

MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI

B.Sc. CHEMISTRY (Affiliated Colleges)

LEARNING OUTCOME BASED CURRICULUM

(For those who joined from 2023-2024 onwards)

VISION AND MISSION OF THE UNIVERSITY

VISION

"To provide quality education to reach the unreached "

MISSION

- To conduct research, teaching and outreach programmes to improve conditions of human living
- To create an academic environment that honours women and men of all races, caste, creed, cultures and an atmosphere that values intellectual curiosity, pursuit of knowledge, academic freedom and integrity
- To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
- To develop partnership with industries and government so as to improve the quality of the workplace and to serve as ^{catalyst} for economic and cultural development
- To provide quality / inclusive education, especially for the rural and un-reached segments of economically downtrodden students including women, socially oppressed and differently abled

VISION AND MISSION OF DEPARTMENT

VISION

To make the students excel in the fields of education, fundamental and advanced research in Chemistry by providing quality education so that they can compete and contribute to the varying *technology*.

MISSION

1. To teach the students to analyze problems ranging from the basics of Chemistry to advanced level.

2. To give the students adequate hands on experience to work in applied fields.
3. To train the students to act as a useful member or effective leader of a team in multidisciplinary setting.

PREAMBLE

The B.Sc Chemistry programme is fundamental to the revolution taking place in Science and Technology. The aim of the programme is to impart basic skills and knowledge on the principles of all branches of Chemistry to cater to need of Society, Scientific Organization and Industries in the context of developing needs of our country by providing extensive coverage on the fundamental aspects of chemistry relating applications of chemistry to life systems. This course provides intensive practical training to develop associate and apply various aspects of chemistry in day to day life. The programme prepares the students to achieve success in competitive examinations and make developments of needs of their life.

Eligibility for the B.Sc Chemistry Programme

B.Sc Chemistry is a three year Undergraduate course which one can apply after completing 12th from science stream. Eligibility for the course says that the interested must have science with subjects as Physics, Chemistry, Mathematics, Biology or Computer Science as their main subjects from any recognized board.

B.Sc Chemistry Curriculum Design First Year

SEMESTER-I

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	6
Part-III	General Chemistry–ICC1	5	5
	Quantitative Inorganic Estimation (titrimetry) and Inorganic Preparations CC2	3	3
	Allied Chemistry for Physical Sciences (Mathematics and Physics) GE I	3	4
	Allied Chemistry Practical I - Volumetric Analysis GE II	2	2
Part-IV	Skill Enhancement Course SEC-1	2	2
	Foundation Course FC	2	2
	Total	23	30

SEMESTER - II

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	6
Part-III	General Chemistry – II CC3	5	5
	Qualitative Organic Analysis and Preparation of Organic Compounds CC4	3	3
	Allied Chemistry for Physical sciences (Mathematics and Physics) GE III	3	4
	Allied chemistry Practical II - Systematic Analysis of Organic Compounds GE IV	2	2
Part-IV	Skill Enhancement Course SEC - 2	2	2
	Skill Enhancement Course SEC-3 (Discipline / Subject Specific)	2	2
	Cosmetics and Personal care Products		
	Total	23	30

III	I	17	Language	Tamil/Other Languages	6	6	0	4
	II	18	Language	English	6	6	0	4
	III	19	Core V	Physical Chemistry – I	4	4	0	4
	III	20	Major Practical III	Organic Preparation & Inorganic Qualitative Analysis - I	2	0	2	2
	III	21	Allied Course II	Allied Chemistry – I	4	4	0	3
	III	22	Allied Practical II	Allied Chemistry Practical- I	2	0	2	2
	III	23	Skilled Based Course I	Green Chemistry/Food Chemistry	4	4	0	4
	IV	24	Non-Major Elective I	Food Science /Water Management	2	2	0	2
	IV	25	Common	Yoga	2	2	0	2
				SUBTOTAL	30+2	26+2	4	27
IV	I	26	Language	Tamil/Other Languages	6	6	0	4
	II	27	Language	English	6	6	0	4
	III	28	Core VI	Inorganic Chemistry – II	4	4	0	4
	III	29	Major Practical IV	Inorganic Qualitative Analysis – II	2	0	2	2
	III	30	Allied Course II	Allied Chemistry – II	4	4	0	3
	III	31	Allied Practical II	Allied Chemistry Practical- II	2	0	2	2
	IV	32	Skilled Based Course II	Pharmaceutical chemistry/ Industrial Chemistry	4	4	0	4
	IV	33	Non-Major Elective II	Dairy Chemistry / Chemistry in Everyday life	2	2	0	2
	IV	34	Common	Computers for Digital Era	2	2	0	2
	V	35	Extension Activity	NCC/NSS/YRC/YWF	-	-	-	1
				SUBTOTAL	30+2	26+2	4	28
	III	36	Core VII	Organic Chemistry – II	6	6	0	4

V	III	37	Core VIII	Physical Chemistry – II	6	6	0	4
	III	38	Major Elective I	Polymer Chemistry / Bio Chemistry	4	4	0	4
	III	39	Major Elective II	Modern Instrumental Analytical Techniques/ Applied Chemistry	4	4	0	4
	III	40	Major Practical V	Organic Analysis & Physical Constant Determination	8	0	8	4
	III	41	Major Practical VI	Gravimetric Estimation & Inorganic Preparation				
	IV	42	Skill Based Common	Personality Development / Effective Communication / Youth Leadership	2	2	0	2
				SUBTOTAL	30	22	08	22
VI	III	43	Core IX	Inorganic Chemistry – III	5	5	0	4
	III	44	Core X	Organic Chemistry - III	5	5	0	4
	III	45	Core XI	Physical Chemistry – III	5	5	0	4
	III	46	Major Elective III	Textile Chemistry / Nano Chemistry	4	4	0	4
	III	47	Major Practical VII	Physical Chemistry Experiments	4	0	4	2
	III	48	Major Project	Major Project	7		7	7
SUBTOTAL					30	19	11	25
GRANDTOTAL					180+4	145+4	35	152

Skill Based Course

One among the two given course will be selected.

Non-Major Elective

One among the two given course will be selected.

Major Elective

One among the two given course will be selected.

Major Project

Group Project –Maximum of five students per group

Extension Program for the Department

Apart from the curriculum, to enrich the skill development of the students following courses in

their premises are conducted.

Effective Communication

Personality Development

Youth development

EVALUATION SCHEME

B.Sc Chemistry curriculum is divided and studied in six semesters. The internal assessments and external examination are the two parts of evaluation scheme. The external theory and practical examinations will be conducted by the university at end of each semester.

There is a separate passing minimum of 40% for the external and overall components.

Distribution of marks between Internal and External Assessment for Core, Skill Based, Non-Major Elective, Major Elective and Allied Courses.

★ Theory Marks 25 : 75

★ Practical Marks 50 : 50

Pass minimum of 40% for external and overall components.

1. Internal Assessment .

Internal Marks for **Theory** shall be allotted in the following manner

The average of the best two tests from three compulsory tests. Each test is of one hour duration	20 Marks
Assignment	05 Marks
Total	25 Marks

Distribution of marks between Internal and External Assessment
for skill based elective Course- 25 : 75

The average of the best two from three compulsory tests. Each test is of one hour duration	20 Marks
Assignment	05 Marks
Total	25 Marks

2. Internal Marks for **Practical** shall be allotted in the following manner

Experimental Work	25 Marks
Regularity	25 Marks
Total	50 Marks

3. Marks for Major Project shall be allotted in the following manner

Internal Marks : 50

External Marks: 50

Internal Marks for Project:

Components	Marks
Experimental work	25 Marks
Project report	25Marks
Total	50 Marks

External evaluation of Project

Project report evaluation and Viva-Voce will be conducted by both the External examiner and the Guide at the end of the semester.

4. The question pattern for all theory courses shall be as follows.

Duration of Exam: 3 Hours

Section	Type of questions	Mark
Part-A	Multiple choice question (Two question from each unit compulsory)	1×10=10 Marks
Part-B	Internal Choice questions (One question from each unit: either/or)	5×5=25 marks
Part-C	Internal Choice questions (One question from each unit: either/or)	8×5=40 marks
	Total	75 Marks

SEMESTER I

Title of the Course	GENERALCHEMISTRY-I						
Paper No.	Core I						
Category	Core	Year	I	Credits	5	Course Code	
		Semester	I				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1	-		5		
Prerequisites	Higher secondary chemistry						
Objectives of the course	<p>The course aims at giving an overall view of the</p> <ul style="list-style-type: none">• various atomic models and atomic structure• wave particle duality of matter• periodic table, periodicity in properties and its application in explaining the chemical behaviour• nature of chemical bonding, and fundamental concepts of organic chemistry						
Course Outline	<p>UNIT I Atomic structure and Periodic trends</p> <p>History of atom (J.J. Thomson, Rutherford); Moseley’s Experiment and Atomic number, Atomic Spectra; Black-Body Radiation and Planck’s quantum theory -Bohr's model of atom; The Franck-Hertz Experiment; Interpretation of H- spectrum; Photoelectrice ffect, Compton effect; Dual nature of Matter - De-Broglie wavelength - Davisson and Germer experiment Heisenberg’s Uncertainty Principle; Electronic Configuration of Atoms and ions - Hund’s rule, Pauli’ exclusion principle and Aufbau principle; Numerical problem solving the core concepts.</p> <p>Unit II Introduction to Quantum mechanics</p> <p>Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wave functions, Formulation of Schrodinger wave equation-</p>						

Probability and electron density - visualizing the orbitals - Probability density and significance of Ψ and Ψ^2 .

Modern Periodic Table

Cause of periodicity; Features of the periodic table; classification of elements - Periodic trends for atomic size- Atomic radii, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electronegativity- electronegativity scales, applications of electronegativity. Problems involving the core concepts

UNIT-III: Structure and bonding I

Ionic bond

Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle – lattice energies, Madelung constant; relative effect of lattice energy and solvation energy; Ion polarization – polarising power and polarizability; Fajans' rules - effects of polarisation on properties of compounds; problems involving the core concepts.

Covalent bond

Shapes of orbitals, overlap of orbitals – σ and Π bonds; directed valency - hybridization; VSEPR theory - shapes of molecules of the type AB_2 , AB_3 , AB_4 , AB_5 , AB_6 and AB_7

Partial ionic character of covalent bond- dipole moment, application to molecules of the type A_2 , AB , AB_2 , AB_3 , AB_4 ; percentage ionic character- numerical problems based on calculation of percentage ionic character.

UNIT-IV: Structure and bonding-II

VB theory – application to hydrogen molecule; concept of resonance- Resonance structures of some inorganic species – CO_2 , NO_2 , CO_3 , NO_3 ; limitations of VBT; MO theory - bonding, antibonding and non bonding H_2 , C_2 , O_2 , O_2^+ , O_2^- , N_2 , NO , HF , CO ; CO_2

	<p>Magnetic characteristics, comparison of VB and MO theories.</p> <p>Coordinate bond: Definition, Formation of BF_3, NH_3, NH_4^+, H_3O^+ properties</p> <p>Metallic bond – electron sea model, VB model; Band theory- mechanism of conduction in solids; conductors, insulator, semiconductor– types, applications of semiconductors</p> <p>Weak Chemical Forces - Vander Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induceddipole interactions. Repulsive forces; Hydrogen bonding – Types, special properties of water, ice, stability of DNA; Effects of chemical force, melting and boiling points</p> <p>UNIT-V: Basic concept sin Organic Chemistry and Electronic effects</p> <p>Types of bond cleavage – heterolytic and hemolytic arrow pushing in organic reactions; reagents and substrates; types of reagents- electrophiles, nucleophiles, free radicals; reaction intermediates – carbanions, carbocations, carbenes, arynes and nitrynes.</p> <p>Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductomeric and electromeric effects.</p> <p>Resonance–resonance energy, conditions for resonance- acidity of phenols, basicity of aromatic amines, stability of carboniumions, carbanions and free radicals, reactivity of vinyl chloride, dipolemoment of vinyl chloride and nitrobenzene, bond lengths; steric inhibition to resonance.</p> <p>Hyper conjugation- stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitro methane</p> <p>Types of organic reactions - addition, substitution, eliminationand rearrangements</p> <p>Recommend</p> <p>Text</p> <ol style="list-style-type: none"> 1. Madan,R.D.and Sathya Prakash,Modern Inorganic Chemistry,2nded.;S.Chand and Company: New Delhi, 2003. 2. Rao, C.N.R. University General Chemistry, Macmillan Publication: New Delhi, 2000
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3. Puri, B. R. and Sharma, L. R. Principles of Physical Chemistry
38th ed.; Vishal Publishing Company: Jalandhar, 2002.

4. Bruce, P. Y. and Prasad K. J. R. Essential Organic Chemistry, Pearson Education: New Delhi, 2008.

5. Dash UN, Dharmarha OP, Soni P. L. Text book of Physical
Chemistry, Sultan Chand & Sons: New Delhi, 2016

Reference Books

1. Maron, S. H. and Prutton C. P. Principles of Physical Chemistry, 4th ed.;
The Macmillan Company: New York, 1972.

2. Lee, J. D. Concise Inorganic Chemistry, 4th ed.; ELBS William Heinemann: London, 1991
3. Gurudeep Raj, Advanced Inorganic Chemistry, 26th ed.; Goel Publishing House: Meerut
2001.

4. Atkins, P. W. & Paula, J. Physical Chemistry, 10th ed.; Oxford University Press
: New York, 2014.

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

1) <https://online.courses.nptel.ac.in>

2) http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm

3) http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html

4) <https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding>
<https://www.chemtube3d.com/>

Title of the Course	Quantitative Inorganic Estimation(titrimetry) and Inorganic Preparations						
Paper No.	Core II						
Category	Core	Year	I	Credits	2	Course Code	
		Semester	I				
Instructional	Lecture	Tutorial	Lab Practice		Total		
Hours per week	-	-	3		3		
Prerequisites	Higher secondary chemistry						
Objectives of the course	<p>This course aims at providing knowledge on</p> <ul style="list-style-type: none">• laboratory safety• handling glass wares• Quantitative estimation• preparation of inorganic compounds						
Course Outline	<p>Unit I Chemical Laboratory Safety in Academic Institutions</p> <p>Introduction- importance of safety education for students, common laboratory hazards, assessment and minimization of the risk of the hazards, prepare for emergencies from uncontrolled hazards; concept of MSDS; importance and care of PPE; proper use and operation of chemical hoods and ventilation system; fire extinguishers- types and uses of fire extinguishers, demonstration of operation; chemical waste and safe disposal.</p> <p>Common Apparatus Used in Quantitative Estimation (Volumetric)</p> <p>Description and use of burette, pipette, standard flask, measuring cylinder, conical flask, beaker, funnel, dropper, clamp, stand, wash bottle, watch glass, wire gauge and tripod stand.</p> <p>Principle of Quantitative Estimation (Volumetric)</p> <p>Equivalent weight of an acid, base, salt, reducing agent, oxidizing agent; concept of mole, molality, molarity, normality; primary and secondary standards, preparation of standard solutions; theories of acid-base, redox, complexometric, iodimetric and iodometric titrations; indicators—</p> <p>Types ,theory of acid–base, redox, metalion and adsorption indicators, choice of indicators.</p>						

	Unit II Quantitative Estimation (Volumetric) Preparation of standard solution, dilution from stock solution
	Permanganometry Estimation of sodium oxalate using standard ferrous ammonium sulphate
	Dichrometry Estimation of ferric alum using standard dichromate (external indicator) Estimation of ferric alum using standard dichromate (internal indicator)
	Iodometry Estimation of copper in copper sulphate using standard dichromate
	Argentimetry Estimation of chloride in barium chloride using standard sodium chloride Estimation of chloride in sodium chloride (Volhard's method)
	Unit III Complexometry Estimation of hardness of water using EDTA Estimations Estimation of iron in iron tablets Estimation of ascorbic acid.
	Preparation of Inorganic compounds- Potash alum Tetraamminecopper(II)sulphate Hexamminecobalt(III)chloride Mohr's Salt
Skills acquired From this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	Reference Books: 1. Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A. R. <i>Basic Principles of Practical Chemistry</i> , 2 nd ed.; Sultan Chand & Sons: New Delhi, 1997. 2. Nad, A. K.; Mahapatra, B.; Ghoshal, A.; <i>An advanced course in Practical Chemistry</i> , 3 rd ed.; New Central Book Agency: Kolkata, 2007.

Title of the Course	ALLIED CHEMISTRY FOR PHYSICAL SCIENCES I (FOR MATHEMATICS & PHYSICS STUDENTS)						
Paper No.	Generic Elective I						
Category	Generic Elective	Year	I	Credits	3	Course Code	
		Semester	I				
Instructional Hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	-			4		
Prerequisites	Higher secondary chemistry						
Objectives of the course	This course aims to provide knowledge on the <ul style="list-style-type: none">basics of atomic orbitals, chemical bonds, hybridizationconcepts of thermodynamics and its applications.concepts of nuclear chemistryimportance of chemical industriesQualitative and analytical methods.						
Course Outline	UNIT I Chemical Bonding and Nuclear Chemistry Chemical Bonding: Molecular Orbital Theory - bonding, antibonding, and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. Nuclear Chemistry: Fundamental particles Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy - mass defect-calculations. Nuclear fission and nuclear fusion-differences – Stellar energy. Applications of radioisotopes - carbon dating, rock dating and medicinal applications.						
	Unit II Industrial Chemistry Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses of silicones. Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.						

UNIT III Fundamental Concepts in Organic Chemistry

Hybridization: Orbital overlap, hybridization and geometry of CH₄, C₂H₄, C₂H₂ and C₆H₆. Electronic effects: Inductive effect and consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples. Reaction mechanisms: Types of reactions—aromaticity (Huckel's rule) - aromatic electrophilic substitution; nitration, halogenation, Friedel Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine

UNIT IV Thermodynamics and Phase Equilibria

Thermodynamics: Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics. Carnot's cycle and its significance. Free energy change and its importance (no derivation). Conditions for spontaneity in terms of entropy and Gibbs free energy. Relationship between Gibbs free energy and entropy. Phase Equilibria: Phase rule- definition of terms in it. Applications of phase rule to water system. Two component system- Reduced phase rule and its application to a simple eutectic system (Pb-Ag).

UNIT V Analytical Chemistry

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

Recommended Text	
	<ol style="list-style-type: none">1. V.Veeraiyan, Textbook of Ancillary Chemistry; Highmount publishing house, Chennai, first edition, 2009.2. S.Vaithyanathan, Textbook of Ancillary Chemistry; Priya Publications, Karur, 2003. S.Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

	<table border="1"> <tr> <td data-bbox="201 237 506 623"> Reference Books </td><td data-bbox="506 237 1576 623"> <ol style="list-style-type: none"> 5. P.L.Soni, Mohan Katyal, Textbook of Inorganic chemistry; Sultan Chand and Comp New Delhi, twentieth edition, 2007. 6. B.R.Puri, L.R. Sharma, M.S.Pathania, Textbook Physical Chemistry; Vishal Publis Co., New Delhi, fortyfourth edition, 2018. 7. B.K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014. </td></tr> </table>	Reference Books	<ol style="list-style-type: none"> 5. P.L.Soni, Mohan Katyal, Textbook of Inorganic chemistry; Sultan Chand and Comp New Delhi, twentieth edition, 2007. 6. B.R.Puri, L.R. Sharma, M.S.Pathania, Textbook Physical Chemistry; Vishal Publis Co., New Delhi, fortyfourth edition, 2018. 7. B.K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.
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Title of the Course	ALLIED CHEMISTRYPRACTICALFORPHYSICAL SCIENCES I (For Mathematics and Physics – I Year/ I Semester)						
Paper No.	Generic Elective II						
Category	Generic Elective	Year	I	Credits	2	Course Code	
		Semester	I				
Instructional	Lecture	Tutorial	Lab Practice		Total		
Hours per week	-	-	2		2		
Prerequisites							
Objectives of the course	This course aims to provide knowledge on the <ul style="list-style-type: none">basics of preparation of solutions.principles and practical experience of volumetric analysis						
Course Outline	VOLUMETRIC ANALYSIS <ul style="list-style-type: none">1. Estimation of sodium hydroxide using standard sodium carbonate.2. Estimation of hydrochloric acid using standard oxalic acid.3. Estimation of ferrous sulphate using standard Mohr's salt.4. Estimation of oxalic acid using standard ferrous sulphate.5. Estimation of potassium permanganate using standard sodium hydroxide.6. Estimation of magnesium using EDTA.7. Estimation of ferrous ion using diphenyl amine as indicator.						
Reference Books	V.Venkateswaran,R.Veerasamy,A.R.Kulandaivelu,BasicPrinciplesofPractical Chemistry; Sultan Chand &sons, Second edition,1997.						

Title of the Course	FOOD CHEMISTRY						
Paper No	SEC I						
Category	SEC	Year	I	Credits	2	Course Code	
		Semester	I				
Instructional hours per Week	Lecture	Tutorial	Lab Practice		Total		
	2	-	-		2		
Prerequisites	Higher secondary Chemistry						
Objectives of the course	<p>This course aims at giving an overall view of the</p> <ul style="list-style-type: none">● Types of food● Food adulteration and poisons● Food additives and preservation						
Course Outline	UNIT I Food Adulteration Sources of food, types, advantages and disadvantages. Food adulteration- contamination of wheat, rice, milk, butter etc. with clay stones, water and toxic chemicals- Common adulterants, Ghee adulterants and their detection. Detection of adulterated foods by simple analytical techniques.						
	Unit-II Food Poison Food poisons-natural poisons (alkaloids - nephrotoxin) -pesticides, (DDT, BHC, Malathion) – Chemical poisons –First aid for poison consumed victims. Unit-III Food Additives Food additives – artificial sweeteners – Saccharin – Cyclamate and Aspartate Food flavours – esters, aldehydes and heterocyclic compounds – Food colours - Emulsifying agents – preservatives – leavening agents. Baking powder–yeast–taste makers–MSG - vinegar.						

	<p>UNIT-IV Beverages</p> <p>Beverages – soft drinks-soda-fruit juices-alcoholic beverages- examples. Carbonation- addiction to alcohol– diseases of liver and social problems</p> <p>UNIT-V Edible Oils</p> <p>Fats and oils – Source so foils – production of refined vegetable oils - preservation. Saturated and unsaturated fats - iodine value - role of MUFA and PUFA in preventing heart diseases- determination of iodine value, RM alue, saponification values and their significance.</p>
<p>Recommended Text</p> <p>Reference Books</p> <p>Web site and e-learning Source</p>	<ol style="list-style-type: none"> 1. Food chemistry, H.K. Chopra ,P.S. Panesar, Narosa publishing house,2010. 2. Jaya shree Ghosh Fundamental Concepts of Applied Chemistry,S.Chand&Co.Publishers,secondeditio n,2006. 3. FoodChemistry,Dr.L.RakeshSharma,Evincepubpublishing,2022. 4. Foodprocessingandpreservation,G.Subbulakshmi,ShobhaAUdipi,PdminiSGhugre,Newageinternationalpublishers,secondedition,2021. 5. H.-D.Belitz,WernerGrosch,FoodChemistrySpringerScience&BusinessMedia,4thEdition,2009. 6. M.Swaminathan,FoodScienceandExperimentalFoods,GaneshandCompany,1979. 7.Hasenhuettl, Gerard.L.;Hartel,Richard. W.FoodEmulsifiersandtheirapplicationsSpringerNewYork2nded.2008. 8.FoodChemistry,H.D.Belitz,W.Grosch,P.Schieberle, Springer,fourthrevisedandextendededition,2009.Principles of food chemistry, John M.de Man, JohnW.Finley, W.Jefferey Hurst,ChangYongLee, Springer,Fourthedition,2018. <p>https://onlinecourses.nptel.ac.inhttp://cactus.dixie.edu/sblack/chem1010/lec</p>

Title of the Course	FOUNDATION COURSE						
Paper No.	SEC						
Category	SEC	Year	I	Credits	2	Course Code	
		Semester	I				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	-	-		2		
Prerequisites	Higher secondary chemistry						
Objectives of the course	<p>This course aims at providing an overall view of the</p> <ul style="list-style-type: none">• atom structure and electronic configuration• types of chemical bonding characters• different states of mater and their general properties• nomenclature of and isomerism in organic compounds• basic concepts of spectroscopy						
Course Outline	UNIT-I Structure of atom and periodic classification of Elements and properties. Atom structure-Fundamental particles-Atomic mass- Atomic number – Isotopes –Isobars – Isotones – Orbitals - Quantum number and their significance. Shapes of s,p and d orbitals- Rules governing electronic configuration in various its atomic orbitals. Periodic table - periodic laws (Mendeleev and Mosley)- Classification of elements into s,p, d and f-blocks. Metals Non - metals -Periodic properties- Concept, Variation and factors affectingvarious periodic properties-Inert pair effect.						
	Unit-II Chemical Bonding Definition- Types of chemical bond-Ionic bond- Ion polarization - Dipole moment and Percentage of ionic character-Covalent bond-Definition –Postulates of Valence bond theory and Concept of hybridization (sp, sp ² ,sp ³ , sp ³ d, sp ³ d ² , dsp ² , d ² sp ³) –Magnetic properties – Paramagnetic – Diamagnetic-Ferromagnetic. Co-ordinate covalent bond-Definition – Examples-Co-ordination compounds (basic concepts only).						

	<p>UNIT III Nomenclature and Isomerism in Organic compounds</p> <p>Carbon compounds- Uniqueness of carbons- Classification of hydrocarbons - IUPAC Nomenclature of Organic compounds</p> <p>Isomerism: Structural and Stereoisomerism</p> <p>Structural Isomerism: Chain isomerism, Functional isomerism, Positional isomerism and Meta isomerism.</p> <p>Stereoisomerism: Geometrical and Optical isomerism-Chiral molecule- Enantiomers- Diastereomers - Meso compounds-Racemic mixture.</p> <hr/> <p>UNIT IV States of Matter</p> <p>Gaseous state: Kinetic theory of gases- Ideal and Non-ideal gases- Ideal gas equation- Deviation of ideal gas from ideal behavior -vander Waal's equation and Liquification of gases.</p> <p>Liquids: Intermolecular forces, Vapour pressure and Boiling point of liquid - Surface tension –Viscosity- Factors affecting surface tension and viscosity.</p> <p>Solids: Definition - Characteristics of solids- Amorphous and Crystalline solids - Space lattice and unit cells - Close packed structure of solids-Radius ratio rule.</p> <hr/> <p>UNIT V Introduction to Spectroscopy</p> <p>Electromagnetic radiation- General characteristics of Wave – Wavelength – Frequency – Amplitude – Wave number - Electromagnetic spectrum- Absorption and Emission spectrum- Quantization of Energy level - Selection rule - Intensity of the Spectral lines – Width of Spectral lines. Types of spectroscopy: Microwave spectroscopy, Infrared spectroscopy, UV-Visible spectroscopy, Nuclear Magnetic Resonance spectroscopy, Electron spin resonance spectroscopy.</p>
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Text Books	<p>1. B.R Puri, L.R.Sharma, K.C. Kalia, Principles of Inorganic chemistry, Milestone Publishers and Distributors, New Delhi, 2012.</p> <p>2. B.R. Puri and L.R.Sharma, 38th edition, Vishal Publishing company, Jaendar 2002.</p> <p>3. K.S, Tewari, S.N. Mehrothra and N.K.Vishnoi, Text book of Organic Chemistry, 2nd edition Vikas publishing House, New Delhi, 1998.</p>
Reference books	<p>1. R.D. Madan, Sathya Prakash, Mordern Inorganic chemistry 2nd edition, S.Chand and company, New Delhi, 2003.</p> <p>2. B.S.Bhal, ArunBhal, Advanced Organic chemistry, 3rd edition, S.Chand and company, New Delhi, 2003.</p> <p>3. U.N.Dash, O.P.Dharmarha, P.L.Soni, Textbook of Physical Chemistry, Sultan Chand & sons, New Delhi, 2016.</p> <p>4. Y.R.Sharma Organic spectroscopy Principles and Chemical applications, S.Chand&Company PVT Ltd ,2002.</p> <p>5. C.N.Banwell, Fundamentals of spectroscopy Tata McGraw Hill, 1983.</p>
Web site and e-learning Source	<p>https://onlinecourses.nptel.ac.inhttp://cactus.dixie.edu/smbblack/chem1010/lec</p>

SEMESTER II

Title of the Course	GENERAL CHEMISTRY-II			
Paper No.	Core III			
Category	Core	Year	I	Credits
		Semester	II	
Instructional Hours per week	Lecture	Tutorial	Lab Practice	
	4	1	-	
Prerequisites	General Chemistry - I			
Objectives of the course	<p>This course aims at providing an overall view of the</p> <ul style="list-style-type: none">• chemistry of acids, bases and ionic equilibrium• properties of s and p-block elements• chemistry of hydrocarbons• applications of acids and bases• compounds of main block elements and hydrocarbons			
Course Outline	<p>UNIT-I Acids, bases and Ionic equilibria</p> <p>Concepts of Acids and Bases – Arrhenius concept, Bronsted – Lowry concept, Lewis concept; Relative strengths of acids, bases and dissociation constant; dissociation of polybasic acids, ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degree of dissociation; acid base indicators, theory of acid base indicators – action of phenolphthalein and methyl orange, titration curves – use of acid base indicators;</p> <p>Buffer solutions – types, mechanism of buffer action in acid and basic buffer, Henderson - Hasselbalch equation; Salt hydrolysis - salts of weak acids and strong bases, of hydrolysis and relation between hydrolysis constant and degree of hydrolysis; Solubility product – determination and applications; numerical problems involving the core concepts.</p>			

Unit – II Chemistry of s-Block Elements

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

Chemistry of p – Block Elements (Group13&14)

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

UNIT-III Chemistry of p – Block Elements (Group15-18)

General characteristics of elements of Group15; chemistry of H₂N-NH₂, NH₂OH, NH₃ and HNO₃. Chemistry of PH₃, PCl₃, PCl₅, POCl₃, P₂O₅ and oxy acids of phosphorous (H₃PO₃ and H₃PO₄).

General properties of elements of group16 – Structure and allotropy of elements - chemistry of ozone - Classification and properties of oxides - oxides of sulphur and selenium – Oxy acids of sulphur (Caro's and Marshall's acids).

Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI), oxides and oxy acids (HClO₄). Inter-halogen compounds (ICl, ClF₃, BrF₅ and IF₇), pseudo halogens [(CN)₂ and (SCN)₂] and basic nature of Iodine.

Noble gases: Position in the periodic table. Preparation, properties and structure of XeF₂, XeF₄, XeF₆ and XeOF₄; uses of noble gases - clathrate compounds.

UNIT-IV HydroCarbonChemistry-I Petro products:

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

Alkenes- Nomenclature, general methods of preparation – Mechanism of elimination reactions – E1 and E2 mechanism – factors influencing – stereochemistry – orientation – Hofmann and Saytzeff rules.

Reactions of alkenes – addition reactions – mechanisms – Markownikoff's rule, Kharasch effect, oxidation reactions – hydroxylation, oxidative degradation, epoxidation, ozonolysis; polymerization.

Alka dienes

Nomenclature - classification—isolated, conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to conjugated dienes - 1, 2 and 1, 4 additions; free radical addition to conjugated dienes— Diels–Alder reactions – polymerisation – poly butadiene, polyisoprene (natural rubber), vulcanisation, polychloroprene.

Alkynes Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, polymerization and isomerisation.

Cycloalkanes: Nomenclature, Relative stability of cycloalkanes, Bayer’s strain theory and its limitations. Conformational analysis of cyclohexane, mono and di substituted cyclohexanes. Geometrical isomerism in cyclohexanes.

UNIT-V Hydrocarbon Chemistry - II Benzene:

Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel’s $(4n+2) \pi e^-$ rule and its applications.

Electrophilic substitution reactions- General mechanism of aromatic

electrophilic substitution- nitration, sulphonation, halogenations.

Friedel - Craft’s alkylation and acylation. Mono substituted and disubstituted benzene –

Effect of substituent – orientation and reactivity.

Polynuclear Aromatic hydrocarbons: Naphthalene – nomenclature, Haworth synthesis; physical properties, reactions—electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation & alkylation, preferential substitution at o -,p - or m-position – reduction, oxidation – uses. Anthracene – synthesis by Elbs reaction, Diels – Alder reaction and Haworth synthesis; physical properties; reactions - Diels- Alder reaction, preferential substitution at C-9 and C-10; uses.

Recommended Text

1. Madan RD, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nd ed., S. Chand and Company, New Delhi.
2. Sathya Prakash, Tuli G D, Basu S K and Madan R D, (2003), Advanced Inorganic Chemistry, 17th ed., S. Chand and Company, New Delhi.
3. Bahl B S, Arul Bhal, (2003), Advanced Organic Chemistry, 3rd ed., S. Chand and Company, New Delhi.
4. Tewari KS, Mehrotra SN and Vishnoi NK, (1998), Textbook of Organic Chemistry, 2nd ed., Vikas Publishing House, New Delhi.
5. Puri BR, Sharma LR, (2002), Principles of Physical Chemistry, 38th ed., Vishal Publishing Company, Jalandhar.

Reference Books

1. Maron SH and Prutton CP, (1972), Principles of Physical Chemistry, 4th ed., The Macmillan Company, New York.
2. Barrow GM, (1992), Physical Chemistry, 5th ed., Tata McGraw Hill, New Delhi.
3. Lee JD, (1991), Concise Inorganic Chemistry, 4th ed., ELBS William Heinemann, London.
4. Huheey JE, (1993), Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed., Addison Wesley Publishing Company, India.
5. Gurudeep Raj, (2001), Advanced Inorganic Chemistry Vol– I, 26th ed., Goel Publishing House, Meerut. Agarwal OP, (1995), Reactions and Reagents in Organic Chemistry, 8th ed., Goel Publishing House, Meerut.

Website and e – learning source

<https://onlinecourses.nptel.ac.in> http://cactus.dixie.edu/sblack/chem1010/lecture_notes/4B.html
<http://www.auburn.edu/~deruija/pdareson.pdf> <https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding> MOOC components

<http://nptel.ac.in/courses/104101090/43> **Lecture1**: Classification of elements and periodic properties

Title of the Course	QUALITATIVE ORGANIC ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS						
Paper No.	Core IV						
Category	Core	Year	I	Credits	2	Course Code	
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	3		3		
Prerequisites	General Chemistry II						
Objectives of the course	<p>This course aims at providing knowledge on</p> <ul style="list-style-type: none">laboratory safetyhandling glass waresanalysis of organic compoundspreparation of organic compounds						
Course Outline	UNIT I Safety rules, symbols and first – aid in chemistry laboratory basic ideas about Bunsen burner, its operation and parts of the flame. Chemistry laboratory glassware – basis information and uses.						
	Unit II Qualitative Organic Analysis Preliminary examination, detection of special elements - nitrogen, sulphur and halogens Aromatic and aliphatic nature test for saturation and unsaturation, identification of functional groups using solubility tests. Confirmation of functional groups <ul style="list-style-type: none">mono carboxylic acid, dicarboxylic acidmono hydric phenol, polyhydric phenolaldehyde, ketone, estercarbohydrate (reducing and non-reducing sugars)primary, secondary, tertiary amine						

- mono amide, diamide, thio amide
- anilide, nitro compound

Preparation of derivatives for functional groups

UNITIII Preparation of Organic Compounds

- Nitration- picric acid from Phenol
- Halogenation-p-bromo acetanilide from acetanilide
- Oxidation-benzoic acid from Benzaldehyde
- Microwave assisted reactions in water:
- Methyl benzoate to Benzoic acid
- Salicylic acid from Methyl Salicylate

Rearrangement-Benzil to Benzilic Acid

Hydrolysis of benzamide to Benzoic Acid

Separation and Purification Techniques (Not for Examination)

- Purification of organic compounds by crystallization (from water/alcohol) and distillation
- Determination of melting and boiling points of organic compounds.

Steam distillation – Extraction of essential oil from citrus fruits/eucalyptus leaves.

4. Chromatography (anyone) (Group experiment)

- Separation of amino acids by Paper Chromatography
- Thin Layer Chromatography – mixture of sugars/plant pigments / Permanganate dichromate.
- Column Chromatography- extraction of carotene, chlorophyll and xanthophyll from leaves /separation of anthracene – anthracene picrate.

5. Electrophoresis– Separation of amino acids and proteins.

(Demonstration)

6. Isolation of casein from milk / Determination of saponification value of oil or fat / Estimation of acetic

acid from commercial vinegar. (Any one Group experiment)

(4,5&6—not for ESE)

Reference Books

1. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. *Basic Principles of Practical Chemistry*, 2nd ed.; Sultan Chand: New Delhi, 2012.
 2. Manna, A.K. *Practical Organic Chemistry*, Books and Allied: India, 2018.
 3. Gurtu, J.N.; Kapoor, R. *Advanced Experimental Chemistry (Organic)*, Sultan Chand: New Delhi, 1987.
- Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Vogel's Textbook of Practical Organic Chemistry*, 5th ed.; Pearson: India, 1989.

Title of the Course	ALLIED CHEMISTRY FOR PHYSICAL SCIENCES II (FOR MATHEMATICS & PHYSICS STUDENTS)						
Paper No.	Generic Elective III						
Category	Generic Elective	Year	I	Credits	3	Course Code	
		Semester	II				
Instructional Hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	-			4		
Prerequisites	Higher secondary chemistry						
Objectives of the course	<p>This course aims at providing knowledge on the</p> <ul style="list-style-type: none">• Co-ordination Chemistry and Water Technology• Carbohydrates and Amino acids• basics and applications of electro chemistry• basics and applications of kinetics and catalysis• Various photo chemical phenomenon						
Course Outline	UNIT I Co-ordination Chemistry and Water Technology Co-ordination Chemistry: Definition of terms – IUPAC Nomenclature -Werner’s theory- EAN rule - Pauling’s theory – Postulates – Applications to [Ni(CO)4], [Ni(CN)4]2- [Co(CN)6]3- Chelation- Biological role of Haemoglobin and Chlorophyll (elementary idea)– Applications in qualitative and quantitative analysis. Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques - BOD, COD.						
	UNIT II Carbohydrates and amino acids Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose, Discussion of open chain ring structures of glucose and fructose. Glucose – fructose inter conversion. Properties of starch and cellulose. Amino acids: Classification- preparation and properties of alanine, preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).						

UNIT III Electrochemistry

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

UNIT IV Kinetics and Catalysis

Order and molecularity. Integrated rate expression for I and II (2A → Products) order reactions. Pseudo first order reaction, methods of determining order of a reaction – Half –life period – Catalysis – homogeneous and heterogeneous, catalyst used in Contact and Haber's processes. Concept of energy of activation and Arrhenius equation.

UNIT V Photochemistry

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

Recommended Text

1. V.Veeraiyan,TextbookofAncillaryChemistry;Highmountpublishing firstedition,2009.
2. S.Vaithyanathan,TextbookofAncillaryChemistry;PriyaPublications
3. ArunBahl,B.S.Bahl,AdvancedOrganicChemistry;S.ChandandComp twentythirdedition,2012.
4. P.L.Soni,H.M.Chawla,TextBookofOrganicChemistry;SultanChand twentyninth edition,2007.

	ReferenceBooks	1. P.L. Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand New Delhi, twentieth edition, 2007. 2. R. Puri, L.R. Sharma, M.S. Pathania, Textbook Physical Chemistry; Vishal Publishing Co., New Delhi, fortyseventh edition, 2018. 3. .K, Sharma, Industrial Chemistry; Meerut, sixteenth edition, 2014.
	Website and e-learning source	https://onlinecourses.nptel.ac.in http://cactus.dixie.edu/smbblack/chem1010/lecture_notes/4B.html

Title of the Course	CHEMISTRYPRACTICALFORPHYSICAL SCIENCES (For Mathematics and Physics–I Year /II Semester)						
Paper No.	Generic Elective IV						
Category	Generic Elective	Year	I	Credits	3	Course Code	
		Semester	II				
Instructional	Lecture	Tutorial	Lab Practice		Total		
Hours per week	-	-	2		2		
Prerequisites							
Objectives of the course	<p>This course aims to provide knowledge on</p> <ul style="list-style-type: none">• Identification of organic functional groups• different types of organic compounds with respect to their properties.determination of elements in organic compounds						
Course Outline	<p>SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS</p> <p>The analysis must be carried out as follows:</p> <ul style="list-style-type: none">(a) Functional group tests [phenol, acids (mono&di) aromatic primary amine, amides (mono &di), aldehyde and glucose].(b) Detection of elements (N,S, Halogens).(c) To distinguish between aliphatic and aromatic compounds.(d) To distinguish – Saturated and unsaturated compounds						
Reference Books	V. Venkateswaran, R. Veerasamy, A. R. Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons,Second edition,1997.						

Title of the course	DAIRYCHEMISTRY						
Paper No	SEC II						
Category	SEC	Year	I	Credits	2	CourseCode	
		Semester	II				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	-	-		2		
Prerequisites	Higher secondary chemistry						
Objectives of the course	This course aims at providing an overall view of the <ul style="list-style-type: none">chemistry of milk and milk productsprocessing of milkpreservation and formation of milk products.						

Course Outline	UNIT I Composition of Milk Milk-definition-general composition of milk-constituents of milk-lipids, proteins, carbohydrates, vitamins and minerals - physical properties of milk - colour, odour, acidity, specific gravity, viscosity and conductivity- Factors affecting the composition of milk- adulterants, preservatives with neutralizer-examples and their detection – estimation of fat, acidity and total solids in milk.
	UNIT II Processing of Milk Microbiology of milk - destruction of micro - organisms in milk, physico – chemical changes taking place in milk due to processing- boiling, pasteurization – types of pasteurization - Bottle, Batch and HTST (High Temperature Short Time) – Vacuum pasteurization – Ultra High Temperature Pasteurization

UNIT III

Major Milk Products

Cream – definition – composition – chemistry of creaming process- gravitational and centrifugal method So separation of cream –estimation of fat in cream. Butter - definition -composition - theory of churning – desi butter -salted butter, estimation of acidity and moisture content in butter. Ghee – major constituents- common adulterants added to ghee and their detection–rancidity- definition-Prevention – antioxidants and synergists – natural and synthetic.

UNIT IV

Special Milk

Standardized milk – definition – merits – reconstituted milk – definition –flow diagram of manufacture – Homogenised milk – flavoured milk – vitaminised milk- toned milk- Incitation milk-Vegetable toned milk- humanized milk – condensed milk-definition, composition and nutritive value

UNIT V

Fermented and other Milk Products

Fermented milk products – fermentation of milk - definition, conditions, cultured milk - definition of culture - example, conditions – cultured cream, buttermilk – Bulgarian milk – acidophilous milk– Yoheer Indigeneous products – khoa and chhena definition- Icecream – definition - percentage composition – types – ingredients - manufacture of ice-cream, stabilizers – emulsifiers and the irrole – milk powder – definition –need for making milk powder – drying process – types of drying.

Recommended Text

1. K.BagavathiSundari, Applied Chemistry, MJP Publishers, firstedition,2006.
2. K.S.RangappaandK.T.Acharya Indian Dairy Products, Asia Publishing House NewDelhi, 1974.
- 3.Text book of dairy chemistry, M.P. Mathur, D.DattaRoy, P.Dinakar, Indian Council of Agri cultural Research,1stedition,2008.
4. A Text book of dairy chemistry, Saurav Singh, DayaPublishinghouse,1stedition,2013.
5. Text book of dairy chemistry, P.L. Choudhary, Bio-Greenbookpublishers,2021.ReferenceBooks 1.
RobertJennessandS. Patom, Principles of Dairy Chemistry, S.Wiley,NewYork,2005.
2. F.P.Wond, Fundamentals of Dairy Chemistry, Springer, Singapore,2006.
3. SukumarDe, Outlines of Dairy Technology, Oxford University Press, NewDelhi,1980.
4. P.F.FoxandP.L.H.Mcsweeney, Dairy Chemistry and Biochemistry, Springer, Second edition,2016.
5. Dairy chemistry and bio chemistry, P.F.Fox, T.UniackLowe,P.L.H. McSweeney,J.A.OMahony,Springer,Secondedition,2015.

Website and**e-learning source e-pathshala**

Title of the course	COSMETICS AND PERSONAL GROOMING						
Paper No	SEC-III(DisciplineSpecific)						
Category	SEC	Year	I	Credits	2	CourseCode	
		Semester	I/II				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	-	-		2		
Prerequisites	Higher secondary chemistry						
Objectives of the course	This course aims at familiarizing the students with <ul style="list-style-type: none">formulations of various types of cosmetics and their significancehair, skin and dental caremake up preparations and personal grooming						
Course Outline	UNIT I Skin care Nutrition of the skin, skin care and cleansing of the skin; face powder– ingredients; creams and lotions – cleansing, moisturizing all purpose, shaving and sunscreen (formulationonly); Gels – formulation and advantages; astringent and skintonics – keyingredients,s kinlightness, depilatories. UNITII Hair care Shampoos – types – powder, cream, liquid, gel – ingredients; conditioner – types – ingredients Dentalcare Toothpastes – ingredients – mouthwash UNITIII Makeup Base–foundation–types– ingredients; lipstick, eyeliner, mascara, eyeshadow, concealers, rouge UNITIV Perfumes Classification – Natural –plantorigin –parts of the plant used, chief constituents; animal origin – amber gries from whale, civetone from civet cat, musk from musk deer; synthetic–classification emphasizing – characteristics – esters – alcohols – aldehydes – ketones						

UNIT V

Beauty treatments

Facials-types–advantages–disadvantages; facemasks–types; bleach-types–advantages–disadvantages; shaping the brows; eyelash tinting; perming – types; hair colouring and dyeing; permanent waving – hair straightening; wax types–waxing; pedicure, manicure – advantages – disadvantages.

Recommended Text

1. Thankamma Jacob,(1997)Foods, drugsandcometics –A consumerguide, Macmillanpublication,London.

Reference Books

1. WilkinsonJBEandMooreRJ,(1997)Harry’scosmeticology,7thed.,ChemicalPublishers,London.
2. GeorgeHoward,(1987)Principlesandpractice ofperfumesandcosmetics, StanleyTherones,Chettenham

Website and e-learning source

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

SEMESTER III
CORE V PHYSICAL CHEMISTRY I

L	T	P	C
4	0	0	4

Course Objectives

The main objectives of this course are to

- Understand the basics of gaseous substances.
- Learn the basics of liquid and solutions.
- Know the structure of solids.
- Gain knowledge in isotopes, nuclear energy and applications.
- Study on photochemical reactions and photo physical process of excited molecules.

UNIT I GASEOUS STATE

Concept of ideal and real gases-Postulates of kinetic theory of gases- Collision frequency, collision diameter, mean free path and viscosity of gases including their temperature and pressure dependence- Relation between mean free path and coefficient of viscosity – Calculation of σ from η - Effect of temperature and pressure on coefficient of viscosity. Maxwell's law of distribution of molecular velocities-Effect of temperature on distribution of molecular velocities-Types of molecular velocities and their interrelations- Degrees of freedom-Principle of Equipartition of energy- molecular basis of heat capacity - Real gases-Compressibility factor-Deviation from ideal gases-Intermolecular forces.

UNIT II LIQUID STATE

Structure of liquids – Vapour pressure –effect of temperature on vapour pressure - Determination of vapour pressure –The Static method –The Dynamic method – Effect of vapour pressure on boiling points –Heat of vaporization-Trouton's rule –Surface tension –Surface energy -Solutions of liquids in liquids- Raoult's law-Ideal solutions - Gibbs-Duhem-Margules equation-Non ideal solutions-Vapour pressure- Composition curves of completely miscible solution-Fractional distillation-Azeotropic distillation – Lever Rule . Partially miscible liquids - CST- Effects of impurity on CST-System with upper CST and lower CST.

UNIT III SOLID STATE

Solids- Types of Solids - Symmetry in crystal systems- Law of constancy of interfacial angles – Law of symmetry: Definitions of lattice point, space lattice and unit cell-Bravais lattices-Lattice energy-Born-

Lande equation-Law of rational indices-Miller indices -Bragg equation-Derivation and applications-Determination of structure of crystals by X-ray diffraction method-Rotating crystal method and Powder method. Structure of NaCl, KCl and CsCl. Imperfections in a crystal-Schottky defects, Frenkel defects and Non-stoichiometric defects- Metallic crystals-Energy band theory of conductors, insulators and semiconductors.

UNIT –IV NUCLEAR CHEMISTRY

Natural radioactivity-Detection and measurement of radioactivity-Geiger Nuttal rule-Rate of disintegration and half life period-Average life period-Nuclear stability, n/p ratio, magic number, packing fraction , mass defect and binding energy-Liquid drop model-Shell model-Isotopes, isobars, isotones and isomers . Artificial radioactivity-Nuclear fission and Nuclear fusion-Mechanisms- Applications -Stellar energy-Nuclear reactors - Separation of isotopes-Hazards of radiations. Applications of radio isotopes- C^{14} dating, Rock dating, Neutron activation analysis.

UNIT- V PHOTOCHEMISTRY

Laws of photochemistry - Beer-Lambert law - Grothus-Draper Law - Stark-Einstein law of photochemical equivalence - Quantum yield of a photochemical reaction - Determination of quantum yield - Primary photochemical processes - Secondary photochemical processes - Excited states - Fluorescence - Phosphorescence - Chemiluminescence - Thermoluminescence - Bioluminescence - Kinetics of decomposition of hydrogen iodide - Photochemical combination of hydrogen and chlorine - Decomposition of acetaldehyde - Photosensitization - Importance of photosensitization.

Text Books

1. Principles of Physical Chemistry – B.R.Puri, L.R. Sharma and M.S.Pathania, 47th Edition, Vishal Publishing Co,2020
2. A textbook of Physical Chemistry - K.K Sharma, L.K Sharma , 6th Edition, Vikas Publishing House Pvt Ltd, 2016.
3. A Text book of Physical Chemistry, A.S.Negi, S.C. Anand 1st Edition, NewAge publishers intertiol(P) Ltd, 2022
3. Source book of Atomic Energy, Samuel Glasstone, East West Press 3rd Edition , Krieger Publications and Co,1979

Reference Books

1. Essentials of Physical Chemistry- B.S Bahl, G.D. Tuli, Arun Bahl, S.Chand & Company Ltd, 2010.
2. Elements of Physical Chemistry, S.Glasstone and D. Lewis, Second Edition, East West Press,2018.
3. Fundamental of Photochemistry - K.K. Rohatgi-Mukherjee, Revised Second Edition-New Age

International (P) Limited Publishers, Reprint 2006.

4. Advanced Physical Chemistry, N. Bajpai, S. Chand, Publishers 2001.

SEMESTER I
ALLIED COURSE I ALLIED CHEMISTRY I

L	T	P	C
4	0	0	3

Course Objectives

The main objective of this course are to

1. Explain the theories of chemical bonding and Study about the principles and types of organic reactions.
2. Understand the various states of substances and Know about mostly used inorganic materials.
3. Gain the knowledge about the medicine for curing diseases

UNIT I INORGANIC CHEMISTRY

Atom: Composition – Atomic structure –Quantum numbers – Shape of atomic orbitals. Bonding: Overlapping of atomic orbitals s-s, s –p and p-p – Valence bond theory- Sigma and pi bonds – Hybridization – sp, sp² and sp³ hybridisations with suitable examples.

Molecules: Shape of molecules – VSEPR theory –Intermolecular forces – Hydrogen bonding.

Molecular Orbital Theory (MOT): Bonding and Antibonding molecular orbitals – Bond order. MO diagrams: Homonuclear diatomic molecules (N₂, O₂ and F₂) and Heteronuclear diatomic molecule (HF).

UNIT II ORGANIC CHEMISTRY

Principles of reactions: Heterolytic and homolytic cleavage - Nucleophiles and electrophiles : Definition – Types – Examples.

Organic reaction intermediates – Preparation and properties of carbonium ions, carbanions and free radicals – Order of stability of the intermediates. Types of reactions - Substitution, addition, elimination and polymerisation reactions – Illustrations with specific examples.

UNIT III PHYSICAL CHEMISTRY

Gaseous state: Postulates of kinetic theory of gases – Derivation of expression for pressure of gas on the basis of kinetic theory – Deducing the basic gas laws. Ideal and real gases- Deviation of real gases from ideal behaviour – Reasons for deviation - Derivation of Vander Waals gas equation.

Liquid state: Comparison of gaseous and liquid states. Surface tension – viscosity – Trouton's rule and its significances.

Solid state: Types of solids - Crystals, crystallographic systems - Conductors, insulators and semiconductors. Intrinsic and extrinsic semiconductors.

UNIT IV INDUSTRIAL CHEMISTRY

Cement: Manufacture – Wet Process and Dry process, types, analysis of major constituents, setting of cement, reinforced concrete. **Glass:** Composition and manufacture of glass. Types of glasses: optical glass, coloured glasses and lead glass. **Chemical explosives:** Preparation and chemistry of lead azide, nitroglycerine, nitrocellulose, TNT, RDX, picric acid and gunpowder.

UNIT V CHEMOTHERAPY

Preparation, uses and mode of action of sulpha drugs - Prontosil, Sulphadiazine and Sulphafurazole. Uses of Pencillin, chloramphenicol and streptomycin - Definition with one example for analgesics, antipyretics, tranquilisers, sedatives, hypnotics, local and general anaesthetics. Cause and treatment of diabetes, cancer and AIDS.

Reference Books

1. B.R. Puri, L.R. Sharma, K. C. Kalia , Principles of Inorganic chemistry, 21st edition, Vallabh Publications, 2005.
2. B . S. Bahl and A. Bahl, Organic Chemistry, 12th edition, New Delhi, Sulthan Chand & Co., 2010.
3. B.R. Puri, L .R. Sharma, Pathania, Principles of Physical chemistry, 35th edition, Shoban Lal Nagin Chand and Co., 2013.
4. B.K. Sharma, Industrial Chemistry, Goel Publishing House, Meerut.
5. James A. Kent, Riegel's Hand Book of Industrial Chemistry, Springer Science, 2013.
6. G.R. Chatwal, Himalaya, Publishing House, New Delhi, 2002.
7. Text Book of Pharmaceutical Chemistry, Jeyashree Gosh S. Chand and company, New Delhi, 2003

ALLIED CHEMISTRY PRACTICALS I
INORGANIC QUANTITATIVE ANALYSIS

L	T	P	C
0	0	2	2

Course Objectives

The main objectives of this course are to

- ❖ Develop the skills in handling apparatus in the laboratory
- ❖ Acquire the knowledge in volumetric analysis.

Acidimetry and alkalimetry

1. Estimation of oxalic acid – Std. oxalic acid
2. Estimation of Na_2CO_3 – Std. Na_2CO_3
3. Estimation of hydrochloric acid – Std. oxalic acid

Permanganometry

4. Estimation of ferrous ammonium sulphate – Std. ferrous ammonium sulphate
5. Estimation of oxalic acid – Std. oxalic acid
6. Estimation of ferrous sulphate – Std. oxalic acid

Internal –50 marks

25 marks - Regularity

25 marks – Average of best four estimations in regular class work

External -50 marks

10 marks – Record (atleast 4 volumetric estimations)*

10 marks – Procedure

30 marks – Result

*Experiments done in the class alone should be recorded(Students having a bonafide record only should be permitted to appear for the practical examination.

Reference books

1. G.H.Jeffery, J.Bassett, J.Mendham and R.C.Denny „Vogel’s Text book of Quantitative Chemical Analysis” 5th Edition ELBS, 1989.
2. I.M.Kolthoff and E.A.Sanderson, Quantitative Chemical Analysis, S Chand
3. O.P. Pandey, D.N Bajpai, S. Gini, Practical Chemistry, for I, II & III BSc. Students. S.Chand & Company Ltd reprint 2009.
- 4.V.K.Ahluwalia, Sunitha Dhingra, Adarsh Gulate College Practical Chemistry, Universities Press (India) Pvt Ltd 2008 (reprint)

SEMESTER III
SKILL BASED COURSE
GREEN CHEMSITRY

L	T	P	C
4	0	0	4

Course Objectives

The main objectives of this course are to

- Understand needs of green chemistry.
- Know the uses of green solvents.
- Understand the efficiency of green catalysts.
- Study green reactions.
- Learn green energies

UNIT I INTRODUCTION TO GREEN CHEMISTRY AND PRINCIPLES OF GREEN CHEMISTRY

Introduction Sustainable development- Definition of Green Chemistry- Need and goal of Green Chemistry- Twelve Principles of Green Chemistry with their explanation.

Efficiency Parameters: Reaction Yield, Atom economy, Conversion factors, Reaction selectivity and Environmental Load factor (E-Factor) .

Atom Economic reactions : (i) Rearrangement reactions(100% atom economy), (ii) Addition reactions(100% atom economy), (ii) Elimination reactions (100% atom economy).

UNIT II GREEN SOLVENTS

Super Critical Fluids: Introduction- Extraction of super critical fluids- Solvents of super critical fluids – Advantages and Applications.

Super Critical Carbondioxide: Preparation , Properties, Advantages and Applications.

Super Critical Water: Reactions in water and Near critical water(NCW)-Region.

Extracting natural products-Dry Cleaning super critical polymerization, Hydrogenation and Hydroformylation.

Ionic Liquids: Introduction – Synthesis of Ionic liquids- Acidic ionic liquid and Neutral ionic liquids and Applications in organic synthesis.

UNIT III GREEN CATALYSTS

Different types of Catalysts

Acid Catalyst-Base catalyst – Oxidation catalyst – Polymer supported catalysts – Photo sensitized super acid catalyst and Tetra Amido Macrocylic Ligand (TAML) catalyst.

Biocatalyst : Microbial Oxidation, Reduction, Enzyme catalysed hydrolytic process perfluorinated catalyst and biocatalyst.

UNIT-IV GREEN REACTIONS

Microwave Assisted Green Synthesis:

Microwave Assisted reactions in water: Hoffman Elimination, Hydrolysis of Benzyl chloride and Methyl benzoate - Oxidation of toluene and alcohol.

Microwave Assisted Reactions in Organic Solvents: Esterification, Fries rearrangement, Claisen rearrangement, Diels-Alder reaction and Decarboxylation.

Ultrasound Assisted Reactions: Esterification, Saponification, Alkylation, Oxidation, Reduction, Coupling reactions and Cannizzaro reactions.

UNIT V GREEN ENERGY

Green Energy: Definition and Types of Green energy.

Biomass Energy: Sources of Biomass – Bio gas Generation-Biofuel(Biodiesel).

Solar energy: Sun and solar energy –Storage, Photovoltaic system, Applications of solar energy.

Hydrogen energy : Hydrogen production , Hydrogen storage and Application.

Wind energy : Importance and uses.

Text Books

1. Green Chemistry: Theory and Practice, P. T. Anastas and J.C. Warner, Oxford University Press, New York, 1998.
2. Real World Cases in Green Chemistry, M.C. Cann and M.E. Connelly, American Chemical Society 2000.
3. V. Kumar, "An Introduction to Green Chemistry" Vishal Publishing Co. Reprint Edition, 2010.

Reference Books

1. Green Chemistry: Environmental Friendly Alternatives. R.S. Sanghi and M.M. Srivastava, Alpha International Science, 2003.
2. Green Chemistry for Environmental Remediation, R. Sanghi, V. Sing, Wiley, 2012.
3. Rashmi Sanghi, M.M. Srivastava "Green Chemistry" Fourth Reprint, 2009.
4. "Green Chemistry. An Introductory Text", 2nd Ed., RSC Publishing, 2010.

SEMESTER III
SKILL BASED COURSE
FOOD CHEMISTRY

L	T	P	C
4	0	0	4

Course Objectives

The main objectives of the course are to

1. Learn basics of foods.
2. Know importance of Nutrients, Vitamins and Minerals.
3. Study food additives and Preservations.
4. Know food adulterations.
5. Gain knowledge in food quality standards

UNIT I INTRODUCTION TO FOOD CHEMISTRY

Definition of Food – Functions of Food – Constituents of Food, properties and their significance – Major Food Groups: Carbohydrates, Lipids, Proteins, Vitamins and Minerals – Calorific values of food – Rice, Wheat, Fruits, Vegetables, Legumes, Milk, Poultry, Eggs and Sea Foods.

UNIT II NUTRIENTS, VITAMINS AND MINERALS

Nutrients : Classifications, Function, Dietary sources, Recommended Dietary Allowances – Fat soluble Vitamins : A, D, E and K. Water soluble Vitamins: Thiamine, Riboflavin, Niacin, Pyridoxine, Vitamin B₁₂ and Vitamin C - Minerals: Role of Ca, P, Fe, Na, K, I, F, Se.

UNIT III FOOD ADDITIVES AND PRESERVATIVES

Food Additives : Definition – Functions of Food Additives – Advantages of Food Additives – Types of Additives – Antioxidants, Acid modifiers, Foaming agents, Sweeteners, Emulsifiers, Thickeners, Nutritive agents, Flavours and Flavour enhancers, Humectants, Food Colourants.

Food Preservatives : Definition – Principles of Food Preservations – Role of Food Preservations- Methods of Food Preservations – Physical, Chemical and Biological methods.

UNIT IV FOOD ADULTERATIONS

Adulteration – Definition of Adulterants - Types of Adulterants – Common Adulterants and their determination in Milk, Oils, Ghee, Honey, Chili powder, Coriander powder, Turmeric powder, Coffee powder. Adulteration through additives – Food poisoning and its prevention – Prevention of Food Adulteration Act – Food laboratories and their functions.

UNIT V FOOD QUALITY STANDARDS

Quality characteristics – Deteriorative factors and their control – Quality Assurance : Regulations, Standards, Grades and Codes – FA, FDA, WTO and WHO Standards – ISI Specifications, Packing and labeling Foods – Essential Commodities Act, Consumer Protection Act – Agricultural Produce (Grading and Marketing) Act 1937 (AGMARK) - Codex Alimentarius Commission (CAC).

Text Books

- 1 B. Sivasankar, Food Processing and Preservation, Prentice Hall of India, Pvt Ltd, New Delhi, 2002.
2. Nutrition Science, B.Lakshmi, 7th Edition, New Age International Pvt Ltd, 2021,
3. M. Swaminathan, Text Book on Food Chemistry, Printing and Publishing Co, Ltd, Bangalore 1993.
4. S.R.Mudambi, S.R. Rao and M.V.Rajagopal, Food Science, 2nd edition, New Age International Publishers, 2006.

Reference Books

1. Hand Book of Food and Nutrition ,BAPPCO.
2. S. Damodran, K.I. Parkin and D.R. Fennema, Fennema's Food chemistry, 4th edition, CRC Press, 2007.
3. M.N. Shakuntala and M.Shadakshara way, Fundamentals of foods and Nutrition, 4th edition, New Age International Publishers, 2013.
4. B.Sri Lakshmi, Food Science, 7th Edition, New Age International Publishers (Indian), 2003.
5. L. M. