparuthi, Adadodai and Thoothvelai.

.**Unit – II: Antibacterials** 9 hrs

.Sulpha drugs-example and its action-prontosil and sulphathiazole. Antibiotics-definition and action of penicillin, streptomycin, chloramphenicol. Antiseptics and disinfectants –

Unit – III: Analgesics and CNS stimulants 9 hrs

Analgesics: Definition and Action – narcotic and non narcotic – morphine – disadvantages and uses. Antipyretic analgesics - salicylic derivative, paracetamol, ibuprofen. Drugs affecting CNS – Definition, distinction and examples for tranquilisers, sedatives, hypnotics, psychedelic drugs – LSD and its effects.

Unit – IV: Anaesthetics and Drugs for Chronic diseases. 9 hrs

Anaesthetics - definition – local and general – volatile nitrous oxide, ether, Chloroform, Cyclo propane – uses and disadvantages –Causes, medicines and mode of action for the treatment of cancer – antineoplastics – diabetes – hypoglycemic agents AIDS – AZT, DDC. Blood: Grouping, composition, Rh factor, blood pressure, hyper tension and hypotension..

Unit – V: Vitamins, Hormones and Enzymes 9 hrs.

Vitamins – fat soluble vitamins – (i) vitamin A; (ii) vitamin D; (iii) vitamin B complex; (iv) vitamin C; (V) vitamin E; (vi) vitamin K; (vii) vitamin P. Hormones – Introduction, properties and function of hormones, chemical nature of hormones. Physiological function of some hormones: Adrenaline, thyroxin, oxytoxin, insulin, sex hormones.

Text Books

1. Jayashree Ghosh, A Text Book of Pharmaceutical Chemistry, 3rd Edition, S.Chand& Company Ltd., New Delhi, 2003.

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignments, Field-based learning.

Course Outcomes (COs):

Upon completion of this course, the students will be able to;

CO code	Course Outcomes	K-levels
CO1	**Acquire basic knowledge** and to **understand** the values of various medicinal plants.	K1,and K2
CO2	**To know** about the Sulpha Drugs, Antibiotic To learn the structural features of sulpha drugs.	K1, K2, K3, K4
CO3	**Obtain knowledge** towards the basic information about the drugs affecting CNS and its examples.	K1, K2, K4
CO4	To **learn** the importance of drugs used for cancer, diabetics, To **classify** blood into various groups based on the composition.	K1, K2, K4
CO5	To **learn** about the property and physiological function of harmones.	K1, K2, K3
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5– Evaluating , K6–Creating		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	1	2	2
CO2	3	2	3	2	2	2
CO3	3	2	2	3	2	2
CO4	3	2	2	3	2	1
CO5	3	2	2	3	2	3
Average	3	2	2.2	2.4	2	2

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

SIXTH SEMESTER				
Course Title		Analytical Chemistry		
Course code.		22UFCHE3A		
Course No	Course Category Core/Elective	No. of Credits	No of hrs/week	Total marks (Int+Ext)
CEC IIIA	Elective	5	3	25+75=100

Course objectives:

- To provide the basic idea about the analytical techniques and find out sources of error, Methods of reporting analytical data.
- To understand the concepts of theory behind the titrimetric analysis
- To provide the principles of gravimetric analysis and the analysis of thermal analytical methods.
- To study about the principles and classification of separation methods.

UNIT I: Basic concepts of analytical chemistry **9** hrs

Role of Analytical Chemistry. Classification of analytical methods – classical and instrumental. - Neatness and cleanliness - Laboratory operations and practical - Analytical balance - Techniques of weighing, errors, Volumetric glassware-cleaning and calibration of glassware. Sample preparations handling of reagents. Laboratory notebooks. Safety in the analytical laboratory.

UNIT II: Errors and their Evaluation 9 hrs

Types of errors in experimental data-determinate (systematic), indeterminate (or random) - Sources of errors and the effects upon the analytical results. Accuracy-absolute error, relative error. Statistical evaluation of data- Definition of terms mean and median. Precision- Average deviation, standard deviation

UNIT III: Titrimetric Analysis **9** hrs

Theoretical considerations of titrimetric analysis – classification of reactions in titrimetric analysis – standard solutions – concentration units – primary and secondary standards – Neutralization indicators – apparent indicator constant – universal or multiple – Range indicators. Neutralization curves – Neutralization of strong acid with strong base, weak acid with strong base, weak base with strong acid, weak acid with weak base precipitation titrations, redox titrations, self - indicators.Complexometric titration, EDTA titrations, EBT and murexide indicator. Titrations in non-aqueous solvents – solvents for non-aqueous titrations - Indicators for non-aqueous titrations.

UNIT IV: Gravimetric Analysis and Thermal Analysis **9**hrs

Principles of gravimetric analysis – characteristics of precipitating agents – choice of precipitants and conditions of precipitation – specific and selective precipitants – DMG, Cup- Ferron, salicylaldehyde, ethylene diamine – use of sequestering agents – co precipitation – post precipitation – peptization – differences reduction of error – precipitation from homogeneous solutions – calculations in gravimetric methods – use of

gravimetric factor. Thermal analytical methods – Principle involved in thermo gravimetric analysis and differential thermal analysis.

UNIT V: Separation Methods **9** hrs

Solvent extraction: Principles and process of solvent extraction – Distribution law and the partition coefficient Classification of chromatographic methods, Principles of differential migration and adsorption phenomenon – Nature of the adsorbent solvent systems – Rf values – Paper chromatography – various modes of development: ascending, descending and horizontal, Detection of spots – preparative paper chromatography, Thin layer chromatography – Coating materials – Preparation of plates – Solvents for development and detection – Preparative TLC - Application – Column chromatography: Adsorption and partition methods: Nature of the column materials, preparation of the column, solvent system and detection methods.

