MOTHER TERESA WOMEN'S UNIVERSITY
KODAIKANAL

DEPARTMENT OF CHEMISTRY

B.Sc. CHEMISTRY

SYLLABUS TO BE IMPLEMENTED FROM THE ACADEMIC YEAR 2021-2022

(CHOICE BASED CREDIT SYSTEM)

Mother Teresa Women's University, Kodaikanal
Department of Chemistry
Choice Based Credit System (CBCS)
(2021-2022 onwards)
B. Sc. Chemistry

1. About the Programme

The B.Sc Chemistry Degree Program aims to impart sound knowledge in the fundamental aspects of the important branches of Chemistry. The curriculum is designed to integrate theoretical aspects with experimental/laboratory techniques and analytical thinking which are incorporated in the core and elective courses to equip the learners with the skills required for employability and research. The non-major elective courses, "Clinical chemistry" and "Applied chemistry" provide an overview of the important applications of chemistry to the non-major students. The unique features of the curriculum are ICT based and management oriented skilled based courses, which equip the learners with the essential knowledge of computer applications and managerial skills.

2. Programme Educational Objectives

PEO1	To develop broad knowledge in Chemistry in addition to understanding of key chemical concepts, principles and theories
PEO2	To employ critical thinking and scientific knowledge to design, carry out, record and analyze the results of chemical reactions.
PEO3	To develop students' ability and skill to acquire expertise in solving both theoretical and applied chemistry problems.
PEO4	To provide knowledge and skill to the students' thus enabling them to undertake further studies in Chemistry related areas or multidisciplinary areas that can be helpful for self- employment/entrepreneurship.
PEO5	inculcate the scientific temperament in the students.

3. Eligibility

A candidate who has passed the Higher Secondary Examination with Chemistry, Physics and Mathematics/Zoology as core subjects of Tamil Nadu Higher Secondary Board or an examination of some other board accepted by Mother Teresa Women's University shall be eligible for admission into B.Sc., course in Chemistry.

4. General Guidelines for UG Programme

i. **Duration:** The programme shall extend through a period of 6 consecutive semesters and the duration of a semester shall normally be 90 days or 450 hours. Examinations shall be conducted at the end of each semester for the respective subjects.

ii. **Medium of Instruction:** English

iii. **Evaluation:** Evaluation of the candidates shall be through Internal Assessment and External Examination.

Evaluation Pattern	Theory		Practical	
	Min	Max	Min	Max
Internal	**10**	**25**	**10**	**25**
External	**30**	**75**	**30**	**75**

- **Internal (Theory): Test (15) + Assignment (5) + Seminar/Quiz(5) = 25**
- **External Theory: 75**

- **Question Paper Pattern for External examination for all course papers.**

Max. Marks: 75 **Time: 3 Hrs.**

S.No.	Part	Type	Marks
1	**A**	**10*1 Marks=10** Multiple Choice Questions(MCQs): 2 questions from each Unit	**10**
2	**B**	**5*4=20** Two questions from each Unit with Internal Choice (either / or)	**20**
3	**C**	**3*15=45** Open Choice: Any three questions out of 5 : one question from each unit	**45**
Total Marks			**75**

*** Minimum credits required to pass: 156**

- **Project Report**

A student should select a topic for the Project Work at the end of the third semester itself and submit the Project Report at the end of the fourth semester. The Project Report shall not exceed 75 typed pages in Times New Roman font with 1.5 line space.

- **Project Evaluation**

There is a Viva Voce Examination for Project Work. The Guide and an External Examiner shall evaluate and conduct the Viva Voce Examination. The Project Work carries 100 marks (Internal: 25 Marks; External (Viva): 75 Marks).

5. Conversion of Marks to Grade Points and Letter Grade

(Performance in a Course/ Paper)

Range of Marks	Grade Points	Letter Grade	Description
90 – 100	9.0 – 10.0	O	Outstanding
80-89	8.0 – 8.9	D+	Excellent
75-79	7.5 – 7.9	D	Distinction
70-74	7.0 – 7.4	A+	Very Good
60-69	6.0 – 6.9	A	Good
50-59	5.0 – 5.9	B	Average
40-49	4.0 – 4.9	C	Satisfactory
00-39	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

6. Attendance

Students must have earned 75% of attendance in each course for appearing for the examination. Students with 71% to 74% of attendance must apply for condonation in the Prescribed Form with prescribed fee. Students with 65% to 70% of attendance must apply for condonation in the Prescribed Form with the prescribed fee along with the Medical Certificate. Students with attendance lesser than 65% are not eligible to appear for the examination and they shall re-do the course with the prior permission of the Head of the Department, Principal and the Registrar of the University.

7. Maternity Leave

The student who avails maternity leave may be considered to appear for the examination with the approval of Staff i/c, Head of the Department, Controller of Examination and the Registrar.

8. Any Other Information

In addition to the above mentioned regulations, any other common regulations pertaining to the UG Programmes are also applicable for this Programme.

9. Program Outcomes (POs)

On completion of this Programme, the learners will be able to

PO1	develop sound disciplinary knowledge and experimental skill
PO2	acquire communication skill to express the subject through technical writing and oral presentation
PO3	identify chemistry related problems, analyse and apply data using appropriate methodologies.
PO4	inculcate ethical awareness, environmental and social responsibility
PO5	become digitally literate to increase their core competency via e-learning resources for lifelong learning.

10. Program Specific Outcomes (PSOs)

On completing the B. Sc. Chemistry programme, the students will acquire

PSO1	systematic and coherent understanding of the fundamental concepts in Organic chemistry, Inorganic Chemistry, Physical Chemistry, Analytical Chemistry and all other related allied chemistry subjects.
PSO2	the ability to use evidence based comparative chemistry approach to explain chemical synthesis and analysis.
PSO3	the ability to demonstrate the experimental techniques and methods of their area of specialization in Chemistry.
PSO4	critical thinking ability by way of solving problems / numerical using Basic chemistry knowledge and concepts.
PSO5	the habit of learning continuously through use of advanced ICT technique and other available techniques / books / journals for academic growth

B.Sc. - CHEMISTRY

S. No	Course Code	Course Title	Credits	Hours		CIA	ESE	Total
				T	P			
Semester I								
1	U21LTA11	Part I – Tamil-I	3	6	-	25	75	100
2	U21LEN11	Part II – English-I	3	6	-	25	75	100
3	U21CHT11	Core I-General Chemistry I	4	5	-	25	75	100
4	U21CHP11	Core II-Practical I Organic Analysis and Estimation	4	-	6	25	75	100
5	U21MTA11/ U21ZOA11	Allied Theory Mathematics I/ Zoology	4	5	-	25	75	100
6	U21EVS11	Environmental Studies	2	2	-	25	75	100
7	U21PEPS11	Professional English I	4	6	-	25	75	100
		Total	**24**	**36**		**-**	**-**	**700**
Semester II								
8	U21LTA22	Part I – Tamil-II	3	6	-	25	75	100
9	U21LEN22	Part II – English-II	3	6	-	25	75	100
10	U21CHT21	Core III- General Chemistry II	4	5	-	25	75	100
11	U21CHP22	Core IV-Practical-II-Volumetric Analysis	4	5	-	25	75	100
12	U21MTA22/ U21ZOA22	Allied: Theory Mathematics II / Practical Zoology	4	5	-	25	75	100
13	U21VAE21	Value education	3	3	-	25	75	100
14	U21PEPS22	Professional English II	4	6	-	25	75	100
		Total	**25**	**36**		**-**	**-**	**700**
Semester III								
15	U21LTA33	Part I – Tamil-III	3	6	-	25	75	100
16	U21LEN33	Part II – English-III	3	6	-	25	75	100
17	U21CHT31	Core V- Analytical Chemistry	4	5	-	25	75	100
18	U21PHA33/ U21BOA33	Allied Chemistry - Physical Sciences / Life Sciences	4	5	-	25	75	100
19	U21CHE311/ U21CHE312	**Elective I-** Polymer Chemistry/Water Treatment	3	4	-	25	75	100
20	U21MSS31	**SBE-1**- Managerial Skills	2	2	-	25	75	100
21	U21CHN31	**Non Major Elective - I**	2	2	-	25	75	100
		Total	**21**	**30**		**-**	**-**	**700**
Semester IV								
22	U21LTA44	Part I – Tamil-IV	3	6	-	25	75	100
23	U21LEN44	Part II – English-IV	3	6	-	25	75	100
24	U21CHT41	Core VI- Medicinal Chemistry	4	4	-	25	75	100
25	U21CHT42	Core VII-Biochemistry	4	4	-	25	75	100
26	U21PHA44/	Allied Practical- III	4	-	4	25	75	100

	U21BOA44	Physical Sciences/ Life Sciences						
27	U21CHE421/ U21CHE422	**Elective-II**-Agricultural Chemistry/Textile Chemistry	3	3	-	25	75	100
28	U21CSS42	**SBE-II**-Computer Skills for office Management	2	2	-	25	75	100
29	U21CHN42	**Non Major Elective - II**	2	2	-	25	75	100
		Total	**25**	**31**		**-**	**-**	**700**
Semester V								
30	U21CHT51	Core VIII- Organic Chemistry-I	4	5	-	25	75	100
31	U21CHT52	Core IX- Inorganic Chemistry –I	4	5	-	25	75	100
32	U21CHT53	Core X–Physical Chemistry-I	4	5	-	25	75	100
33	U21CHP53	Core XI-Practical-IV Inorganic Qualitative Analysis	4	-	5	25	75	100
34	U21CHP54	Core XII- Practical V Physical Chemistry	4	-	5	25	75	100
35	U21CHE531/ U21CHE532	**Elective III**-Forensic Chemistry/Chemistry of Materials	3	3	-	25	75	100
36	U21CHS53	**SBE III**-Clinical Chemistry	2	2	-	25	75	100
		Total	**25**	**30**		**-**	**-**	**700**
Semester VI								
37	U21CHT61	Core XIII- Organic Chemistry-II	4	5	-	25	75	100
38	U21CHT62	Core XIV- Inorganic Chemistry –II	4	5	-	25	75	100
39	U21CHT63	Core XV- Physical Chemistry-II	4	5	-	25	75	100
40	U21CHT64	Core XVI-Spectroscopy	4	4	-	25	75	100
41	U21CHP65	Core XVII:-Practical VI-Gravimetric Estimation & Organic Preparation	4		6	25	75	100
42	U21CHE641/ U21CHE642	**Elective IV**- Nano science and Technology/ Molecular Dynamics	3	3	-	25	75	100
43	U21CHS64	**SBE-IV**-Engineering Chemistry	2	2	-	25	75	100
44	U21EAS61	Extension Activities (NSS/NCC/RRC/YRC/Physical Education)	3	-	-	100	-	100
		Total	**28**	**30**		**-**	**-**	**800**
		Total Credits	**148**	**193**				**4400**

Non Major Elective

The candidates, who have joined the UG Programme, can also undergo Non Major Elective offered by other Departments.

Non Major Elective (NME) offered by Department of Chemistry:

Code	Course Title
U21CHN31	NME-I-Cosmetic Chemistry
U21CHN42	NME-II-Applied Chemistry

Additional Credit Courses (Two Credit courses)

1. **U21CHO31 Online course3rd Semester**
2. **U21CHI41 Internship 4th Semester**
3. **U21CHV51 Value added course - 5th Semester (Pharmaceutical Chemistry)**

SEMESTER - I

Course Code	U21CHT11	GENERAL CHEMISTRY –I	L	T	P	C
CORE –I			5	-	-	4
Learning Objectives	The course aims to 1. understand the basics of organic reactions, to know the chemistry of Hydro carbons. 2. know the basic principles of cleavage of bonds 3. understand the periodic properties 4. know the critical phenomena of gases					

Unit -I - Basics of Organic Chemistry –I

a) Introduction: Sources and classification of organic compounds, Geometry of hydrocarbons. Hybridization.
b) Functional Groups: Definition – various functional groups – IUPAC – Nomenclature – Homologous series.
c) Molecular weight determination of organic acids and bases.
d) Problems to derive empirical and Molecular formula incorporating the estimation of elements and molecular weight calculations. Detection of elements - lassaigne's test.

Unit -II- Basics of Organic Chemistry-II

a) Tetra valency of carbon atom
b) Cleavage of bonds: Homolytic and heterolytic cleavages, bond energy, bond length and bond angle.
c) Electron displacement effects: Inductive, electrometric, mesomeric, resonance, hyper conjugation and steric effects.
d) Stability of Reaction Intermediates: Free radicals, carbonium and carbanion.

Unit- III–Periodicity

a) Periodic law and arrangement of elements in the periodic table, IUPAC nomenclature and group number.
b) Horizontal, vertical and diagonal relationships in the periodic table, atomic radii, ionic radii, ionization potential, electron affinity; electro negativity-Pauling, Mulliken-Jaffe, Alfred-Rochow definitions
c) Oxidation states and variable valency; isoelectronic relationship; inert-pair effect. Atomic, molecular and equivalent weights; Avogadro's principle and mass-volume relationship.

Unit– IV - Atomic Structure

a) Bohr's theory, its limitations, Particle and wave character of electron, de Broglie's theory – equation, Davission – Germer experiment – photo electric effect – Compton effect, Heisenber's uncertainty principle – the Schrodinger equation derivation
b) Postulates of quantum theory – quantum numbers and their significance
c) Pauli's exclusion principle, atomic orbitals, shapes of orbitals, filling up of orbitals – Aufbau principle, (n+1) Hund's rule – Electronic configurations of the elements.

Unit –V- Gaseous State

a) Gaseous state: Ideal gas laws – deviations – limiting density of gases -van der Waal's equation – Equation of state – clausius, Berthelot and Dielectric – reduced equation of state and the law of corresponding state – Compressibility factor for gases – Boyle and inversion temperature of gases and their calculations Determination of van der Waal's constants.

b) Critical phenomena of gases: PV isotherms of real and van der Waal's gases – critical state of gases. Definitions and determination of Pc, Vc, Tc – relation between van der Waal's constants.

Text Books

1. A.Bahl and B.S. Bahl, Advanced Organic Chemistry, I Multicolor Edition, S.Chand& Company, New Delhi,2010.
2. SatyaPrakash, Advanced Inorganic Chemistry, R.D.Madan, VolI, 5th Edition, S.Chand and Sons, New Delhi, 2012.
3. B.R. Puri, L.R.Sharma and M.S.Pathania, Principles of Physical Chemistry, 46thEdision, Vishal Publishing Company, New Delhi, 2013.

Reference Books

1. I.L. Finar, Organic Chemistry Vol. I, 6 th Edition, Pearson Education, New Delhi, 2014.
2. P.L. Soni, Text book of Inorganic Chemistry, Sultan Chand and Sons, 2007.

CO	Course outcomes	Remarks
CO1	Identify the Sources and Classification of Organic compounds and hybridization	K4
CO2	Understanding the Electron displacement effects in organic reactions	K2
CO3	Learn the Periodic law and arrangement of elements in the periodic table,	K2
CO4	Understand the Postulates of quantum theory	K2
CO5	Learn the Gaseous state and Critical phenomena of gases	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	S	M	M	S	S	M	M
CO3	S	S	S	S	M	M	S	M	M	M
CO4	S	S	S	S	M	M	S	S	M	M
CO5	S	S	S	M	M	M	S	S	M	M

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHP11	ORGANIC ANALYSIS AND ESTIMATION (Practical)	L	T	P	C
CORE II			-	-	6	4
Learning Objectives	The course aims to 1. enable the students to develop analytical skills in organic qualitative analysis and preparative skills in organic preparations. 2. enable the students to check the purity of organic compounds by determining the melting or boiling points. 3. know the titration methods 4. plan the experimental projects and execute them.					

Organic Analysis

a. Identification of acidic, basic, phenolic, and neutral organic substances.
b. Detection of N, S and halogens.
c. Test for aliphatic and aromatic nature of substances.
d. Test for saturation and unsaturation.
e. Identification of functional groups:
i) Carboxylic acids ii) Phenols iii) Aldehydes iv) Ketones v) Esters
vi) Carbohydrates vii) Amines viii) Amides ix) Halogen compounds
f. Preparation of derivatives for the functional groups
g. Determination of melting and boiling points

Organic Estimation

a. Estimation of aniline
b. Estimation of phenol

Text Books

1. B.S. Furniss, A.J. Hannaford, P.W. G. Smith, A.R. Tatchell, Vogel's Text Book of Practical Organic Chemistry. 5th Edition, Pearson Education, 2005.
2. Mann & Saunders, Practical Organic Chemistry, 4th Edition, 2009.

Reference Books

1. J. Leonard, B. Lygo, G. Procter, Advanced Practical Organic Chemistry, 3rd Edition, 2013
2. Basic Principles of Practical Chemistry, V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu, Sultan Chand & Sons, New Delhi, 2nd Edn., 2004.

CO	Course outcomes	Remarks
CO1	Learn the concept of Organic Analysis	K2
CO2	Understand the saturated and unsaturated groups	K2
CO3	Learn the preparation of standard solutions	K2
CO4	Learn the calculations of concentration of the solutions	K2
CO5	Acquire the knowledge of Organic Estimation	K2,K4

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	M	M	M	S	S	S	S
CO2	S	M	S	S	M	M	S	S	S	S
CO3	S	S	M	S	M	M	S	M	S	S
CO4	S	S	M	S	M	M	S	S	S	S
CO5	S	S	M	M	M	M	S	S	S	S

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

SEMESTER - II

Course Code	U21CHT21	GENERAL CHEMISTRY – II	L	T	P	C
CORE-III			5	-	-	4
Learning Objectives	1. To understand the substitution and elimination reactions 2. To understand the nature of bonding in inorganic compounds 3. To know the concept of phase equilibria					

Unit-I -Aliphatic Halogen Compounds

a) Nomenclature and classification
b) Preparation of aliphatic and aromatic halides: Free radical mechanism, addition and Substitution reactions.
c)Reactions: Nucleophilic substitutions, SN_1, SN_2 and SNAr mechanisms, stereochemistryand reactivity, effects of structure, substrate, solvent, nucleophile and leaving groups.
d) Eliminations: E_1 and E_2 mechanisms, evidences, orientations and stereochemistry.

Unit-II - Hydroxy Compounds

a) Aliphatic alcohols: Preparation by hydroboration, oxidation, Reduction of carbonyl compounds, epoxidation, Grignard synthesis and haloform reaction.
b) Phenols: Nomenclature, physical properties, hydrogen bonding.
c) Reactions: acidity, ether formation, ester formation, mechanism of ring substitution, nitration, sulphonation, halogenation, Friedel -Craft's reaction, nitrosation, coupling reactions, Kolbe's reaction and Riemer-Tiemen reaction.

Unit – III -Energetics of Ionic Bonding

Solubility of ionic compounds – energetics of formation of ionic compounds, Lattice energy – Born – Lande Equation – Born-Haber's cycle- Fajan's rule – van der wall's forces, ion-ion, ion-dipole interaction, hydrogen bonding, intermolecular theory and applications.

Unit – IV - Phase Equilibria

a) Statement of significance of the terms involving derivation of phase rule.
b) Application of phase rule to one-component systems. Water, Sulphur and Carbon dioxide.
c) Application of phase rule to two component systems- Pb-Ag, Zn- Mg Condensed systems and reduced phase rule
d) Solids in solids: simple eutectic with suitable examples, Compound formation with congruent and incongruent melting points with suitable examples.

Unit – V - Ideal solutions:

a) Ideal solutions: Vapour pressure- Composition diagrams of solutions. Raoults law, positive and negative deviations from the law. Principle of fractional distillation: Binary systems. Vapour diagram and azeotropicdistillation, Variation of solubility with temperature – critical solution temperature (consolute temperature) lower, upper and critical solution temperature – influence of impurities on C.S.T. and applications.
b) Solubility of gases in liquids; Henry's law, its relationship with Raoults law.

c) Lowering ofvapour pressure: Thermodynamic derivation for elevation of boiling pointand depression of freezing point. Relationship between osmotic pressure and vapourpressure.

Text Books

1. A.Bahl and B.S. Bahl, Advanced Organic Chemistry, 5th Edition, S.Chand& Company, New Delhi, 2010.
2. SatyaPrakash, Advanced Inorganic Chemistry, R.D.Madan, VolI, 5th Edition, S.Chand and Sons, New Delhi, 2012.
3. B.R. Puri, L.R.Sharma and M.S.Pathania, Principles of Physical Chemistry, 46thEdision, Vishal Publishing Company, New Delhi, 2013.

Reference Books

1. F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman,Advanced Inorganic Chemistry,6thed., John Wiley, New York, 2007.
2. B. R. Puri, L. R. Sharma, K. C. Kalia,Principles of Inorganic Chemistry, 33rd Edition, 2020.

CO	Course outcomes	Remarks
CO1	Learn the aliphatic halogen compounds Nomenclature	K2
CO2	Understand the importance of Hydroxy compounds	K2
CO3	Learn the Boron and carbon family in the periodic table	K2
CO4	Statement of significance of the terms involving derivation of phase rule.	K2,K3
CO5	Learn the Ideal solutions, Solubility of gases in liquids, Lowering ofvapour pressure and Distribution law	K2, K3

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	S	M	M	S	S	M	M
CO3	S	S	S	S	M	M	S	M	M	M
CO4	S	S	S	S	M	M	S	S	M	M
CO5	S	S	S	M	M	M	S	S	M	M

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHP22	VOLUMETRIC ANALYSIS (Practical)	L	T	P	C
PRACTICAL-II			-	-	5	4
Learning Objectives		1. To understand basics and gain knowledge on laboratory reagents and their uses in Volumetric analysis. 2. To enable the students to acquire knowledge in preparation of standard solutions 3. At the end of the course, the students should be able to plan experimental projects and execute them				

A double titration involving the making up of the solution to be estimated and the preparation of a primary standard.

Acidimetry and alkalimetry

1. Titration acids: hydrochloric acid, sulphuric Standard solutions prepared: sodium carbonate, sodiumbicarbonate, oxalic acid.

Oxidation and reduction titration:

1. Oxidising agents: Potassium permanganate (permanganometry) Reducing agents: Ferrous sulphate, ferrous ammonium Sulphate, oxalic acid
2. Standard solutions prepared: Ferrous Sulphate, ferrous ammonium Sulphate and oxalic acid.

Iodometry titrations:

1. Titrations of liberated iodine against sodium thiosulphate using acidified potassium permanganate, potassium dichromate and copper Sulphate solutions.
2. Standard solutions: potassium dichromate, copper sulphate.

Text Books

1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 2009.
2. B.S. Furniss, A.J. Hannaford, P.W. G. Smith, A.R. Tatchell, Vogel's Text Book of Practical Organic Chemistry. 5th Edn., Pearson Education, 2005.

Reference Books

1. Mann & Saunders, Practical Organic Chemistry, 4th Edition, 2009.
2. V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, 2nd Edn., 2004.

CO	Course outcomes	Remarks
CO1	Learn the concept of Titration methods and various Titrations.	K2
CO2	Understand the Acidimetry and alkalimetry titrations	K2
CO3	Learn the preparation of standard solutions	K2
CO4	Learn the calculations of molarity, molality and Normality of the solutions	K2
CO5	Understand the concept of organic analysis	K2,K4

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	M	M	M	S	S	S	S
CO2	S	M	S	S	M	M	S	S	S	S
CO3	S	S	M	S	M	M	S	M	S	S
CO4	S	S	M	S	M	M	S	S	S	S
CO5	S	S	M	M	M	M	S	S	S	S

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

SEMESTER - III

Course Code	U21CHT31	ANALYTICAL CHEMISTRY	L	T	P	C
CORE-V			5	-	-	4
Learning Objectives	1. To understand laboratory safety measures and error analysis 2. To emphasize the basic principles of purification techniques 3. To know the basic principles and applications of separation techniques					

Unit- I -Handling of Chemicals and Analysis

a) Safety and hygiene in the Chemistry Lab

Storage and handling of chemicals, handling of acids, ethers, toxic and poisonous chemicals, antidotes, threshold vapour concentration and first aid procedure. Heating methods, stirring methods filtration techniques. Calibration of pipette, standard measuring flask and burette. Weighing principle in chemical balance and single pan balance

b) Errors:

Definition – terms- absolute and relative error – precision and accuracy – Methods of expressing precision: mean, median, deviation, average deviation and coefficient of variation -classification of errors - t-test rejection of experimental data – Q-test sources and elimination of errors or Minimizing errors -Significant figures and its application with respect to the glassware used. Normal error curve and its importance.

Unit-II - Purification Techniques

a) Chromatography

Definition of Chromatography, mobile phase and stationary phase. Classification of Chromatography. Principle of adsorption and partition chromatography.

b) Column chromatography:

Requirement of a good adsorbent- solid stationary phase-liquid stationary phase, adsorbents, classification of adsorbents, solvents, preparation of column, applications.

c) Thin Layer Chromatography:

Choice of adsorbent, choice of solvent, preparation of chromatogram, preparation of plate, developing chambers, development of plate, Rf value, applications.

d) Paper chromatography:

Types of paper used, various method of development (ascending, descending and radial) solvent used, Rf value, factors which affect Rf value. Separation of amino acids by paper chromatography – TLC is superior to other methods of chromatography.

Unit-III - Solubility Equilibria

a) General Separation Techniques

Solubility and solubility products, expressions for solubility products. Determination of solubility from solubility products.

b) Precipitation titrations

Argentometric titrations, indicators for precipitation titrations involving silver. Determination of chloride by Volhard's method. Adsorption indicators.

c) Gravimetric methods of analysis

Separation by precipitation, factors affecting solubility, gravimetric factor. Purity of precipitates, Co-precipitation, post precipitation. Precipitation from homogenous solution.

Unit –IV - Titrimetric Methods of Analysis

a) General Introduction

General principle- Types of titrations- Requirements for titrimetric analysis. Concentration systems: Molarity, formality, normality, wt% ppm, milli-equivalence and millimoles-problems. Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions. Limitation of volumetric analysis, endpoint and equivalence point.

b) Acid-baseEquilibria

pH of strong and weak acid solutions. Buffer solutions. Henderson equations. Preparation of acidic and basic buffers. Relative strength of acids and bases from Ka and Kb values. Neutralisation- titration curve, theory of indicators, choice of indicators. Use of phenolphthalein and methyl orange.

c) Complexometric titrations

Stability of complexes, titration involving EDTA. Metal ion indicators and characteristics.

Unit-V - Atomic Absorption Spectroscopy

Introduction, Instrumentation source, burner, flame, monochromators, Detectors, Double beam Absorption Spectrometer, Interference, Applications.

Thermal Analysis

Thermal analytical methods, principle involved in thermogravimetric analysis and differential gravimetric analysis, discussion of various components with block diagram, characteristics of TG and DTA, Factors affecting TG and DTA curves.

Polarography

Introduction—migration current-diffusion current-residual current-polarogram-Instrumentation-advantages of DME-Ilkovic equation (no derivation)- Applications.

Text Books

1. P.L.Soni; Sultan Chand &Sons,Text Book of Organic Chemistry, 29th edition ,2012.
2. Gopalan et al;Analytical Chemistry, Sultan Chand & Sons,2013.

Reference Books

1. N. Colin, Banwell, B and Elaine.M. Fundamentals of Molecular spectroscopy by 4th edition, McGraw Hill Edn (Ind) Pvt Ltd, 2016.
2. A.K. Srivastava, P.C. Jain, Chemical Analysis: An Instrumental Approach for B.Sc. Hons. and M.Sc. Classes, S. Chand and company Ltd., Ram Nagar, New Delhi. 2011.

CO	Course outcomes	Remarks
CO1	Study the importance of safety and security, responsibility types of hazards and risk in chemical laboratory.	K2
CO2	Understand the use of personal protective and other safety equipments, handling of chemical in laboratory	K2
CO3	Understand the accuracy and precision and classification error.	K2
CO4	Learn good laboratory practices and its applications	K2, K3
CO5	Understand the Purification Techniques and Titrimetric method of analysis	K2,K4

K1- Remember **K2**- Understand**K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	M	S	M	S	S	S
CO2	S	S	M	S	M	S	M	S	S	S
CO3	S	S	M	S	M	S	M	S	S	S
CO4	S	S	M	S	S	S	M	S	S	S
CO5	S	S	M	S	S	S	M	S	S	S

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHE311	POLYMER CHEMISTRY	L	T	P	C
ELECTIVE –I			4	-	-	3
Learning Objectives	1. To understand the importance of polymers and an exposure to polymer chemistry 2. To understand various polymer and characterization of polymers 3. To enable a student to understand polymer structures and properties 4. To know the basic importance of molecular weight determinationof polymer					

Unit – I - Introduction of Polymers

Introduction – Monomers, Oligomers, Polymers and their characteristics-Degree of polymerization- Functionality of polymer-Classification of polymers-addition polymers – PVC, orlon, Condensation polymers – Definition, Dacron, Nylon 6-Nylon 6,6 – preparation properties, uses – copolymers – preparation, properties and uses of saron. Mechanism of addition polymerization – free radical polymerization – ionic polymerization.

Unit – II- Thermoplastics and Thermosetting

Introduction of Thermoplastics and thermosetting polymers.Thermoplastics- difference between thermoplastic and thermosetting: Preparation, Properties and Uses of Polyethylene, Polypropylene, polystyrene, Polyacrylonitrile, Poly Vinyl Chloride, Poly tetrafluoro ethylene, nylon and polyester. Thermosetting Plastics: Phenol formaldehyde and epoxide resin

Unit – III –Rubber

History of Rubber- Elastomers or Rubber – natural rubber – compounding of rubber, properties, uses, synthetic rubbers – buna-s neoprene, silicone rubber. Preparation, Properties and use of Conducting Polymers,examples: poly sulphur nitriles, poly phenylene, polypyrrole and poly acetylene.

Unit – IV - Weight determination of polymer and polymerization Techniques

Nature and structure of polymers-structure property relationships weight determination – number average, weight average methods of determination – osmotic pressure, viscosity, light scattering methods. Polymerization Techniques: Bulk, Solution, Suspension and Emulsion.

Unit –V - Inorganic Polymers

Introduction of Inorganic polymers – Classification of Inorganic Polymers- Homo-atomic polymer-Hetero-atomic polymer – general properties of Inorganic polymers – glass transition temperature classification – polymer containing boron -preparation, properties and uses of Boron Nitride, Borazine, silicone rubber.

Text Books

1. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, 31st Edition, Milestone Publishers and Distributors, New Delhi, 2013.
2. SatyaPrakash, Advanced Inorganic Chemistry, R.D.Madan, Volume 1, 5th Edition, S. Chand and Sons, New Delhi, 2012.

3. R. Gopalan, Text book of Inorganic Chemistry, Universities Press India Ltd., Hyderabad, 2012.

Reference Books

1. D.A. Skoog, D.M. West, F.J. Holler and S.R. Crouch, Fundamentals of Analytical Chemistry, 8th Edition, Brooks/Cole, Thomson Learning, Inc., USA, 2004
2. B. K. Sharma, Polymer Chemistry, GOEL Publishing House, 2014.

CO	Course outcomes	Remarks
CO1	Gain the knowledge of formulation for manufacturing, properties and applications of variety of thermoset plastic materials.	K2, K3
CO2	Can brings the knowledge toward polymer and characterization of polymers, Thermoplastics and thermosetting polymers, rubber – properties, uses, synthetic rubbers, Molecular weight determination and Inorganic polymers.	K2, K3
CO3	Utility of copolymerization reaction & preparation techniques	K3
CO4	Learn the basic importance of molecular weight determination of polymer	K2
CO5	Learn the Inorganic polymer and its classification	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M	M	S	S	S	M
CO2	S	S	S	M	M	S	S	S	M	M
CO3	S	S	S	M	M	S	S	S	M	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	M	M	S	S	S	M	M

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHE312	WATER TREATMENT	L	T	P	C
ELECTIVE –I			4	-	-	3
Learning Objectives	1. To give an in-depth understanding of water quality parameters, ground water and surface water pollution and its control measures. 2. In addition, the students will also learn the water treatment methods, sewage and industrial effluent treatment methods and water resources management. 3. To understand the pollutants and their effect on environment and on human health 4. To know the basic information of water treatment methods for domestic and industrial purposes					

Unit-I - Source of water

Uses of water – safe and wholesome water – sources of water supply: Rain: hydrological cycle, acid rain, artificial rain, rain water harvesting. Surface water: impounding reservoir, river and tanks – their characteristics and impurities. Ground water; wells and springs.Water borne diseases/substances affecting the portability of water.

Unit-II - Effects of impurities in natural water

Effects of impurities in natural water: colour taste and odour, turbidity and sediment and micro organism. Dissolved mineral matter – hardness types – estimation (EDTA method) – methods of softening – boiling, addition of lime – addition of sodium carbonate – ion exchange method.

Unit – III - Water Treatment methods

Clarification of water: sedimentation and filtration. Coagulation of water electrochemical coagulation – flocculants – sterilization and disinfection of water: chemical methods and physical methods.

Unit- IV - Water analysis

Demineralization of water – ion exchange process – desalination of sea water: electrodialysis method, reverse osmosis methods.

Water analysis: physical examination – chemical examination bacteriological examination – BOD, COD.

Unit – V - Miscellaneous methods of water treatment

Miscellaneous methods of water treatment: color, odour and taste removal – iron and manganese removal – fluoridation – deflouridation, prevention of plumb solvency – removal of slime and algae from water - de- oxygenation of water.

Text Books

1. A. K. De, Environmental Chemistry, 5th Edition., New Age International Publisher, 2005.
2. B. K. Sharma,Environmental Chemistry, 11th Edition., Krishna Prakashan media Limited, 2007.

Reference Books

1. D. Samuel & D. Faust, Chemistry of Water Treatment, 2nd Edition, 2018.
2. A.D. Patwardhan, Industrial Wastewater Treatment 2nd Edition, 2017.

CO	Course outcomes	Remarks
CO1	Understand the in-depth knowledge of acid rain, artificial rain, rain water harvesting, and BOD, COD.	K2
CO2	Learn the effects of impurities in Natural waters	K2
CO3	Learn the techniques of filtration and sedimentation	K2
CO4	Study the chemical, physical and biological examination of water analysis	K2, K3
CO5	Study about water quality parameters, ground water and surface water pollution and its control measures and the water treatment methods, sewage and industrial effluent treatment methods and water resources management.	K2, K3

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M	S	S	S	S	S
CO2	S	S	S	S	S	M	M	M	M	M
CO3	S	S	S	M	M	M	M	M	M	M
CO4	S	S	M	M	M	S	S	S	S	M
CO5	S	S	M	M	M	S	S	S	S	S

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

SEMESTER - IV

Course Code	U21CHT41	MEDICINAL CHEMISTRY	L	T	P	C
CORE-VI			4	-	-	4
Learning Objectives		1. To understand the basic concepts and strategies in drug design and synthesis. 2. To provide preliminary introduction to vitamins and their classification 3. To provide preliminary introduction to sulpha drugs and antimalarial activity. 4. To provide preliminary knowledge on Anesthetics drugs, antibiotics and their synthesis.				

Unit – I - Introduction and Importance of Chemistry in Pharmacy

Important terminologies used their meaning – molecular pharmacology – pharmacodynamics, pharmacophore – metabolites, antimetabolits – drugs – definition – important drugs dosage – Indian medicinal plants and trees. Discovery and Development of Drugs- History of drug discovery, Strategies in drug discovery, lead discovery.

Unit – II - Types of Drugs

Antibacterial drugs – synthesis, properties and applications of Sulpha drugs: sulphanilamide, sulphadiazin– Analgesics: synthesis, properties and application of morphine, heroin – Antimalarials: quinine, plasmoquinine.Cardio vascular drugs: Antiarrhythemic drugs, antihypertension drugs.

Unit – III –Vitamins

Definition-Classification –Sources-Daily Requirement-Functions & deficiencies of Vitamin B1, B2, B3 & B6-Folic acid (Vitamin B9)-Cynocobalmin (Vitamin B12)-therapeutic uses and Deficiency of Vitamin A - Vitamin D & its role in calcium Metabolism-Vitamin- E & Vitamin- K.

Unit – IV–Anesthetics

Definition –chloroform – ethylchloride – trichloroethylene – gaseous anesthetics – cyclopropane and nitrous oxide – local anesthetics, classification, characteristics – benzocine, piperocaine and lidcaine.

Antibiotics Definition – pencillins, teracyclins, teramycin, streptomycin and chloromycetin.

Unit- V - Structure prediction and Drug Design

Structure prediction - Introduction to comparative Modeling- Sequence alignment- Constructing and evaluating a comparative model -Predicting protein structures by 'Threading' - Introduction of Molecular docking.

Text Books

1. G. Jayashree, A Text book of Pharmaceutical Chemistry, S. Chand & Co., New Delhi, 2009.
2. B.K.Sharma, Industrial Chemistry byKrishnaPrakashan Media(p) Ltd, 2011.

Reference Books

1. A.R. Leach, Molecular Modelling Principles and Application, Longman, 2001.
2. SatyaPrakash Gupta, QSAR and Molecular Modeling, Springer - Anamaya Publishers, 2008.

CO	Course outcomes	Remarks
CO1	Understand the important terminologies of molecular pharmacology	K2
CO2	Learn the classification of Vitamins and its importance	K2
CO3	Study the importance of sulpha drugs and antimalarials.	K2
CO4	Learn the concept of Anesthetics and transportation and antibiotics	K2
CO5	Study the importance of structure –prediction and drug design	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	M	M	S	S	S	S	S
CO4	S	S	M	M	M	S	S	S	S	M
CO5	S	S	M	M	M	M	M	M	M	M

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHT42	BIOCHEMISTRY	L	T	P	C
CORE-VII			4	-	-	4
Learning Objectives		1. To enable the student to develop a sound knowledge of fundamental concepts in biochemistry. 2. To emphasis on the various aspects of lipids and proteins 3. To understand the classification and properties of nucleic acid, amino acid and hormones. 4. To emphasis on the various aspects of metabolism and interrelationship of metabolic events.				

Unit – I –Lipids

a) Introduction- Classification - neutral lipids, Phospho lipids (lecithines, cephalins, plasmalogens) and glycolcoipids.
b) Fatty acids – saturated, unsaturated fatty acids, Properties – Hydrolysis-acid number, saponification number.
c) Cholesterol – biosynthesis. Bile salts derived from cholesterol.
d) Metabolism: biosynthesis of lipids – synthesis of fatty acids and synthesis of triglycerides.

Unit –II –Proteins

Protein Introduction to protein, classification of protein based on solubility, shape, composition and Function. Peptide bond – Structure of peptide bond. Denauration – renaturation of protein, properties of protein. Introduction to lipoprotein, glycoprotein and nucleoprotein. Biological function of protein (Protein structure) Protein structure - Primary, secondary / tertiary and quaternary. Separation and purification of proteins – dialysis – gel filtration – electrophoresis.

Unit – III - Amino Acids

Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Malonic ester synthesis c) strecker's synthesis. Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point.

Unit – IV - Nucleic Acids

Introduction to nucleic acid, Difference between nucleotide and nucleoside, composition of DNA & RNA Structure of Nitrogen bases in DNA and RNA along with the nomenclature. · DNA double helix (Watson and crick) model · · Types of RNA , structure of t – RNA (clover leaf model).

Unit –V–Hormones

a) Introduction-Vertebrate hormones – classification – Testosterone – progesterone – Insulin Functions of hormones and their regulation. Chemical classification of hormones, transport of hormones in the circulation. Thyroid hormone: Thyroid gland. Biosynthesis of thyroid hormone and its regulation; Mechanism of Ca2+ regulation and pathways involving bone, skin, liver, gut and kidneys.

Text Books

1. Lehninger, Principles of Biochemistry, Fourth Edition, David L. Nelson and Michael M. Cox, Worth Publishers, New York, 2005.
2. A.Bahl and B.S. Bahl, Advanced Organic Chemistry, I Multicolor Edition, S.Chand& Company, New Delhi,2010.

Reference Books

1. L. Veerakumari, Biochemistry, MJP publishers, Chennai, 2004.
2. J. M. Berg, J. L. Tymoczko. and L. Stryer, L. Biochemistry, 6th Edition, 2007.

CO	Course outcomes	Remarks
CO1	Understand the structure of organic natural products	K2
CO2	Know and appreciate the importance of chemistry of natural compounds	K2,K3
CO3	Identify the structures of Lipids and Proteins.	K4
CO4	Learn the classification of Amino acids and Nucleic acids	K2, K4
CO5	Understand the importance of Harmones and its functions	K2,K3

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	S	M	S	M	S	S
CO2	S	S	S	S	S	S	S	M	S	M
CO3	S	S	S	S	M	M	S	M	S	S
CO4	S	S	M	S	S	M	S	S	S	M
CO5	S	S	M	S	M	S	M	S	S	M

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHE421	AGRICULTURAL CHEMISTRY	L	T	P	C
ELECTIVE-II			3	-	-	3
Learning Objectives	1. To give the students the importance of Agricultural chemistry and an exposure 2. To analyze and find a suitable method to cultivate and promote agricultural methods.					

Unit- I - Soil Chemistry

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

Unit- II –Fertilizers

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

Unit- III–Fungicides

Inorganic (Bordeaux Mixture) and organic (dithiocarbamate). Industrial fungicides: creosote fractions.

Herbicides and Weedicides: Selective and non-selective, 2, 4-D and 2, 4, 5-t (structure and function)

Unit- IV - Plant Growth Regulators

3-Indole acetic acid-Napthalene acetic acid-Ethepon(2-chloroethyl phosphoric acid)- Alar (succinin acid-2, 2-dimethyhydrzine) their function. Plant hormones: Gibberlin, Cyclocel, Phosphon, dwarfing compound (CCC: 2-Chlorethyltrimethyl ammonium chloride). Defoliants.

Unit- V –Insecticides

Introduction of Insecticides, stomach poisons, contact insecticides, fumigants, manufacture and applications of insecticides. DDT, BHC, pyrethrin mention of aldrin, dieldrin, endrin and pentachlorophenol

Text books

1. D.Choudhary,Basics of Agricultural Chemistry, Anmol Publication,2009.
2. J. Subbiah, An Introduction of Agricultural Chemistry, JV Publishers, 2020.

Reference Books

1. R. Rajeswari et. all., Elements of Agricultural Chemistry, Satish Serial Publishing House, 2014.
2. T. Anderson,Elements of Agricultural Chemistry, Good Press Publishes,2019.

CO	Course outcomes	Remarks
CO1	Acquire knowledge about Soil Chemistry and composition	K2
CO2	Learn the use of fertilizers	K2
CO3	Understand the industrial Fungicides and its application	K2, K3
CO4	Learn the plant growth regulators	K2
CO5	Understand the types of insecticides	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	M	M	S	S	S	M	M
CO3	S	S	S	M	M	S	S	S	M	M
CO4	S	S	S	M	M	S	S	S	M	M
CO5	S	S	S	M	M	S	S	S	M	M

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHE422	TEXTILE CHEMISTRY	L	T	P	C
ELECTIVE-II			3	-	-	3
Learning Objectives		1. To facilitate the students to learn about the pre-treatments of Various kinds of textile materials involved in textile wet processing industries. 2. To acquire knowledge of natural fibers 3. To get basic importance of dying process 4. To understand the basic concept of printing methods				

Unit – I - Natural Fiber

Properties of textile fiber – classification of fibers. Natural fibers of vegetables origin – chemical and physical properties of cotton, jute. Natural fibers of animal origin: chemical and physical properties of wool and silk – natural mineral fibers: chemical and physical properties of asbestos and glass.

Unit – II – Man made fiber

Mode of production – types of spinning – wet dry and melt spinning.

a. viscose rayon: Raw material, method of conversion to fiber and filament form. Physical and chemical properties and uses.
b. Cuprammoniumrayon and cellulose acetate: raw materials, method of conversion to fiber and filament form. Physical and chemical properties and uses.
c. Synthetic organic fiber: polyamide and polyester fiber – raw materials, method of production, physical and chemical properties fiber structure.

Unit – III–Dyeing

Dyeing: classification of dyes – theories of dyeing

Direct dye: properties, method of application to cotton – assistants used and their functions.

Sulphur dye: properties, method of application to cotton. Acid dye: properties, method of application to cotton.

Vat dye: properties, method of application to cotton.

Unit – IV - Pre-treatment process of dyeing

Introduction and Pre – treatment process for dyeing-process sequence in pretreatment processing- singeing –singeing process sequence, yarn singeing, desizing, Oxidative desizing scouring, Basic surfactant concepts, and bleaching.-introduction of bleaching, bleaching with sodium chlorite.

Unit – V - Printing Process

Printing Process-Historical Perspective-Methods Used for printing-Block Printing method-stencil method-machine roller printing-screen printing method-semi automated process-Finishing Process- Chemical Finishing process-Applications of Printing -different methods of printing like hand block printing, stencil printing, wax printing, screen printing, roller printing etc.

Text Books

1. K. Venkatraman, "The Chemistry of Synthetic Dyes" – Vol. III, Academic press, London, 2010.
2. Robert R Mather ,Roger H Wardman ,The Chemistry of Textile Fibers,Royal Society of Chemistry, 2nd Edition,2015.

Reference Books

1. David. R. Waring, Geoffrey Hallas, The Chemistry and Application of Dyes, Springer-Verlag New York Inc. 2012.
2. V. A. Shenai, "Technology of Textile Printing," 2nd Edition,Sevak Publisher, 2003.

CO	Course outcomes	Remarks
CO1	Importance of Natural Fibers and its applications	K3, K4
CO2	Learn the Man- made fiber and its types	K2
CO3	Understand the pre-treatment of processing of dyes	K2
CO4	Remember the theories and classification of dyes	K1
CO5	Learn the different methods of printing process and applied various fields.	K2, K3

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	M	M	S	S	S	M	M
CO3	S	S	S	M	M	S	S	S	M	M
CO4	S	S	S	M	M	S	S	S	M	M
CO5	S	S	S	M	M	S	S	S	M	M

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

SEMESTER - V

Course Code	U21CHT51	ORGANIC CHEMISTRY – I	L	T	P	C
CORE-VIII			5	-	-	4
Learning Objectives	1. To develop an understanding of food components such as carbohydrates. 2. To understand the chemistry Heterocyclic compounds and their derivatives. 3. To learn the polynuclear hydrocarbons and fused ring systems.					

Unit– I - Alicyclic Compounds

a) General method of preparation and properties of cycloparaffins – Baeyer's Strain theory and its modifications.
b) Conformational analysis – Fischer's plane Projection formula – Newmann's projection formula and Sawhorse formula of ethane, 1,2 Cyclic ketones.

Polynuclear Hydrocarbons and fused ring systems

Polynuclear hydrocarbons and their derivatives. Isolated systems: Naphthalene, Anthracene and Phenanthrene: preparation, properties uses and structure. Derivatives of Naphthalene – preparation, properties and uses of Naphthylamines, naphthols and naphthaquionnes.

Unit – II - Heterocyclic Compounds

a) Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene – Comparison between basicity of pyridine, piperidine and pyrrole
b) Pyridine -. Methods of synthesis and chemical reactions - electrophilic substitution and nucleophilic substitution reaction mechanism in pyridine derivatives.
c) Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis
d) Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

Unit – III - Molecular Rearrangements

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

Unit – IV - Carbohydrates

a) Monosaccharides – detailed study of glucose and fructose – structure and configuration – mutarotation and epimerization – Interconversion glucose and fructose – Descent and ascent of the sugar series – Estimation of Glucose.
b) Disaccharides – structure and properties of sucrose.
c) Polysaccharides – structure of starch and cellulose – applications of cellulose derivatives.

Unit – V - Natural products

a) Alkaloids: Definition, occurrence, extraction of alkaloids and general methods for determining the structure of alkaloids – Classification of alkaloids - structure and synthesis of the following alkaloids : Cocaine, papaverine, pipperine and nicotine.

b)Terpenoids: Introduction, classification occurrence, isolation – general properties – isoprene rule – General methods of determining structure, Synthesis – properties – structures of citral, geraniol, terpineol.

Text Books

1. K.S. Tewari, N.K. Vishil, S.N. Mehotra , A text book of Org. Chem., 1st edition, Vikas Publishing House Pvt Ltd., 2001.
2. Bahl and ArunBahl, Organic Chemistry, S. Chand and Sons, New Delhi, 2005.

Reference Books

1. Jerry March, Advanced Organic Chemistry, 5th Edition, John Wiley and Sons, New York, 2004
2. I.L. Finar, Organic Chemistry Vol. I, 6th Edition, Pearson Education, New Delhi, 2014.
3. R.T. Morrison &R.N. Boyd, Organic Chemistry, 7th Edition, Pearson Education, New Delhi, 2013

CO	Course outcomes	Remarks
CO1	Remember the preparation methods and analyze properties of cyclo paraffins and conformational analysis.	K1, K4
CO2	Able to understand the Molecular rearrangement and heterocyclic compounds.	K2
CO3	Understand the concept of configuration and conformational stereo isomers	K2
CO4	Learn preparation and properties of Mono, di and polysaccharides	K2
CO5	Learn Natural products like alkaloids and terpenoids	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	M	S	S	S	S	M	M
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	M	S	S	S	S	S
CO5	S	S	S	M	M	S	S	S	S	S

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHT52	INORGANIC CHEMISTRY - I	L	T	P	C
CORE-IX			5	-	-	4
Learning Objectives		1. To understand the nature of bonding in coordination compounds. 2. To understand the importance and application of coordination compounds in industry and in medicine. 3. To understand the active roles played by metal ions and coordination compounds in biological systems. 4. To understand the concept of nuclear chemistry and radiation chemistry.				

Unit–I - d-Block & f-Block Elements

Chemistry of transition elements – electronic configuration – group study of titanium, vanadium, chromium, manganese and iron metals – 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.

Unit – II - Coordination Chemistry

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 - Experimental determination of stability and composition of complexes

Stability of complexes -factors affecting the stability of complexes - Stability constants of coordination compounds and their importance in inorganic analysis. Kinetic verses thermodynamic stability. Experimental determination of stability constant and composition of complexes. Isomerism, reactivity and stability: 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.

Unit– IV - Bioorganic Chemistry

Metal ions in biology and their vital role in the active site, Structure and functions of Metallo proteins and enzymes.Structures and characteristic features of Hemoglobin 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

Introduction - Structure and application -metal carbonyls -mono and poly nuclear carbonyls of Ni, Fe, Cr, Co and Mn -synthesis and structure -nitrosyl compounds -classification, preparation and properties -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.

Text Books

1. J. E. Huheey, E. A. Kieter& R. L. Keiter, Inorganic Chemistry, 5th ed., Harper Collins, New York, 2003.
2. F.A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry, 6th Ed., John Wiley & Sons, 2007.

Reference Books

1. D.E. Douglas, D.H. McDaniel,& J.J. Alexander, Concepts and Models in Inorganic Chemistry, Wiley, 3rd Ed., 2006.
2. A.G. Sharpe, Inorganic Chemistry, Pearson Education, 2008.

CO	Course outcomes	Remarks
CO1	Learn about transition metal element and its properties.	K2
CO2	Known the preparation and properties of transition metal complexes	K2, K4
CO3	Understand the theories of coordination compounds	K2
CO4	Understand of hemoglobin, myoglobin and vitamins	K2
CO5	Learn photochemistry of organo metallic compounds	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	M	M	S	S	S	M	M
CO3	S	S	S	M	M	S	S	S	M	M
CO4	S	S	S	M	M	S	S	S	M	M
CO5	S	S	S	M	M	S	S	S	M	M

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHT53	PHYSICAL CHEMISTRY –I	L	T	P	C
CORE-X			5	-	-	4
Learning Objectives	1.To understand the concepts of thermodynamics 2. To understand the physical and chemical properties of systems. 3.To understand the Carnot's Theorem 4.To Understand the Maxwell Relationship 5.To Learn the methods of determining order of the reaction					

Unit – I –Thermodynamics

Introduction: Scope and importance of thermodynamics – energy and its units – mechanical work and heat and their relation – thermodynamic systems and their characteristics – state of a system – state function and path function and their characteristics – thermodynamic functions – exact and inexact differentials.

First Law: Statement – mathematical formulation – change in constant pressure – Cp-Cv relationship – work done in isothermal, reversible expansion and compression of an ideal gas – Calculation of E, H and w for adiabatic reversible expansion. Reversible isothermal expansion of a rea gas – calculation of E, q, w and H for a VanderWaal's gas – Joule-Thomson effect ($\Delta E/ \Delta V$)T value for ideal gas – temperature, calculation and significance.

Unit – II - Second law of Thermodynamics

Variation of enthalpies with temperature – Kirchoff'sequation – Hess's law of constant heat summation – statement and applications.

Bond enthalpies – definition – calculation from the thermo chemical data and applications. Zeroth law of thermodynamics and its significance.

Second law of thermodynamics - object of the II law – different ways of stating II law and its significance.Conversion of heat into work – Carnot'stheorem and cycle – Thermodynamic efficiency – thermodynamic scale of temperature.

Unit – III - Third law of Thermodynamics

Entropy – definition and significance the concept of entropy – entropy changes in isolated systems – entropy as a thermodynamic function dependence of entropy on variables of the system. Entropy changes in ideal gas, in mixing of gases, physical transformations and in chemical reactions. Entropy and probability

Free energy functions: Helmholtz free energy (A) – definition and temperature dependence – Gibb's free energy with temperature and pressure – Gibb's-Helmholtz equation and its applications – Maxwell's relations.

Unit – IV - Partial Molar Quantities

Chemical potential – relationship between partial molar quantities – Gibb's Duhem equation – chemical potential in case of a system of ideal gases – application of the concept of chemical potential – Clausius-Claypeyron equation – derivation and its applications.

Nernst heat theorem and its application - Third law of thermodynamics – a simple treatment of the law. Temperature dependence of heat capacity and its use in the determination of absolute entropy. Exceptions to III law – residual entropy of CO,N_2O,H_2O,NO and H_2

Unit– V - Chemical Kinetics

Rate of a reaction – rate law and rate constant – order and molecularity of a reaction.
Reactions of first order and pseudo first order reaction – derivation of rate constant and half life period – catalytic decomposition of hydrogen peroxide, conversion of N-chloro acetanilide to p-chloro acetanilide, decomposition of dinitropentoxide – hydrolysis of ester by acids – inversion of cane sugar.
Reaction of II order: derivation of rate constant and half-life period – saponification of ester.
Reactions of III order: derivation of rate constant and half-life period. Reaction between FeCl3 and $SnCl_2$.
Reactions of zero order surface reactions – derivation of rate law – specific examples.
Influence of temperature on the rate of a reaction – Arrhenius rate equation and its significance – measurement of Arrhenius parameters, A and Ea.
Theory of reaction rates – Collision theory – unimolecular reactions – Lindemann – Theory of absolute reaction rates.

Text Books

1. P.W. Atkins,Physical Chemistry, 7th Ed., Oxford University press, 2010.
2. P.L. Soni, O.P. Dharmarha& U.N. Dash, Textbook of Physical Chemistry, 23rd Edition, Sultan Chand & Sons, New Delhi, 2011.

Reference Books:

1. D.A. McQuarrie, D. Simon, Physical chemistry, A Molecular Approach, Viva Books Pvt. Ltd, 2003
2. R.P. Rastogi& R.R. Misra, An Introduction to Chemical Thermodynamics, 6th Edition, Vikas Publishing House Pvt. Ltd., Noida, 2002.

CO	Course outcomes	Remarks
CO1	Learn the thermodynamic description of exact, inexact differential and state function	K2, K4
CO2	Remember the concept of Conversion of heat into work – Carnot'sTheoremand cycle	K1, K3
CO3	Learn the Gibb's-Helmholtz equation and its applications – Maxwell's relations	K2, K3
CO4	Know the statistical thermodynamics and various partition functions.	K2, K3
CO5	Study the steady state approximation Michaelis- Menten mechanism, Lindemann- mechanism, and chain reaction	K2, K3

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	M	M	S	S	S	M	M
CO3	S	S	S	M	M	S	S	S	M	M
CO4	S	S	S	M	M	S	S	S	M	M
CO5	S	S	S	M	M	S	S	S	M	M

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHP53	PRACTICAL -IV INORGANIC QUALITATIVE ANALYSIS	L	T	P	C
COREXI			-	-	5	4
Learning Objectives	1. To enable the students to develop analytical skills in inorganic qualitative analysis. 2. To appreciate the various colored chemical reactions of metal ions					

Semi micro qualitative analysis:

1. Training sessions for three classes:
   Mixture of anions containing an interfering anion and its elimination technique.
   Mixture of cations of simple radicals to familiarize with the inter group separation techniques.
2. Semi micro qualitative analysis of inorganic salt mixtures containing one interfering acid radical.
3. Simple anions: Carbonate, nitrate, sulphate, sulphide, sulphite, chloride and bromide.
4. Interfering anions: Borate, fluoride, oxalate, phosphate, arsenite and chromate.
5. Cations:
   (i) Group I cations: Lead, silver, mercurous.
   (ii) Group II cations: Mercuric, copper, cadmium, bismuth, antimony, tin.
   (iii) Group III cations: Aluminium, ferrous, ferric, chromium.
   (iv) Group IV cations: Cobalt, nickel, manganese, zinc.
   (v) Group V cations: Barium, strontium, calcium
   (vi) Group VI cations: Magnesium, ammonium.

Text Books

1. Krishna Kumar Sharma, Principles of Qualitative Analysis, Ist Edition, 2019.
2. M. Clyde, Inorganic Qualitative Analysis in the Laboratory, Academic Press, 2012

Reference Books

1. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, Pearson Education Pvt. Ltd., New Delhi, 2003.
2. Daniel C. Harris, Quantitative Chemical Analysis, 7th edition, 2006.

CO	Course outcomes	Remarks
CO1	Identify less common metal ions.	K4
CO2	Identify the Acid radicals and Basic radicals	K4
CO3	Learn the concept of Molarity, Molality and Normality	K2
CO4	Learn the Semi micro qualitative Analysis	K2
CO5	Identify interfering anions	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S	S	M	S	M	S
CO2	M	M	M	S	S	S	S	S	M	S
CO3	M	M	M	S	S	M	M	S	S	S
CO4	M	M	M	S	S	S	S	S	S	M
CO5	M	M	M	S	S	S	S	S	S	S

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHP54	PRACTICAL-V PHYSICAL CHEMISTRY	L	T	P	C
CORE- XII			-	-	5	4
Learning Objectives	1. To enable the students to acquire knowledge in physical chemistry experiments 2. To learn the applications of colligative properties, to carry out experiments based on phase rule 3. To acquire skills based on chemical kinetics experiments and to understand electrochemistry through experiments					

Experiments: (Any 8 experiments)

a) Determination of $K_f$and molecular weight of a solute by Rast method
b) Simple eutectic phase diagram
c) Compound formationphase diagram
d) Determination of CST of phenol-water system study of effect of impurities on CST
e) Determination of Partition coefficient of iodine in CCl_4 and water system
f) Determination of equilibrium constant andstrength ofpotassium iodide in $KI+I_2$ KI_3 $\rightleftharpoons$ system.
g) Determination of rate constant and Comparison of strengths of two acids of a first order reaction by ester hydrolysis
h) Conductometry - Acid – base titration (HCl vs NaOH).
i) Conductometry – Determination of limiting molar conductance of a strong electrolyte (KCl).
j) Potentiometry – Determination of solubility product of a sparingly soluble substance.
k) Potentiometry – Redox titration of ferrous vs dichromate.
l) Verification of Beer-Lambert's law and determination of concentration of metal ions spectrophotometrically

Text Books

1. B. Viswanathan and P. S. Raghavan, Practical Physical Chemistry, Viva Books,2009.
2. O.P.Pandey, D.N.Bajpai, S.Giri, Practical Chemistry,Revised Edition,2010.

Reference Books

1. O. P. Pandey, D. N. Bajpai, and S. Giri, Practical Chemistry, S. Chand Publishing, 2013.
2. R. Sonia, S. Agrawal, & S. Mishra, Practical Chemistry, Kindle Edition, 2020.

CO	Course outcomes	Remarks
CO1	It can enable the students to acquire knowledge in physical chemistry experiments, applications of colligative properties, chemical kinetics experiments	K1, K2, K3
CO2	understand the electrochemistry through experiments	K2
CO3	Gain the knowledge of conductometric and potentiometric titrations	K2
CO4	Determination of CST of phenol-water system	K2, K4
CO5	Study the Preparation of solutions	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	M	M	M	S	S	S	S
CO2	S	M	S	S	M	M	S	S	S	S
CO3	S	S	M	S	M	M	S	M	S	S
CO4	S	S	M	S	M	M	S	S	S	S
CO5	S	S	M	M	M	M	S	S	S	S

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHE531	FORENSIC CHEMISTRY	L	T	P	C
ELECTIVE III			3	-	-	3
Learning Objectives		1. To understand the basics of Forensic Science, to impart awareness to the students on crime investigations and cyber crimes. 2. To Demonstrate the basic concepts and terminologies of forensic science 3. To Analyze and interpret forensic samples				

Unit- I - Introduction

History and introduction to forensic science- crime-types of crimes-The crime scene, physical evidence-definition- types of physical evidences- identification and comparison of physical evidences-Method of analysis in forensic science- spectrometry-microscopy.

Unit- II - Traces at Crime Scene

Fiber- collection of fiber evidence-comparison of man-made fibers- forensic examination of paint-collection and preservation of paint evidence- collection and preservation of glass evidence-comparison of glass fragments- forensic characteristics of soil- comparison of soil specimens.

Unit- III - Human Specific Physical Evidences and analysis

Hair- collection of hair evidence-morphology of hair- identification and comparison of hair – Finger prints- classifications- methods of detecting- preserving developed finger prints, foot prints and lifting- foot wear and tire impressions. Hand writing comparison- genuine and forged writing- collection of samples- detection.

Unit- IV - Forensic Characterization of samples

Blood group - forensic characterization of blood stains - paternity testing - forensic characterization of semen- collection of rape evidences- DNA analysis. heavy metal poisoning - CO-poisoning- classification of drugs- drug identification- collection and preservation of drug evidence-snake poisoning.

Unit- V - Cyber Crimes

The emergence of internet or cyber crime-common types of cyber crimes-Hacking, steeling of data, damage to personal data-abusing of personal data. Forensic investigation of cyber crime- Recovery and protection of computer crime evidences.

Text Books

1. B.B. Nanda & R.K Tiwari, Forensic Science in India : A vision for the Twenty First Centrury, select publishers, New Delhi, 2001.
2. M. K Bhasin&S.Nath, Role of Forensic Science in the New Millenium, University of Delhi, 2002.
3. S.H James & J.J Nordby, Forensic Science:An introduction to scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton, 2005.

Reference Books

1. K. Kobilinsky, Forensic Chemistry, John Wiley, 2012.
2. R. Saferstein, M.L. Hastrup and C.Hald, Fisher's Techniques of Crime scene Investigation, CRC Press, Boca Raton ,2013.

CO	Course outcomes	Remarks
CO1	Learn about the history and introduction of forensic chemistry	K2
CO2	Understand the concept of Traces at Crime Scene	K2
CO3	Understand the theories of fingerprints and classification	K2
CO4	Learn the techniques of drug identification	K2
CO5	Learn the cyber crimes	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	M	M	S	S	S	M	M
CO3	S	S	S	M	M	S	S	S	M	M
CO4	S	S	S	M	M	S	S	S	M	M
CO5	S	S	S	M	M	S	S	S	M	M

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHE532	CHEMISTRY OF MATERIALS	L	T	P	C
ELECTIVE III			3	-	-	3
Learning Objectives	1. To introduce and give an insight into the fascinating area of structure of solids and material science. This will enable the students in pursuing higher studies					

Unit-I - Fundamentals of supramolecular chemistry of soft materials

The concept and development of soft materials, Nature of supramolecular interactions for the soft materials; Noncovalent interactions, ion-ion interactions,π stacking, Cation-π-πinteractions, Ion-dipole interactions, Dipole-dipole interactions, Solvophobic interactions; van der Waals interactions, Hydrogen bonding, Multiple hydrogen bonding motifs.

Unit-II - Structure of solids

Introduction to engineering materials, Description of materials science tetrahedron, Force – interatomic distance curve, Structure - description of unit cell and space lattices, Coordination number, APF for cubic and hexagonal close packed structures, Crystal imperfections Significance of structure property correlations in all classes of engineering materials.

Unit-III - Material Characterization Techniques

Electron microscopy: Scanning electron microscopy (SEM), Instrumentation, Electron beam-specimen interaction, Specimen preparation, Energy dispersive spectroscopy (EDS) in electron microscopes; Transmission electron microscopy (TEM) - Basics of TEM, Electron sources, Specimen preparation.

Unit –IV - Preparative methods and Characterization

Solid state reactions – ceramic method, sol-gel, hydrothermal, high pressure, zone refining, CVD, Czochralski and Bridgman and Stockbarger methods.

Physical methods – thermogravimetric and differential thermal analysis and scanning electron microscopy (only introduction and application).

Unit-V - Special Materials

Superconductivity – introduction, Meissner effect – mention of Bardeen, Cooper and Schrieffer theory and Cooper pairs – examples of superconducting oxides, Chevrel phases – applications of superconducting materials.

Ionic conductors – sodium-β alumina, sodium-sulphur battery. Intercalation – layered compounds – graphitic compounds. Special applications of solidstate materials.High energy battery, lithium cells.

Text books

1. D. Helena Dodziuk, Introduction to Supramolecular Chemistry, Springer, 2007.
2 . Elaine, A, Moore, Lesley E. Smart, Solid State Chemistry: An Introduction 5th Edition., 2020

Reference books

1. A. Sheikh, Introduction to Materials Chemistry, Oxford Book Company, 2018.
2. Anthony R. West, Solid State Chemistry and its Applications-2nd Edition, 2014.

CO	Course outcomes	Remarks
CO1	Learn the fundamentals of soft materials	K2
CO2	Learn the preparative methods and characterization of materials	K2,K3
CO3	Apply the magnetic properties of the solids	K3
CO4	Study the special types of materials	K2, K3
CO5	Understand the details about the structure of solids	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	M	M	S	S	S	M	M
CO3	S	S	S	M	M	S	S	S	M	M
CO4	S	S	S	M	M	S	S	S	M	M
CO5	S	S	S	M	M	S	S	S	M	M

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHS53	CLINICAL CHEMISTRY	L	T	P	C
SBE-III			2	-	-	2
Learning Objectives		1. To understand the basics of human organ functions and to impart knowledge on clinical biochemistry and laboratory practices. 2. To Describe the basic anatomy of human body 3. To interpret laboratory results of blood and urine samples 4. To Measure total cholesterol, serum LDL and blood glucose level				

Unit -I - Basics of Human Metabolism

Basics of Human Organ Functions - Plasma proteins in disease - Liver function and disease - Carbohydrate metabolism and its disorders - Disorders of detoxification and excretory mechanisms – renal function, Acid base disorders, Electrolyte and water Balance..

Unit -II - Laboratory Techniques

Introduction to Clinical Laboratories - Laboratory Work Flow cycle - Phlebotomy equipments -Identification of Blood Collection Tubes &Preparation of Blood Plasma and Serum, , Liver Function Tests - Measurement of Serum ALT &AST, Liver Function Tests.

Unit- III - Renal Function

Renal Function Tests, Measurement of Serum BUN -Renal Function Tests -Measurement of Serum Creatinine Clearance -lipid Profile, - Routine Urine Analysis & Identification of Normal Physical and Chemical Urine Constituents.

Unit- IV - Urine Analysis

Identification of Pathological Physical and Chemical Urine Constituents & Microscopic examination of Urine, Quantitative Determination of Urine Protein Proteinuria & Micro albuminuria Quantitative Determination of Urine Uric Acid Quantitative Determination of Urine Creatinine

Unit- V - Blood Analysis

Measurement of Serum Total cholesterol, Measurement of Serum LDL-C, Measurement of Serum HDL-C, Measurement of Serum TG, Diabetic Profile Tests Measurement of Blood Glucose.

Text Books

1. R. Chawla, Practical Clinical Biochemistry: Methods and Interpretations, 3rd Edn.,Medical Publishers, New Delhi, 2003.
2. B. Mohanty and S.Basu, B. I,Fundamentals of Practical Clinical Biochemistry,. publishers, New Delhi, 2006.

Reference Books

1. Michael L. Bishop, Edward P.Fody, and Larry E. Schoeff, Clinical Chemistry: Principles, Techniques, Correlations, 8th Edition, 2017.
2. D. White, N. Lawson, P. Masters and D. Mc Laughlin, Clinical Chemistry, Garland Science, 2016.

CO	Course outcomes	Remarks
CO1	Learn the Basics of Human Metabolism	K2
CO2	Under the concept of Laboratory Work Flow cycle	K2, K3
CO3	Understand the techniques of Renal Function	K2, K3, K4
CO4	Learn Quantitative Determination of Urine	K2, K3
CO5	Gain the knowledge of Blood sample Analysis	K2, K3

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	M	S	S	S	S	M	M
CO3	S	S	S	M	M	S	S	S	M	M
CO4	S	S	S	S	M	S	S	S	S	S
CO5	S	S	S	M	M	S	S	S	S	S

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

SEMESTER - VI

Course Code	U21CHT61	ORGANIC CHEMISTRY – II	L	T	P	C
CORE-XIII			5	-	-	4
Learning Objectives	1. To understand the basic concept of organic spectroscopy 2. To learn and understand the carbonyl compounds and its derivatives. 3. To learn the basic aspects of stereochemistry 4. To learn the tautomerism and its types					

Unit-I - Carbonyl compounds and their Derivatives

a) 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.

b) 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 and Knoevenagel condensations, Wittig reaction, Mannich reaction, Reformatsky reaction 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.

Unit-II - Nitrogen containing compounds

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

b) 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 effecting basicity of amines - basicity of aliphatic and aromatic amines -reactions of amines.

c) Aryl diazonium salts - preparation, stability, reactions and synthetic transformations.

d) Amino acids - essential and nonessential - methods of preparation - zwitterions formation - isoelectric point - chemical reactions of amino acid.

Unit-III – Stereochemistry

a) Representation of molecules in saw horse, Fischer, flying-wedge and Newman formulae and their inter translations.

b) Geometrical isomerism – nomenclature of geometrical isomers – cis - trans, E-Z and syn-anti notation for C=C, C=N compounds - Methods to assign configurations - Stability of geometrical isomers and heats of hydrogenation.

c) Optical rotation – specific rotation -optical purity - 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 - Optical activity in compounds without asymmetric carbon atoms namely biphenyls, allenes and spiranes, Stereo selectivity, stereo specificity - asymmetric synthesis.

d) Conformational nomenclature: eclipsed, staggered, gauche and anti; dihedral angle, torsion angle, energy barrier of rotation - potential energy diagram. Relative stability of conformers on the basis of steric effect, dipole-dipole interaction, H-bonding - Conformational analysis of ethane, propane, n-butane.

Unit – IV – Tautomerism

Definition – condition of Tautomerism – prototropy and Anisotropy – types of Tautomerism.

i) Keto – enoltautomerism
ii) Nitro-acinitrotautomerism
iii) Nitro-isonitrotautomerism
iv) Lactam – lactimtautomerism and
v) Quinone monoxime – p-nitrophenol

Unit – V - Application of Spectroscopy to Organic Molecules

Electromagnetic spectrum – the UV spectrum – Identification of conjugation – woodwardFieser Rule – adsorption maxima.

IR Spectrum – functional group detection, finger print region – study in Hydrogen bonds.

NMR Spectrum – no of signals – equivalent and non-equivalent protons- chemical shift – peak area and proton counting – splitting of signals – spin-spin coupling.

Text Books

1. M. B. Smith &J. March , March′s Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, Wiley–Blackwell; 6th Ed., 2007.
2. P.S.Kalsi,Stereochemistry: Conformation and Mechanism, New Age Publishers,10thEdition,2019.

Reference Books

1. F.A.Carey and R.J.Sundberg, Advanced Organic Chemistry, Part A and Part B, 5thEd.,Springer, 2007.
2. GurdeepChatwal, Chemistry of Organic Natural Products, Vol 1 and 2, Goel Pub. House, 2002.

CO	Course outcomes	Remarks
CO1	Learn the application of spectroscopy of organic molecules	K2
CO2	Understand the concept of Tautomerism and reactions of free radicals	K2
CO3	Learn basic introduction of stereochemistry	K2, K3
CO4	Gain the knowledge of carbonyl compounds	K2, K3
CO5	Understand the preparation and properties of nitrogen containing compounds	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	M	S	S	S	S	M	M
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	M	S	S	S	S	S
CO5	S	S	S	M	M	S	S	S	S	S

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHT62	INORGANIC CHEMISTRY-II	L	T	P	C
CORE-XIV			5	-	-	4
Learning Objectives		• To learn about nuclear isomerism, internal conversion, detection and determination of activity by cloud chamber, determination of radioactivity, application of tracers and Semi conductors.				

Unit –I - Nuclear Chemistry I

Introduction – composition of 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, types of reactions – fission and fusion – modes of radioactive decay.

Unit –II - Natural and induced radioactivity

Natural and induced radioactivity – radioactive decay – half-life period – radioactive displacement law – radioactive series – Radioactive techniques – Geiger Muller and ionization counters. Natural radioactivity – 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 – uses of radioisotopes – hazards of radiations – nuclear energy – nuclear reactors – nuclear fission and fusion – fission products and fission yields – Spallation – photonuclear and thermo nuclear reactions – energy source of the sun and stars – carbon dating – rock dating. radioactive waste disposal – applications of nuclear science in agriculture, biology and medicine.

Unit –III - Solid State Chemistry

Ionic bonding – lattice energy – Born equation and its derivation, 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 –Solid state electrolytes – Types of magnetic behavior, dia, para, ferro, antiferro and ferrimagnetism – Hysterisis.– Solid state lasers – inorganic phosphors – ferrites.

Unit –IV - Structure of Solids

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

Ionic conductors – sodium, β- alumina, sodium-sulphur battery. Intercalation – layered compounds – graphitic compounds. Special applications of solid state materials. High energy battery, lithium cells. Introduction – techniques for synthesis of nanophase materials – sol-gel synthesis- electro deposition –inert gas condensation-mechanical alloying –properties

of nanophase materials –applications of nanophase materials, composite materials. Band theory – semiconductors – Superconductivity – introduction– examples of superconducting oxides– applications of superconducting materials.

Text Books

1. SatyaPrakash, Advanced Inorganic Chemistry, R.D.Madan, VolI, 5th Edition, S.Chand and Sons, New Delhi, 2012.
2. J.E. Huheey, Inorganic Chemistry, Pearson Education India; 4th Ed.,2006.

Reference Books

1. Attila Vértes, Sándor Nagy, ZoltánKlencsár, Rezső G. Lovas, Frank Rösch. Handbook of Nuclear Chemistry, Springer, 2011.
2. F.A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry, 6th Ed., John Wiley & Sons, 2007

CO	Course outcomes	Remarks
CO1	Learn about the different types of nuclear reactions	K2, K4
CO2	Study about the Detection and Measurement of radioactivity	K2,K3,K4
CO3	Learn the structure of solids and defects in crystal structure.	K2
CO4	Learn the Band theory and Semi Conductors	K2, K3
CO5	Understand the laws of crystallography and crystal structure	K2,K4

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	M	S	S	S	S	M	M
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	M	S	S	S	S	S
CO5	S	S	S	M	M	S	S	S	S	S

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHT63	PHYSICAL CHEMISTRY -II	L	T	P	C
CORE-XV			5	-	-	4
Learning Objectives	1. To understand the inter conversion of chemical and electrical energy and to link thermodynamics with electrochemistry. 2. To apply the concepts of kinetics, catalysis and photochemistry to different chemical processes.					

Unit – I – Photochemistry

Photochemical reactions – definition – comparative study of thermal and photochemical reactions – laws of photochemistry: Lambert and Beer's laws, Grotthus – Drapper law, Stark-Einstein law – quantum efficiency and its determination – consequences of light.

Absorption by atoms and molecules – photophysical processes- fluorescence, phosphorescence and other deactivating processes. Jablonskii diagram. Photochemical processes: Kinetics of photochemical reactions.

i) Gaseous reactions: Hydrogen-chlorine reaction, decomposition of HBr, HI and photolysis of ammonia.
ii) Reactions in liquid phase (solutions) – isomeric transformation of maleic to fumaric acid – polymerization of anthracene.
iii) Photochemical equilibrium – flash photolysis – photosensitization – chemiluminescence.
iv) Radiation chemistry – application.

Unit – II - Electrochemistry

Conductance: Definition and determination – specific, equivalent conductance with dilution and its limiting values.

Strong and weak electrolytes: theory of strong electrolytes – Debye-Huckel-Onsager equation (no derivation) ionic activity and activity co-efficient

Ostwald's dilution law and its applications

Kohlrausch's law of ionic mobilities and its applications.

Applications of conductivity measurements – degree of dissociation – solubility of a sparingly soluble salt – degree of hydrolysis – basicity of acids – conductometric titrations.

Unit– III - Ionic Equilibria

Common ion effect and solubility product – quantitative study and theirapplications. Hydrolysis – degree of hydrolysis (∞) – hydrolysis constant (Kh) –experimental determination and derivation of these values for different salt solutions – based on Kw, Ka and Kb calculation involving hydrolytic constants. pH of solutions – definition and methods of determination of pH- Buffer solution - definition – theory of buffer action and applications – Henderson equation.

Unit – IV - Electrode potentials and electrochemical cells

Electrode potentials and electrochemical cells. Single electrode potentials – oxidation and reduction potentials Thermodynamics and electromotive force (EMF) – relation between chemical and electrical energies – calculation of G, S, and H of cell reaction. Calculation of EMF.Nernst equation – standard electrode potential and its characteristics.

Types of electrodes: metal – metal ion, gas, metal – insoluble salt, redox, glass electrodes.

Chemical and voltaic cells: Definition – cell reaction and representations of electrodes and cells – EMF of cell – conventions regarding signs of EMF – calculation of cell EMF from single electrode potentials. Calculation of cell EMF with the aid of Nernst equation.Experimental determination of EMF of cells.Measurement of single electrode potentials – chemical cells with and without transference – liquid junction potential and salt bridge.

Unit – V - Commercial cells

Primary and secondary cells – Weston Cadmium cell, lead storage cell, Ni-Cd cell, fuel cell.

a) Applications of EMF measurements.
b) Determination of solubility and solubility product of sparingly soluble salts.
c) Determination of pH – using Hydrogen electrode, glass electrode, quinhydrone electrode.
d) Determination of valency of ion.
e) Potentiometer titrations – acid-base, redox, precipitation and complexometric titrations.
f) Determination of transport number. Electrolysis and polarization: Over voltage, decomposition potential, hydrogen over voltage.

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. R.L. Madan, G. D. Tuli, Physical Chemistry, S. Chand, Revised edition, 2014

Reference Books

1. P.W. Atkins, Physical Chemistry, 8th Edition, Oxford University Press, New Delhi, 2006.
2. D.A. McQuarrie, D. Simon, Physical chemistry, A Molecular Approach, Viva Books Pvt. Ltd, 2003.

CO	Course outcomes	Remarks
CO1	Learn the basic ideas of photochemistry and photophysical processes	K2, K3
CO2	Learn concept of ionic activity and ionic strength	K2
CO3	Derive Nernst equation and redox system•	K3
CO4	Study of Debye Huckel theory, Kohlraush's law and Debye-Huckel equation	K2, K3
CO5	Understand the concept of commercial cell and its applications	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	M	S	S	S	S	M	M
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	M	S	S	S	S	S
CO5	S	S	S	M	M	S	S	S	S	S

Strongly Correlating(S) - 3 marks Moderately Correlating (M) -2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

ourse Code	U21CHT64	SPECTROSCOPY	L	T	P	C
U21CHT64			4	-	-	4
Learning Objectives	1. To help the student to develop the habit of accurate manipulation and an attitude of critical thinking. 2. To learn the basic analytical methods and appreciate what is involved in an analysis.					

Unit – I - Introduction and Microwave spectroscopy

Regions of electromagnetic spectrum – parameters of electromagnetic radiation – molecular spectroscopy – Born-Oppenheimer approximation - Electronic, vibrational and rotational energy levels, and transitions in atoms and molecules.Absorption and emission spectra Microwave spectroscopy – rotational spectra of diatomic molecules (rigid rotors), frequency separation – determination of moment of inertia and bond length.

Unit – II - IR Spectroscopy

Principle – types of stretching and bending vibrations. vibrational frequency – factors influencing vibrational frequencies – instrumentation, fingerprint region, study of hydrogen bond. Raman spectroscopy – Rayleigh and Raman scattering – stokes and anti-stokes lines. Comparison of Raman and IR spectroscopy- Mutual exclusion principle, applications.

Unit – III - Electronic Spectroscopy

Beer –Lambert's law, Types of electronic transitions, chromophore, auxochrome, absorption maximum (λ_{max}) and intensity of absorption bands, factors influencing λ_{max} and intensity - instrumentation of UV-Visible spectrophotometer, Frank-Condon principle.

Unit – IV - Nuclear Magnetic Resonance Spectroscopy

Introduction – number of signals – equivalent and non-equivalent protons – position of signals – chemical shift – peak area and proton coupling. Splitting of signals – spin-spin coupling – coupling constant – NMR spectra of simple organic compounds.

Unit – V - Mass Spectroscopy

Principle, molecular ion peak, base peak, isotopic peak, metastable peak fragmentation – nitrogen rule.Mass spectrum of simple organic compounds (acetaldehyde, ethyl alcohol, methyl amine and toluene).

Text Books

1. S. Chand, Elementary Organic Spectroscopy: Principles and Chemical Applications, New Delhi, 2001.
2. V.K. Srivastava and K.K. Srivastava, Introduction to Chromatography: Theory and Practice, S. Chand and company, New Delhi, 2000.

Reference Books

1. W. Kemp, Organic Spectroscopy,3rdEdition, 2002.
2. Y. R. Sharma, Elementary Organic Spectroscopy: Principles and Chemical Applications, Revised Edition, 2013

CO	Course outcomes	Remarks
CO1	Learn rotation spectroscopy of a rigid rotor and non- rigid rotor.	K2
CO2	Understand the instrumentation and comparison of Raman and IR spectroscopy	K2
CO3	Derive the Equation of motion of spin in magnetic fields and Chemical shift	K2, K3
CO4	Study the spin-spin coupling, NMR	K2
CO5	Learn the principles of Mass spectroscopy	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	S	M	S	M	S	S	S
CO2	S	S	M	S	M	S	M	S	S	S
CO3	S	S	M	S	M	S	M	S	S	S
CO4	S	S	M	S	S	S	M	S	S	S
CO5	S	S	M	S	S	S	M	S	S	S

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHP65	PRACTICAL-VI GRAVIMETRIC ESTIMATION & ORGANIC PREPARATION	L	T	P	C
CORE-XVII			-	-	6	4
Learning Objectives	1. To enable the students to acquire the quantitative skills in gravimetric analysis and preparative skills in inorganic preparations 2. To acquire practical knowledge of estimation of inorganic compounds 3. To develop skill in single stage preparation of organic compounds 4. To understand the basic concept of preparation of solutions					

Gravimetric Analysis

1. Estimation of Ca as calcium oxalate monohydrate
2. Estimation of Ba as chromate
3. Estimation of Lead as Chromate

Organic Estimation

Preparation involving

1. Hydrolysis – Ester hydrolysis
2. Amide hydrolysis
3. Benzoylation of beta naphthol amines
4. Acetylation of an amine
5. Nitration of acetanilide
6. Oxidation: Benzoic acid from benzaldehyde

Text Books

1. O.P. Agarwal ,Advanced Practical Organic Chemistry, Krishna Prakashan Media (P) Ltd, 2014.
2. Mann & Saunders , Practical Organic Chemistry, fourth edition Pearson Education India , 2009.

Reference Books

1. V. K. Ahluwalia, P. Bhagat, and R. Agarwal, Laboratory Techniques in Organic Chemistry; I. K. International, 2005.
2. V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, 2nd Edn., 2004.

CO	Course outcomes	Remarks
CO1	Brings about the methods of gravimetric analysis, estimation of inorganic compounds	K1, K2, K3
CO2	Gain the knowledge about the preparation of organic compounds	K2, K3, K4
CO3	Learn the preparation of Standard solutions	K2
CO4	Study the molarity, molality and Normality	K1, K2, K3
CO5	Understand the Principles of Gravimetric Analysis	K2, K4

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	M	M	M	S	S	S	S
CO2	S	M	S	S	M	M	S	S	S	S
CO3	S	S	M	S	M	M	S	M	S	S
CO4	S	S	M	S	M	M	S	S	S	S
CO5	S	S	M	M	M	M	S	S	S	S

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHE641	NANOSCIENCE AND TECHNOLOGY	L	T	P	C
ELECTIVE –IV			3	-	-	3
Learning Objectives	1. To introduce some of the fundamentals and current state-of-the-art in Nano technology. 2. To get familiarized with the synthesis, characterization and applications of nanomaterials. 3. To understand the basic concept of preparation of nanotubes 4. To acquire knowledge in importance of nanomaterials in medicine					

Unit-I - Fundamentals of Nanoscience and Nanotechnology

Definitions, Relationship and Differences. Nano and Nature: Nanoscopic Colours (Butterfly Wings), Bioluminescence (Fireflies), Tribiology (Geckos sticky feet, lotus leaf effect). Introduction to hydrophilic and hydrophobic materials. Nanotechnology timeline, Pre-18th Century, 19th Century, 20th Century and 21st Century. Future perspectives of nanoscience and nanotechnology.

Unit-II - Carbon Nanotubes

Carbon nanotubes – synthesis and purification -filling of nanotubes mechanism of growth – transport properties – mechanical properties – physical properties – application of carbon nanotubes. Preparation methods: Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition.

Unit-III - Classification of Nanomaterials

Introduction to dimensional growth process. Classification of nanomaterials into 0D, 1D, 2D and 3D. Relationship between dimension and shape of nanomaterials (Quantum dots, Quantum wires, Carbon nanotubes, Bucky balls, Fullerenes). Introduction to size effect on electronic and optical properties (Quantum confinement).

Unit- IV - Core-shell

Nanoparticles -types of system – properties – application of core shell nanoparticles – monolayer protected metal nanoparticles method of preparation – functional metal nano particles – applications.

Nanosensors – nanoscale organization for sensors – nanosensors on optical properties – physical properties – nanobiosensors – sensors of the future nanoshells – types of nanoshells – properties - applications.

Unit-V - Nanomedicines

Various kinds of nano system in use – protocols for nanodrug – administration – nanotechnology in diagnostic application. Use of gold nano- particles in diagnostic and therapeutic application molecular nanomachines -covalent and non-covalent approaches molecular motors and machines – molecular devices – practical problems with molecular devices.

Text Books

1. T. Pradeep, Nano: The Essentials: Understanding Nanoscience and Nanotechnology, McGraw-Hill Professional Publishing, 2008.
2. Geoffrey A. Ozin and Andre C. Arsenault, Nanochemistry: A chemical approach to nanomaterials‖, RSC publishing, 2005.

Reference Books

1. J. Dutta, H.F. Tibbals and G.L. Hornyak, Introduction to Nanoscience, CRC press, Boca Raton, 2008.
2. 1.C.N.R. Rao, A. Muller and A.K. Cheetham, The Chemistry of Nanomaterials, Volume I & II‖, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, 2004.

CO	Course outcomes	Remarks
CO1	Gain the Knowledge of Nanoscience and technology	K2
CO2	Understand the classification nanostructured materials and its application.	K2, K3
CO3	Understood the principles and Characterization Techniques	K2, KR
CO4	Understand the basics Electronic Nanomaterial Properties.	K2
CO5	Impart understanding on Nanoparticle based Drug Delivery	K2, K3

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M	M	S	S	S	M
CO2	S	S	S	M	M	S	S	S	M	M
CO3	S	S	S	M	M	S	S	S	M	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	M	M	S	S	S	M	M

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHE642	MOLECULAR DYNAMICS	L	T	P	C
ELECTIVE –IV			3	-	-	3

Learning Objectives	After the study of this course, the student should be able to 1) understand the concept of computational chemistry 2) understand the concept of statistical analysis and significance 3) know the postulates of quantum mechanics and statistical thermodynamics 4) understand the concept of molecular modeling 5) gain the knowledge of photochemical kinetics

Unit-I - Introduction of Computational Chemistry

Theory, computation & modeling – Definition of terms; Need of approximate methods in quantum mechanics; Computable Quantities – structure, potential energy surfaces and chemical properties; Cost & Efficiency – relative CPU time, software & hardware; Classification of computational methods.

Unit–II - Density Functional Methods

Introduction to density matrices, N-reprentability & V-represetability problems, Hohenberg – Kohn theorems, Kohn-Sham orbital's; Exchange correlation functional – Thomas-Fermi-Dirac model, Local density approximation, Comparison between DFT and HF methods.

Unit–III - Basic Principles of Statistical Thermodynamics

Thermodynamic probability – macro and microstates, most probable distribution. Maxwell–Boltzmann statistics. Partition function – relation between partition function and energy. Separation of partition function – partition function for translation.
Entropy and probability. Translational entropy: Sackur-Tetrode equation. Residual entropy.

Unit–IV - Introduction to Molecular Modeling

Introduction to molecular modeling, concepts of coordinate systems (Cartesian and Z-matrix), potential energy surface, global and local minima. Force Field (Bond stretching, Angle bending, Non-bonded interactions), Basic idea about Monte Carlo and Molecular dynamics simulations.

Unit–V - Photochemical Kinetics

Kinetics of photochemical reactions between hydrogen and chlorine and bromine – rate law, comparison with thermal reactions. Bimolecular quenching – Stern- Volmer equation – photosensitization. Kinetics of fast reactions - relaxation techniques.

Text books

1. C. J. Cramer, Essentials of computational Chemistry: Theories and models, John Wiley & Sons 2002.
2. D. C. Rapaport, An Introduction to Molecular Dynamics Simulation, Springer Publisher, 2003.

Reference books

1. Kopin Liu &Xueming Yang, Modern Trends in Chemical Reaction Dynamics- (Advanced Series in Physical Chemistry), 2004.
2. Dominik Marx and JurgHutter, Ab Initio Molecular Dynamics: Basic Theory and Advanced Methods, Kindle Edition, 2012.

CO	Course outcomes	Remarks
CO1	Understand the concept of Computational Chemistry	K2, K4
CO2	Acquire the basic ideas of statistical Thermodynamics	K2
CO3	Apply the concept of statistical distribution of thermal energy	K3
CO4	Understand the basics of Molecular Modelling & DFT	K2
CO5	Explain the Photochemical activation and deactivation of molecules	K4

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	M	M	S	S	S	M	M
CO3	S	S	S	M	M	S	S	S	M	M
CO4	S	S	S	M	M	S	S	S	M	M
CO5	S	S	S	M	M	S	S	S	M	M

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHS64	ENGINEERING CHEMISTRY	L	T	P	C
SBE-IV			2	-	-	2
Learning Objectives	1. To understand the concepts of fuels and energy resources, generation of energy from various types of fuels, 2. To understand the use of chemicals in the improvement of agricultural crops 3. To learn the manufacturing processes of iron, steel, ceramics and refractories and to understand the process of surface coatings.					

Unit I - Fuels and Energy Resources

Petroleum - origin of petroleum, composition, refining of petroleum fractionation - composition of various fractions, cracking - catalytic and thermal cracking, synthetic petrol, knocking, octane and cetane numbers, anti-knocking agents, coal gas, producer gas, methane production from biomass, alcohol as fuel.

Unit-II - Corrosion and its control Corrosion

Introduction of corrosion-chemical and electrochemical - factors affecting electrochemical corrosion - sacrificial anode - impressed current cathodic protection - surface treatments and protective coatings - oil paint - emulsion paint - special paints - heat resistant, fire retardant and luminous.

Unit-III - Iron, Steel and Alloys

Manufacture of pig iron by blast furnace, wrought iron by puddling processes - steel by Bessemer's process - Heat treatment of steel. Alloys-purpose of making alloys - preparation of alloys by fusion method - electro deposition and reduction method - effects of carbon, silicon, phosphorus and sulphur - application of alloy steels.

Unit-IV - Ceramics and Refractories

Ceramics - various classes of ceramics, general properties, porous and non-porous wares, raw materials for ceramics, uses. Refractories - manufacture of refractories - properties and uses of common refractory bricks - silica bricks - fire clay bricks, magnesite bricks and dolomite bricks.

Unit-V - Pollution and its control

Causes of air and water pollution - primary and secondary pollutants - assessment of water pollution - definition and significance of DO, BOD and COD - primary and secondary treatment of sewage - air pollution - environmental impact - acid rain, greenhouse effect and global warming, ozone depletion - smog - pollution control by Cottrell precipitator, bag filter and absorption towers.

Text Books

1. K. Pushpalatha, Text book of Engineering Chemistry, published by Wiley publications 2nd edition. 2007.
2. P. C. Jain, Monica Jain, DhanpatRai, A text book of Engineering Chemistry 15th Edition Publishing Co (P) Ltd., New Delhi. 2006.

Reference Books

1. M. Karunanidhi, N. Ayyaswami, T. Ramachandran and H. Venkatraman, Applied Chemistry, Anuradha Agencies, 2002.
2. Shashi Chawla, A Text Book of Engineering Chemistry, DhanpaiRai& Co., 2017.

CO	Course outcomes	Remarks
CO1	Acquire knowledge about fuels and energy sources	K2
CO2	Learn the corrosion control techniques	K2
CO3	Learn the manufacture techniques of iron, steel and alloys	K2, K3
CO4	Learn the concept of Ceramics and Refractories	K2
CO5	Understand the concept of Pollution and its control	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	M	M	S	S	S	M	M
CO3	S	S	S	M	M	S	S	S	M	M
CO4	S	S	S	M	M	S	S	S	M	M
CO5	S	S	S	M	M	S	S	S	M	M

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

NON MAJOR ELECTIVE

Course Code	U21CHN31	COSMETIC CHEMISTRY	L	T	P	C
SEMESTER - III			2	-	-	2
Learning Objectives	1. To create awareness among the undergraduate students about the role of chemistry in day- to- day life, 2.To know more about the cosmetics natural and artificial, 3.To obtain adequate knowledge and scientific information regarding basic principles of cosmetic chemistry.					

Unit-I - Natural Perfumes

Perfumes –plant and animal sources– examples –components of perfume – vehicle – characteristics of good vehicle -fixatives and its types, odoriferous compounds, extraction of essential oils by distillation, enlarge and solvent extraction methods.

Unit- II - Artificial Perfumes and flavors

Preparation and uses of methyl anthranilate, methyl salicylate, methyl cinnamate, phenyl ethanol, citronellol, vanillin, coumarin and heliotrope. Composition and preparation of rose and jasmine perfumes –manufacture of fruit flavors – fruit syrup preparation and composition of apple and pineapple flavors.

Unit-III - Hair Care Products

Shampoos – principal constituents – thickeners and foam stabilizers – perfumes – preservatives – conditioning agents – antidandruff shampoos. Hair cream – composition – hair dyes – types – constituents – dye removals

Skin Care Product

Skin cleansers – classifications – cold cream – cleansing milk – moisturizers – hand and body lotions – sun screen lotions – constituents

Unit- IV - Soaps and Detergents

Cleansing action of soap – differences between soap and detergents – ingredients and preparation of washing and bathing soap – TFM of bathing soap – composition of solid and liquid detergents – functions of ingredients in detergents.

Unit- V- Colour Cosmetics

Lipstick – constitutions – manufacturing method – lip glosses – nail polish – formulation – manufacture – face powder – constitution.

Dental Product

Oral care product – product categories – toothpaste – toothpowder – oral rinses – mouth washes.

Text Books:

1. Ramesh Kumari, Chemistry of Cosmetics, Prestige Publishers, 2018.
2. R. K. Nema, Textbook of Cosmetics, CBS, Publisher, 2017.

Reference Books

1. M. Vimaladevi, Textbook of Cosmetic, CBS Publisher, 2019.
2. Heather A. E. Benson, Michael S. Roberts, Vania Rodrigues Leite-Silva, Kenneth Walters, Cosmetic Formulation: Principles and Practice, CRC Press Publisher, 2021.

CO	Course outcomes	Remarks
CO1	acquire basic knowledge About cosmetics	K2
CO2	Choose cosmetics upon checking harmless chemical ingredients from various products	K2, K3
CO3	Judiciously use cosmetics and other related chemicals.	K2
CO4	Learn the idea about colour cosmetics	K2
CO5	Learn the preparation of dental product and bath product	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	M	M	S	S	S	M	M
CO3	S	S	S	M	M	S	S	S	M	M
CO4	S	S	S	M	M	S	S	S	M	M
CO5	S	S	S	M	M	S	S	S	M	M

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21CHN42	APPLIED CHEMISTRY	L	T	P	C
SEMESTER -IV			2	-	-	2
Learning Objectives	1.To understand the preparation and properties of Rubber and Fibers 2. To understand the preparation and properties of Plastics and Resins. 3.To know the classification and importance of Fertilizers 4.To understand the use of chemicals in improvement of agricultural crops					

Unit – I - Elastomers

Natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene. Rubber: Types-defects in natural rubber-vulcanization-synthetic rubbers- uses of neoprene, thiocol, silicone rubber and foam rubber.

Unit – II - Fibers

Definition, natural and synthetic fibers:Natural fibers (cellulosic and protenious) –Semi synthetic (Rayon) Synthetic fibers (Poly ester, Nylon and Acrylic) –Pretreatment of fibers (Sizing, Desizing, Bleaching).

Unit – III - Resins

Natural and synthetic resins – distinction between resins and plastics, action of ion exchange resins,separation of inorganic mixtures,applications,phenol- formaldehyde resins -amino resins-urea- formaldehyde and melamine-formaldehyde resins-polyurethanes -epoxy resins.

Unit – IV – Plastics

Classification- differences between thermoplastics and thermosetting polymers. Advantages of plastics-preparation, properties and uses of polythene, PVC, polystyrene, Teflon and PAN.

Unit –V – Fertilizer

Definition-characteristics of a good fertilizer- role of nitrogen, potassium and phosphorous in plant growth – natural fertilizers- chemical fertilizers: urea, muriatic of potash and triple superphosphate - mixed fertilizers – biofertilizers – advantages of biofertilizers.

Text Books

1. B. S. Chauhan, Applied Chenistry, Vayu Education India, 2013.
2. B. K. Sharma, Industrial Chemistry Krishna PrakashanMedia(p) Ltd., 2011

Reference Books

1. B.S Chauhan, Applied Chemistry,Vayu Education of India, 2013.
2. K. BagavathiSundari , “Applied Chemistry” MJP Publishers, 2006.

CO	Course outcomes	Remarks
CO1	Study the Natural and synthetic rubber composition	K2
CO2	Learn the Natural and synthetic fibers	K2
CO3	Understand the distinction between resins and plastics	K2
CO4	Remember the classification of plastics and properties	K1
CO5	Understand the importance of fertilizers	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	M	S	S	S	S	M	M
CO3	S	S	S	M	M	S	S	S	M	M
CO4	S	S	S	S	M	S	S	S	S	S
CO5	S	S	S	M	M	S	S	S	S	S

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

VALUE ADDED PROGRAMME

Course Code	U21CHV51	PHARMACEUTICAL CHEMISTRY	L	T	P	C
SEMESTER - V			30			2
Learning Objectives	1. To learn disinfectants and antiseptics. 2. To understand the import ants drugs and the mode of actions. 3. To study the function of Enzymes 4. To gain the knowledge of Body fluids					

Unit-I: Clinical Hygiene and Biochemical Analysis

Definition of health.Ryde of WHO. Sterilization of surgical instruments.Disinfectants, antiseptics, sanitation.Biochemical analysis of urine, serum and fecal matter.Treatment for specific poisons-acids, alkalis, arsenic and mercury compounds.

Unit-II- Common Drugs

Manufacture of drugs (e.g. quinine, reserpine, atopside and d – tubocurarine) from indian medicinal plants. Testing of drugs : biological variation, screening and toxicity. Use of pharmacoepia and therpeutic index. Cardiovascular drugs-nitrates, beta blockers(propranalol and atinelol) and calcium channel blockers. h) uclear medicine (Radiation therapy)

Unit-III– Enzymes

Introduction of Enzymes-Classification, specificity, Coenzymes, Cofactor, ATP, Mechanism of enzyme action and Immobilisation of enzymes.-Specific action of enzymes, factors affecting enzyme activity.

Unit-IV- Body Fluid

Blood volume, blood groups, coagulation of blood.Plasmalipoprotiens.Blood pressure. Arteriosclerosis, diseases affecting red cells: Hyperchromic and hypochromic anaemia. Blood tranfusion.Blood sugar and diabetes.

Unit-V– Biotechnology

Heredity, recombinant DNA, Genetic engineering and its possible hazards, Gene splicing, manufacture of interferon and human insulin(Humulin), Drug manufacture based on fermentation(only antibiotics)

Text Books

1. Akhil Nagar, AtulBendale, RajanikantKakade, VinodUgale, A Textbook of Pharmaceutical Inorganic Chemistry, IP Innovative Publication Pvt. Ltd., 2021.
2. Varun and PragiArora, Textbook of Pharmaceutical Organic Chemistry, S Vikas and Company (PV), 2019.

Reference Books

1. V. N. Rajasekaran, Phamaceutical Chemistry II: Theory and Practical, CBS Publisher, 2019.
2. R. Kabra, Pharmaceutical Chemistry –I, S Vikas and Company (PV), 2016.

CO	Course outcomes	Remarks
CO1	Discuss Clinical hygiene and biochemical analysis	K2
CO2	Learn the manufacturing of drugs.	K2
CO3	Understand the specific action of enzymes	K2
CO4	Remember the Blood groups and blood sugar control levels.	K1, K3
CO5	Gain the knowledge of manufacture based on fermentation	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	M	M	M	S	S	M	M
CO2	S	S	S	M	S	S	S	S	M	M
CO3	S	S	S	M	M	S	S	S	M	M
CO4	S	S	S	S	M	S	S	S	S	S
CO5	S	S	S	M	M	S	S	S	S	S

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

Course Code	U21BOA44	LIFE SCIENCES	L	T	P	C
SEMESTER -IV			-	-	4	4
Learning Objectives		1. To understand basics and gain knowledge on laboratory reagents and their uses in volumetric analysis. 2. At the end of the course, the students should be able to plan experimental projects and execute them.				

Acidimetry and alkalimetry: Titration acids used: hydrochloric acid, sulphuric Standard solutions prepared: sodium carbonate, sodium bicarbonate, oxalic acid.
Oxidation and reduction titration: Oxidizing agents: Potassium permanganate (permanganimetry) Reducing agents: Ferrous sulphate, ferrous ammonium Sulphate, oxalic acid
Standard solutions prepared: Ferrous Sulphate, ferrous ammonium Sulphate and oxalic acid.
Iodometry titrations: titrations of liberated iodine against sodium thiosulphate using acidified potassium permanganate, potassium dichromate and copper Sulphate solutions.
Standard solutions: potassium dichromate, copper sulphate.

Text Books

1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 2009.
2. B.S. Furniss, A.J. Hannaford, P.W. G. Smith, A.R. Tatchell, Vogel's Text Book of Practical Organic Chemistry. 5th Edn., Pearson Education, 2005.

Reference Books

1. Mann & Saunders, Practical Organic Chemistry, 4th Edition, 2009.
2. V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, 2nd Edn., 2004.

CO	Course outcomes	Remarks
CO1	Learn the concept of Titration methods and various Titrations	K2
CO2	Understand the Acidimetry and alkalimetry titrations	K2
CO3	The preparation of standard solutions and methods of analyze the various salts	K2, K4
CO4	Understand the calculations of molarity, molality and Normality of the solutions	K2
CO5	Understand the concept of Iodometry titrations	K2

K1- Remember **K2**- Understand **K3**- Apply **K4**- Analyze **K5**-Evaluate

Mapping of COs with POs &PSOs:

PO/PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	M	M	M	S	S	S	M
CO2	S	M	S	S	M	M	S	S	S	M
CO3	S	S	M	S	M	M	S	M	S	M
CO4	S	S	M	S	M	M	S	S	S	M
CO5	S	S	M	M	M	M	S	S	S	M

Strongly Correlating(S) - 3 marks Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark No Correlation (N) - 0 mark

****