Text Books:

1. G.D.Christian, Analytical Chemistry, 5th Ed., John Wiley, 1994.
2. D. A. Skoog and D. M. West, Fundamental of Analytical Chemistry, 7th Edition, International Edition, Saunders College Publishing,Philadelphia, Holt, London, 1996.
3. L.G.Hargis, Analytical Chemistry: Principles and Techniques, Prentice Hall, 1988.

Reference Books:

1. R.A.Day, Jr. and A.L.Underwood, Quantitative Analysis, 6th edition, Prentice Hall, 1991.
2. S.M.Khopkar,EnvironmentalSolution Analysis,Wiley Eastern Ltd.,NewDelhi, 1993.
3. S.M.Khopkar, Basic Concepts of Analytical Chemistry, WileyEastern.1984.
4. F.Settle, Handbook of Instrumental Techniques for Analytical Chemistry,Prentice Hall, 1997.

Web Resources

https://www.unom.ac.in/webportal/uploads/library/gcl-opac/chemanalysis.html
https://usiu-ke.libguides.com/AnalyticalChemistry

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignments, Field-based learning

Course Outcomes (COs):

Upon completion of this course, the students be able to

CO code	Course Outcomes	K-levels
CO1	Acquire thorough knowledge of Role of Analytical Chemistry, Use Analytical balance, Recognize handling of reagents, and Safety in the analytical laboratory.	K1, K2, K3
CO2	Classify the errors in experimental data, Describe the Sources of errors and the effects upon the analytical results.	K1, K2, K4
CO3	Explain the Theoretical considerations of titrimetric analysis.	K1, K2, K3, K4

CO4	Explain and tp understand the Principles of gravimetric analysis, Compare Principle involved in thermo gravimetric analysis and differential thermal analysis.	K1, K2, K3, K4
CO5	Explain Principles and process of solvent extraction.	K1, K2, K3
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	1	2	2
CO2	3	2	3	2	2	2
CO3	3	2	2	3	2	2
CO4	3	2	2	3	2	1
CO5	3	2	2	3	2	3
Average	3	2	2.2	2.4	2	2

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

SIXTH SEMESTER				
Course Title		Bio-Chemistry		
Course code		22UFCHE3B		
Course No	Course Category Core / Elective /	No of Credits	No of hrs /week	Total marks (Int+Ext)
CEC IIIB	Elective	5	3	25 + 75=100

Course objectives

- To know about the building blocks of human system
- To learn about the function of enzymes
- To acquire knowledge about the carbohydrates and their metabolism.
- To get indepth knowledge about the energy and oxidation reaction.
- To understand the role of DNA and RNA

UNIT I : Components of Cell 9 Hrs

Synthesis of amino acids and their identification - Proteins – Primary structure: composition of amino aicds in proteins. Sequencedetermination (N- terminal & C-terminal amino acid analysis)

- Amino acuid and replacement in haemoglobin and its consequences bonding with the same poly peptide chain. Denaturation of proteins-Metabolism – Catabolism of amino acids including sulphur containing amino acids,Proteins absorption and digestion.

UNIT II: Enzymes and Lipids 9 Hrs

Mechanism of Enzyme action. Concept of the active site – localization of enzyme activity in the cell – kinetics of mono and di substrate enzyme – catalyzedreaction.Mechanism of inhibition (competitive, non, and uncompetitive and allosteric) ; Coenzymes and its mechanism of action – immobilization of enzymes. Classification, Neutral fats.fatty acids and its distribution in triglycerides – Phospho Lipids (Lecithines, Ceplhalins,Plasmalogens) – Structure and Biosynthesis.

UNIT III: Carbohydrates 9 Hrs

Structure and conformation of glucose and fructose only. Polysaccharides (Starch and Glycogen): structure and utility. Metabolism: Glycolysis and its reversal; TCA cycle – Relationship between glycolysis and respiration.

UNIT IV: Biological Oxidation 9 Hrs

Cellular oxidation reactions – Energy liberation during oxidation. Energy liberation during electron transport – Mechanism of oxidative phosphorylation.

UNIT V: Nucleic Acids and Blood Proteins 9 Hrs

Purine and pyrimidine type of bases – structure of DNA and RNA. Classification of RNA. **DNA**: Replication and enzymatic synthesis – RNA's involved in protein biosynthesis.

Genetic code and protein biosynthesis. Regulatory mechanism in nuclei acid metabolismcatabolismandanabolism.**Blood composition** : Plasma proteins – blood coagulation – Haemoglobin and its rolein chemistry of respiration and iron metabolism

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignments, PPT presentation.

Course Outcomes (COs):

Upon completion of this course, the students are able to

CO code	Course Outcomes	K-levels
CO1	Explain the synthesis of amino acids and their identification	K1, K2,K3.
CO2	Understand the mechanism of enzyme action.	KI,K3,K4
CO3	Illustrate the structure glucose and fructose.	K2,K3,K5
CO4	Summarize hoe energy is liberated in humansystems.	K2, K3,K6
CO5	Describe the role of DNA and RNA.	K2,K6
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6–Creating		

CO- PSO Mapping (Course Articulation Matrix)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	3	3
CO2	3	2	3	3	2	3
CO3	3	3	2	2	3	3
CO4	3	2	2	3	2	3
CO5	2	3	2	3	3	2
Average	2.8	2.6	2.2	2.4	2.6	2.4

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

ALLIED COURSES

FIRST SEMESTER - B.Sc. Maths THIRD SEMESTER - B.Sc. Physics				
Course Title		ALLIED CHEMISTRY – I		
Course Code		22UACHA1		
Course No.	Course Category	No. of Credits	No of hours / week	Total Marks (Int + Ext)
AC - IA	Core	3	4	25 + 75 = 100

COURSE OBJECTIVES:

1. To know the role of fundamental particles of nucleus and the changes brought about in it during nuclear reactions.
2. To classify fuels, fertilizers, water and use it based on its characteristic property
3. To identify the organic compounds and utilize it for various organic reactions
4. To synthesize some important useful organic compounds and relate their usage to their properties.
5. To understand how a chemical reaction proceeds, the factors that influence it and also understand photochemical processes.

Unit I: NUCLEAR CHEMISTRY (12 hrs)

Fundamental particles Of Nucleus - Isotopes, Isobars, Isotones and Isomers -Differences between chemical reactions and nuclear reactions - Fusion and fission - Radio active series, group displacement law - Mass defect - Applications of radio isotopes - carbon dating, rock dating and medicinal applications.

Unit II: INDUSTRIAL CHEMISTRY (12 hrs)

Fuels- Classification-gaseous fuels like water gas, producer gas, liquefied petroleum gas, gobar gas, Compressed natural gas - Fertilizers- Classification - urea, Ammonium sulphate, superphosphate, Triple super phosphate, potassium nitrate- manufacture and uses- Hardness of water: temporary and permanent hardness, disadvantages of hard water - Softening of hard water - demineralization process and reverse osmosis - Purification of water for domestic use.

Unit III: FUNDAMENTALS OF ORGANIC CHEMISTRY (12 hrs)

Classification of organic compounds - Classification of reagents - electrophiles, nucleophiles and free radicals - Classification of reactions - addition, substitution, elimination, condensation and polymerisation - Polar Effects-Inductive effect, resonance, hyper-conjugation, steric effect - Keto-enol tautomerism - electrophillic substitution mechanism in benzene (Nitration and Sulphonation)

Unit IV: CHEMISTRY OF SOME USEFUL ORGANIC COMPOUNDS (12 hrs)

Preparation and uses of CH_2Cl_2, $CHCl_3$, CCl_4, CF_2Cl_2. BHC, DDT and Teflon - Heterocyclic compounds - Preparation, properties and uses of furan, thiophene, pyrrole, pyridine.

Unit V : CHEMICAL KINETICS AND PHOTOCHEMISTRY (12 hrs)

Rate of chemical reaction - order and molecularity - Determination of order of reaction (Trial and error & Graphical methods only) - Effect of temperature on reaction rate - Activation energy - Arrhenius equation - Homogeneous and Heterogeneous catalysis - Photochemistry - Statement of Grotthus - Draper Law, Stark - Einstein's Law, Quantum yield, Hydrogen chlorine reaction (elementary idea only), photosynthesis, photosensitization, phosporescence, fluorescence, chemiluminescence - Definition with examples

TEXT BOOKS

1. Dr .Veeraiyan V., Text book of Ancillary Chemistry, Highmount Publishing house, Chennai-14. Edition-2006.
2. Soni P.L. and Others, Textbook of Organic chemistry, Sultan Chand and Company, New Delhi, Edition-2006.
3. Puri B.R., Sharma and Pathania, Text book of Physical Chemistry, Vishal Publishing Co., New Delhi. Edition-2006.

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignments, Field-based learning./

COURSE OUTCOMES:

On completion of the course the student will be able to:

CO Code	**Course Outcomes**	**K - levels**
CO 1	Define and interpret the fundamental particles of nucleus Learn about nuclear reactions.	K1,K2,K3 K4
CO 2	Define, classify and explain the uses of fuels, fertilizers and water. Explain hardness in water and the methods of removal of hardness in order to use water effectively	K1,K2,K3 K4
CO 3	Identify organic compounds and classify and use them for various organic reactions.	K1,K2,K3 K4
CO 4	Describe and summarize the preparation, properties and uses of some organic compounds (CH_2Cl_2, $CHCl_3$, CCl_4, CF_2Cl_2,BHC, DDT, Teflon) and heterocyclic compounds.	K1,K2,K3 K4
CO 5	Expalin the of chemical reaction. Summarize and explain various photo chemical processes with examples.	K1, K2
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing		

MAPPING OF CO's – PSO's(Course Articulation Matrix)

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	1	3	4	1	3	1
CO 2	3	3	2	3	3	4
CO 3	2	4	3	4	3	1
CO 4	2	4	4	4	1	2
CO 5	1	3	3	3	4	1
Average	1.8	3.4	3.2	3	2.8	1.8

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

First Semester - B.Sc. Home Science Third Semester - B.Sc. Botany, B.Sc. Zoology				
Course Code			22UACHA1	
Name of the Course			ALLIED CHEMISTRY – I	
Course No.	Course Category	No. of Credits	No of hours / week	Total Marks (Int + Ext)
AC - IB	Core	3	4	25 + 75 = 100

COURSE OBJECTIVES:

- To know the role of fundamental particles of nucleus and the changes brought about in it during nuclear reactions.
- To classify fuels, fertilizers, water and use it based on its characteristic property
- To synthesize some important useful organic compounds and relate their usage to their properties.
- To understand how a chemical reaction proceeds, the factors that influence it and also understand photochemical processes.

Unit I: NUCLEAR CHEMISTRY 12 hrs

Fundamental particles Of Nucleus - Isotopes, Isobars, Isotones and Isomers -Differences between chemical reactions and nuclear reactions - Fusion and fission - Radio active series, group displacement law - Mass defect - Applications of radio isotopes - carbon dating, rock dating and medicinal applications.

Unit II: INDUSTRIAL CHEMISTRY 12 hrs

Fuels- Classification-gaseous fuels like water gas, producer gas, liquefied petroleum gas, gobar gas, Compressed natural gas - Fertilizers- Classification - urea, Ammonium sulphate, superphosphate, Triple super phosphate, potassium nitrate- manufacture and uses- Hardness of water: temporary and permanent hardness, disadvantages of hard water - Softening of hard water - demineralization process and reverse osmosis - Purification of water for domestic use.

Unit III: FUNDAMENTALS OF ORGANIC CHEMISTRY 12 hrs

Classification of organic compounds - Classification of reagents - electrophiles, nucleophiles and free radicals - Classification of reactions - addition, substitution, elimination, condensation and polymerisation - Polar Effects-Inductive effect, resonance, hyper-conjugation, steric effect - Keto-enol tautomerism - electrophillic substitution mechanism in benzene (Nitration and Sulphonation)

Unit IV: CHEMISTRY OF SOME USEFUL ORGANIC COMPOUNDS 12 hrs

Preparation and uses of CH_2Cl_2, $CHCl_3$, CCl_4, CF_2Cl_2. BHC, DDT and Teflon - Heterocyclic compounds - Preparation, properties and uses of furan, thiophene, pyrrole, pyridine.

UNIT V :Acids and Bases 12 hrs

Theories of acids and bases- Bronsted Lowry and Lewis concepts-Amphoteric nature of water,Buffer solutions and concept of pH –Henderson's equation for pH of buffer

TEXT BOOKS

1. Dr .Veeraiyan V., Text book of Ancillary Chemistry, Highmount Publishing house, Chennai-14. Edition-2006.
2. Soni P.L. and Others, Textbook of Organic chemistry, Sultan Chand and Company, New Delhi, Edition-2006.
3. Puri B.R., Sharma and Pathania, Text book of Physical Chemistry, Vishal Publishing Co., New Delhi. Edition-2006.

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignments, Field-based learning.

COURSE OUTCOMES:

On completion of the course the student will be able to:

CO Code	**Course Outcomes**	**K - levels**
CO 1	Illustrate the changes brought about in them during nuclear reactions. Explain radio isotopes and their applications in various areas.	K1,K2,K3 K4
CO 2	Define, classify and explain the uses of fuels, fertilizers and water. Explain hardness in water and the methods of removal of hardness in order to use water effectively	K1,K2,K3 K4
CO 3	Identify organic compounds and classify and use them for various organic reactions.	K1,K2,K3 K4
CO 4	Describe and summarize the preparation, properties and uses of some organic compounds (CH_2Cl_2, $CHCl_3$, CCl_4, CF_2Cl_2,BHC, DDT, Teflon) and heterocyclic compounds .	K1,K2,K3 K4
CO 5	Understand the basics of acids and bases.	K1, K2
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing		

MAPPING OF CO's – PSO's(Course Articulation Matrix)

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	1	3	4	1	3	1
CO 2	3	3	2	3	3	4
CO 3	2	4	3	4	3	1
CO 4	2	4	4	4	1	2
CO 5	1	3	3	3	4	1
Average	1.8	3.4	3.2	3	2.8	1.8

Second Semester - B.Sc. Maths Fourth Semester - B.Sc. Physics				
Course Title		ALLIED CHEMISTRY – II		
Course Code		22UBCHA2		
Course No.	Course Category	No. of Credits	No of hours / week	Total Marks (Int + Ext)
AC – IIA	Core	3	4	25 + 75 = 100

COURSE OBJECTIVES:

1. To study the importance of co-ordination compounds, theories and its application in qualitative and quantitative analysis.
2. To talk about the occurrence of metals, explain principles of metallurgy and basic metallurgical process.
3. To discuss the preparation, properties and biological functions of carbohydrates, amino acids, proteins and nucleic acids.
4. To know about the basics of electrochemistry, emf, standard electrode potential, reference electrodes, electroplating and types of pH and its determination, buffer and its application, corrosion.
5. To understand the concepts of qualitative and quantitative analysis and explain the different separation techniques

Unit I : COORDINATION CHEMISTRY 12 hrs

Definition of terms-classification of ligands-Nomenclature-chelation-EDTA and its Applications –Werner's Theory-Effective Atomic Number-Pauling's Theory-Postulates-Applications to $(Ni(CO)_4)$, $(Ni(CN)_4)^{2-}$, $(Co(CN)_6^{3-}$- Merits and demerits of Werner and Pauling's Theory-Biological role of haemoglobin and chlorophyll -Applications of coordination compounds in qualitative and quantitative analysis like separation of copper and cadmium ions; Nickel and cobalt ions; identification of metal ions like Cu, Fe and Ni-Estimation of Nickel using DMG.

Unit II : METALLURGY12 hrs

Occurrence of metals – Principles of metallurgy – basic metallurgical operations and metallurgy process – General methods involved in extraction of metals –concentration of ores – froth floatation, magnetic separation, calcinations, roasting, smelting, flux, aluminothermic process Extraction processes – Chemical reduction – electrolytic reduction – metal displacement – Refining methods – distillation – fractional crystallization – electrolysis Zone refining – van Arkel de Boer methods – Electrolytic refining.

Unit III : BIOMOLECULES12 hrs

Carbohydrates - Classification, preparation and reactions of glucose-open and ring structure of glucose - Mutarotation, Interconversion of glucose to fructose and vice versa - Amino acids: Classification, preparation and properties of alanine - Gabriel Phthalimide Synthesis - preparation of dipeptide using Bergman method. Proteins -Classification - Denaturation and colour reactions of Proteins - Primary and Secondary structure of

Proteins (elementary treatment only) - Nucleic acids: DNA and RNA-their components and biological functions.

Unit IV :ELECTROCHEMISTRY 12 hrs

Galvanic Cells - emf - standard electrode potential - reference electrodes - Electroplating process -Nickel and Chrome plating - Different type of cells - primary cell, secondary cell and fuel cells - Conductometric titrations - Definition of pH and its determinations by colorimetric method. Buffer solution – Henderson's equation - Applications of buffer solution in biological process and industries – Corrosion and its prevention.

Unit V : ANALYTICAL CHEMISTRY12 hrs

Introduction to Qualitative and Quantitative Analysis - Principle of volumetric analysis - Separation techniques - extraction - distillation - crystallization - Chromatographic separations - Principles and applications of column, paper and thin layer chromatography.

TEXT BOOKS

1. Dr .Veeraiyan V., Text book of Ancillary Chemistry, Highmount Publishing house, Chennai-14. Edition-2006.
2. Soni P.L. and Others, Textbook of Organic chemistry, Sultan Chand and Company, New Delhi, Edition-2006.
3. Puri B.R., Sharma and Pathania, Text book of Physical Chemistry, Vishal Publishing Co., New Delhi. Edition-2006.

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignments, Field-based learning.

COURSE OUTCOMES:

On completion of the course the student will be able to:

CO Code	Course Outcomes	K - levels
CO 1	Define the terms (ligands, chelation), classifyligandsand explain Pauling's and Werner's theory and their applications	K1,K2,K3 K4
CO 2	Identify and explain the areas of occurrence of metals in earth's crust. Explain the principles of basic metallurgical process.	K1,K2,K3 K4
CO 3	Classify carbohydrates, aminoacids, proteins, nucleic acids and explain their preparation, properties and biological functions	K1, K2, K3
CO 4	Explain determination of pH by colorimetric method, prevention of corrosion application of buffer solution in industries	K1, K2, K3
CO 5	Summarize the principle of volumetric analysis, describe the various separation techniques (extraction, distillation, crystallization, chromatography) and its applications.	K1, K2, K3
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing		

MAPPING OF CO's – PSO's(Course Articulation Matrix)

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	1	3	2	2	3	2
CO 2	3	3	2	4	2	3
CO3	2	3	3	3	3	3
CO 4	2	3	3	2	3	3
CO 5	3	3	3	3	2	3
Average	2.2	3	2.6	2.8	2.6	2.8

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

Second Semester - B.Sc. N&D Fourth Semester -, B.Sc. Botany, B.Sc. Zoology				
Course Title		ALLIED CHEMISTRY – II		
Course Code		22UBCHA2		
Course No.	Course Category	No. of Credits	No of hours / week	Total Marks (Int + Ext)
AC – IIB	Core	3	4	25 + 75 = 100

COURSE OBJECTIVES:

- To study the importance of co-ordination compounds, theories and its application in qualitative and quantitative analysis.
- To know the biological role of enzyme.
- To discuss the preparation, properties and biological functions of carbohydrates, amino acids, proteins and nucleic acids.
- To understand the plant protection chemicals and micronutrients.
- To understand the concepts of qualitative and quantitative analysis and explain the different separation techniques

Unit I : COORDINATION CHEMISTRY 12 hrs

Definition of terms-classification of ligands-Nomenclature-chelation-EDTA and its Applications –Werner's Theory-Effective Atomic Number-Pauling's Theory-Postulates-Applications to $(Ni(CO)_4)$, $(Ni(CN)_4)^{2-}$, $(Co(CN)_6^{3-}$- Merits and demerits of Werner and Pauling's Theory-Biological role of haemoglobin and chlorophyll -Applications of coordination compounds in qualitative and quantitative analysis like separation of copper and cadmium ions; Nickel and cobalt ions; identification of metal ions like Cu, Fe and Ni-Estimation of Nickel using DMG.

Unit II : ENZYMES 12 hrs

Nomenclature and classification-biological role of enzyme-chemical nature,characteristics of enzyme-colloidal nature,catalyticnature,specificity of enzyme action.Heatsensitivity,pH sensitivity – Enzyme catalysis-Fischer's lock and key model

Unit III : BIOMOLECULES 12 hrs

Carbohydrates - Classification, preparation and reactions of glucose-open and ring structure of glucose - Mutarotation, Interconversion of glucose to fructose and vice versa - Amino acids: Classification, preparation and properties of alanine - Gabriel Phthalimide Synthesis - preparation of dipeptide using Bergman method. Proteins -Classification - Denaturation and colour reactions of Proteins - Primary and Secondary structure of Proteins (elementary treatment only) - Nucleic acids: DNA and RNA-their components and biological functions.

Unit IV : Plant protection chemicals,Micronutrients and their role 12 hrs

Inorganic pesticides,Fungicides,Herbicides and Rotendicides. Biological functions of some micronutrients- Iron,Copper,Iodine,Zinc and Fluorine-Physiological functions and source of Cobalt and Chromium.

12 hrs

Unit V : ANALYTICAL CHEMISTRY

Introduction to Qualitative and Quantitative Analysis - Principle of volumetric analysis - Separation techniques - extraction - distillation - crystallization - Chromatographic separations - Principles and applications of column, paper and thin layer chromatography.

TEXT BOOKS

1. Dr .Veeraiyan V., Text book of Ancillary Chemistry, Highmount Publishing house, Chennai-14. Edition-2006.
2. Soni P.L. and Others, Textbook of Organic chemistry, Sultan Chand and Company, New Delhi, Edition-2006.
3. Soni P.L. and Others, Text book of Inorganic Chemistry, Sultan Chand and Company, New Delhi, Edition-2006.
4. Puri B.R., Sharma and Pathania, Text book of Physical Chemistry, Vishal Publishing Co., New Delhi. Edition-2006.
5. Dara S.S., Text book of Environmental chemistry and Pollution Control.-S.Chand and Co., NewDelhi, Edition 2006.

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignments, Field-based learning.

COURSE OUTCOMES:

On completion of the course the student will be able to:

CO Code	Course Outcomes	K - levels
CO 1	Define the terms (ligands, chelation), classifyligandsand explain Pauling's and Werner's theory and their applications	K1,K2,K3 K4
CO 2	Understand the biological role of enzyme and its characteristics.	K1,K2,K3K4
CO 3	Classify carbohydrates, aminoacids, proteins, nucleic acids and explain their preparation, properties and biological functions	K1, K2, K3
CO 4	Acquire knowledge about the pesticides,Herbicides.To learn the biological of nutrients .	K1, K2, K3
CO 5	Summarize the principle of volumetric analysis, describe the various separation techniques (extraction, distillation, crystallization, chromatography) and its applications.	K1, K2, K3
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing		

MAPPING OF CO's – PSO's(Course Articulation Matrix)

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	1	3	2	2	3	2
CO 2	3	3	2	4	2	3
CO3	2	3	3	3	3	3
CO 4	2	3	3	2	3	3
CO 5	3	3	3	3	2	3
Average	2.2	3	2.6	2.8	2.6	2.8

(Common to all Branches)

Course Title		ALLIED CHEMISTRY PRACTICALS		
Course Code		22UBCHA3		
Course No.	Course Category	No. of Credits	No of hours / week	Total Marks (Int + Ext)
ACP - III	Core	4	3	40 + 60 = 100

COURSE OBJECTIVES:

- To identify and recognize the amount of substance (Sodium hydroxide, Borax, Ferrous sulphate, Potassium permanganate) and acid (Hydrochloric acid, Oxalic acid) in the given analyte solution using a standard solution volumetrically.
- To explain the presence of metal ion in the given solution and summarize the type and amount of hardness in water using a standard solution volumetrically.

SYLLABUS

1. Estimation of Sodium hydroxide using standard sodium carbonate.
2. Estimation of Hydrochloric acid using standard oxalic acid.
3. Estimation of Borax using standard Sodium carbonate.
4. Estimation of Ferrous Sulphate using standard Ferrous ammonium sulphate.
5. Estimation of Oxalic acid using standard Ferrous sulphate.
6. Estimation of Potassium permanganate using standard sodium hydroxide.
7. Estimation of Magnesium using EDTA
8. Estimation of Ferrous ion using diphenyl amine as internal indicator.
9. Estimation of hardness of water using standard EDTA

TEXT BOOKS

Sundaram, Krishnan, Ragavan, Practical chemistry (Part II), S.Viswanathan Co. Pvt Ltd.1996.

METHODOLOGY OF TEACHING

(Class lectures, Demonstration, Laboratory experience.

COURSE OUTCOMES:

On completion of the course the student will be able to:

CO Code	Course Outcomes	K – levels
CO 1	To identify the amount of substance present in the analyte solution using a link solution titrimetrically.	K1,K2,K3
CO 2	To recognize the weight of acids in the given solution using a standard solution titrimetrically.	K1,K2,K3
CO 3	To tell the presence of metal ions and identify its amount in the given solution and also quote the type and amount of hardness in water using a standard solution titrimetrically	K1,K2,K3
K1 – Remembering , K2– Understanding , K3 –Applying		

CO – PSO Mapping (Course Articulation Matrix)

CO/PO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	2	2	2	3
CO 2	3	3	2	2	2	3
CO 3	3	3	2	2	2	3
Average	3	3	2	2	2	3

NON MAJOR ELECTIVES

NON MAJOR ELECTIVE

FIRST SEMESTER				
Course Title	CHEMISTRY IN EVERY DAY LIFE			
Course Code	22UACHN1A			
Course No.	Course Category	No. of Credits	No of hours / week	Total Marks (Int + Ext)
NME - IA	Elective	3	2	25 + 75 = 100

COURSE OBJECTIVES:

1. To understand the effectiveness of chemicals as medicines in the treatment of various ailments.
2. To quote the different sweeteners, food preservatives available, categorize them and use accordingly
3. To realize the importance of certain chemicals such as soaps, detergents and their cleansing action in our day to day life

Unit I :MEDICINAL CHEMISTRY 6 hrs

Aneasthetics - Antipyretics - Analgesics-Antiseptic- Antimalarial- Antibiotics-Antacids- Definition, Examples,uses and their side effects.

Unit II :DYES 6 hrs

Introduction - Fibres to be dyed - Dyeing - Methods of dyeing - Direct dyeing - Vat dyeing - Modern dyeing - Food dyes - Classification of dyes based on chemical constitution - Azo dyes - Methyl orange, methyl red, diphenyl methane dyes, triphenyl methane dyes, phthalein dyes, indigoids - Application of the dyes

Unit III :CHEMICALS IN FOOD 6 hrs

Food preservatives- Table salt,Vegetable oils and Sodium benzoate-Artificial sweetening agents-Saccharin,Sucralose,Aspartame (only structure)-Antioxidants- Definition and examples.

Unit IV :POLYMERS 6 hrs

Cellulose,Starch,Wool and Silk- Polythene,Natural and Synthetic rubbers-Buna rubbers and their uses-Polyesters-Nylon-6,6-Formaldehyde resins- biodegradable plastics

Unit V : CHEMICALS IN CLEANSING AGENTS 6 hrs

Soaps - Types of soaps - Toilet soaps, floating soaps, Transparent soaps, Laundry soaps - Cleansing action of soaps - Detergents - Anionic detergent - Cationic detergent

Text Books:

1. Engineering Chemistry by P.C. Jain and Monica Jain, Dhanpatrai and Sons, 15th edition, 2006.
2. Thanlamma Jacob, Text Book of Applied Chemistry for Home Science and Allied Science, Macmillan.
3. Swaminathan. M, Food Science and Experimental foods, Ganesh and Company.

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignments, Field-based learning

COURSE OUTCOMES:

On completion of the course the student will be able to:

CO Code	Course Outcomes	K – levels
CO 1	Identify, classify, relate, categorize and grade the chemicals used in medicine for treatment of ailments	K1,K2,K3 K4
CO 2	Define , Classify, categorize, grade dyes and modify them according to usage	K1,K2,K3 K4
CO 3	Quote and classify the various sweeteners and food preservatives available.	K1,K2,K3 K4,K5,K6
CO 4	Explain, relate, categorize, grade and modify the usage of various polymer	K1,K2, K4,K5,K6
CO 5	Analyze, apply and appraise the various chemicals used in everyday life	K3,K4,K5
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6–Creating		

CO – PSO Mapping (Course Articulation Matrix)

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	2	1	3	3	1	3
CO 2	1	2	3	3	4	4
CO3	2	1	2	3	3	4
CO 4	2	2	1	3	3	1
CO 5	3	3	3	4	5	5
Average	2	1.8	2.4	3.2	3.2	3.4

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

FIRST SEMESTER				
Course Title		DAIRY CHEMISTRY		
Course code		22UACHN1B		
Course No	Course Category Core / Elective /	No of Credits	No of hrs /week	Total marks (Int+Ext)
NME IB	NME	2	2	25 + 75=100

Course Objectives

- To learn about the adulteration in milk
- To gain knowledge about the processing og milk
- To know the various products of milk

Unit I Composition of milk 6 Hrs

Milk -definition – general composition of milk – contituents of milk – lipids ,proteins, carbohydrates ,vitamins and minerals – physical properties of milk – colour ,odour ,acidity,specific gravity ,viscosity and conductivity – Rearnaged effect – 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 milk – destruction of mocroorganisms 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 6Hrs

Cream – definition – composition – chemistry of creaming process – gravitational and cetntrifugal methods of separation of cream – estimation of fat in cream.

Butter – definition – composition – theory of churning – desibutter – salted butter estimation of acidity and moisture content in butter.

Ghee – major constituents – common adiulterants added to ghee and their detection – rancidity – definition – prevention -antioxidants and synergists – natural and synthetic.

Unit IV Special milk 6 Hrs

Standardised milk – definition – merits – reconstituted milk – definition – flow diagram of manufacture – Homogenised milk – flavoured milk – vitaminized milk – toned milk –

incitation milk – vegetable toned milk – humanized milk -condensed milk – definition , composition and nutritive value.

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 – Bulgaricus milk-acidophilus milk – yogurt indigenous products – khoa and channa definition. Ice cream – definition – percentage composition – types – ingredients – manufacture of ice-cream-stabilizers -emulsifiers and their role -milk powder – definition – need for making milk powder – drying process – types of drying.

Text Books:

1. Outline of Dairy Technology - Sukumar De
2. Indian dairy products-K.S. Rangappa and K.T. Acharya

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignments, Field-based learning.

COURSE OUTCOMES:

On completion of the course the student will be able to:

CO Code	**Course Outcomes**	**K – levels**
CO 1	Identify adulterants in milk.To know the stimation of fats,acidity	K1,K4
CO 2	To describe the different methods processing of milk	K1,K2,K3 K4
CO 3	Summarize various products that can be obtained from milk.	K1,K2, K3,K6
CO 4	To know the different types of milk	K1,K2,K3 K4
CO 5	To learn the fermentation of milk	K1 - K4
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5– Evaluating , K6–Creating		

MAPPING OF CO's – PSO's(Course Articulation Matrix)

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	2	1	3	3	1	3
CO 2	1	2	3	3	4	1
CO3	2	1	2	3	3	4
CO 4	2	2	1	3	3	1
CO 5	3	3	3	4	5	5
Average	2	1.8	2.4	3.2	3.2	2.8

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1	A (Answer all the questions)	10 × 2	Short Answer (Two questions from each unit)	20
K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

SECOND SEMESTER				
Course Title		INDUSTRIAL CHEMISTRY		
Course Code		22UBCHN2A		
Course No.	Course Category	No. of Credits	No of hours / week	Total Marks (Int + Ext)
NME - IIA	Elective	2	2	25 + 75 = 100

COURSE OBJECTIVES:

1. To know about the the vital resource water, its types, applications and study of certain parameters in it.
2. To categorize the energy resources and summarize its application in various areas.
3. To understand the importance of paper, paper products and its uses.
4. To have an indepth knowledge about leather, its applications and also know about the problems encountered in its disposal.
5. To tell about the effectiveness of milk and its products as a nutritive diet.

Unit I :Water treatment, purification and management 6 hrs

Water pollutants – water treatment- methods of treatment - sedimentation, coagulation, filtration - removal of micro organisms - chlorination, adding bleaching powder, UV irradiation and ozonisation- Determination of contaminants- Electrical conductivity - turbidity - pH, total solids, TDS - alkalinity - hardness – Soft water and hard water- removal of hardness by ion exchange method- Rain water harvesting.

Unit II :Energy resources 6 hrs

Sources-renewable and non-renewable energies- effect of using fuels on the environment- solar energy-technology and advantages of using solar energy- hydrogen as fuel-its advantages- Rocket propellants – batteries- types and its impact on the environment.

Unit III :Pulp and paper 6 hrs

Introduction - Manufacture of pulp - Sulphate/Kraft pulp - Soda pulp - Rag pulp - Beating, refining, filling, sizing and coloring - Manufacture of paper - Calendering - Uses - Clean technology in Agro based industries - Ecological problems of Indian pulp and paper industry.

Unit IV :LEATHER CHEMISTRY

6 hrs

Leather-sources and composition-steps involved in leather processing-uses of leather-stability of leather-environmental impact. Chemistry of chrome tanning. Dyeing of leather- Tannery effluents-pollution and control.

Unit V :DAIRY CHEMISTRY 6 hrs

Milk- composition and effectiveness as a diet – heat processing of milk- pasteurization- preservation of milk- deep freeze preservation-dairy products – cheese, butter, ghee and kova. Spray drying technique – milk powder, infant food preparation.

References:

1. Outline of Dairy Technology - Sukumar De
2. Indian dairy products-K.S. Rangappa and K.T. Acharya
3. Polymer chemistry-M.G. Arora-Anmol publications-New Delhi
4. Text-book of Polymer Science - F.W. Billmeyer_New Age International

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignments, Field-based learning.

COURSE OUTCOMES:

On completion of the course the student will be able to:

CO Code	Course Outcomes	K - levels
CO 1	Identify the sources of water, describe the methods of water treatment, analyze the water sample for hardness, alkalinity, TDS	K1,K4
CO 2	Classify and describe the different types of energy resources. Relate the usage of these energy resources in fields	K1,K2,K3 K4
CO 3	Describe andsummarize various types of pulp, changes brought about to modify it into paper	K1,K2, K3,K6
CO 4	Quote the sources and composition of leather. Summarize the steps involved in leather processing, categorize and utilize it for various purposes	K1,K2,K3 K4
CO 5	Identify the composition of milk, summarize its heat processing methods. Categorize the milk products and relate their usage in various ways in various fields.	K1 - K4
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5– Evaluating , K6–Creating		

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CO 4	2	2	1	3	3	1
CO 5	3	3	3	4	5	5
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BLOOM TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

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K1, K2, K3	B (**INTERNAL CHOICE**) EITHER (a) OR (b)	5 × 5	Question (a) OR (b) from the same Unit and same K Level	25
K3, K4, K5	C (Answer any three question from five questions)	3 × 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

SECOND SEMESTER				
Course Title		APPLIED CHEMISTRY		
Course Code		22UBCHN2B		
Course No.	Course Category	No. of Credits	No of hours / week	Total Marks (Int + Ext)
NME – II B	Elective	2	2	25 + 75 = 100

Course Objectives:

- To know about fuels and their efficiency.
- To acquire knowledge about cement manufacture and paints.
- To learn about the preparation of fertilizers and their applications.
- To know the applications of plastics
- To gain awareness about the role of micro nutrients in our human body.

UNIT I Fuels 6 Hrs

Classification of fuels –Calorific value-Characteristics of a fuel-Refining of petroleum-Synthetic petrol-Aviation fuel- CNG- Bio gas- Fuel cells.

UNIT II Cement and Paints 6 Hrs

Raw materials- Manufacture of Portland cement- Special cements- setting of cement.Paints-Characteristics-Constituents of paints-special paints- water repellent- Fire retardant-Heat resistant-Anti fouling and Luminous paints.

UNIT III Fertilizers 6 Hrs

Preparation and uses of Urea,ammonimsulphate,superphosphate,triple superphosphate and NPK fertilizer.

UNIT IV Plastics 6 Hrs

Thermoplastics and Thermosetting plastics(Definition only)- PVC-Teflon-Polycarbonates-Polyurethanes and Thermocole-properties and applications –Compounding of plastics-Moulding methods-compression and injection moulding.

UNIT V Micro nutrients and their role 6 Hrs

Bilogical functions of some micro minerals – Iron,Copper,Iodine,Zinc and Fluorine.Physiological functions and source of Cobalt and Chromium.

Text Books:

1. Applied chemistry ,R.Gopalan,Vikasa publishing House Pvt Ltd.
2. Industrial Chemistry by B.K Sharma
3. Engineering Chemistry by Jain and Jain.

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignments, Field-based learning.

COURSE OUTCOMES:

On completion of the course the student will be able to:

CO Code	Course Outcomes	K - levels
CO 1	To know about fuels and their efficiency.	K1,K4
CO 2	To acquire knowledge about cement manufacture and paints.	K1,K2,K3 K4
CO 3	To learn about the preparation of fertilizers and their applications.	K1,K2, K3,K6
CO 4	To know the applications of plastics	K1,K2,K3 K4
CO 5	To gain awareness about the role of micro nutrients in our human body.	K1 - K4
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5– Evaluating , K6–Creating		

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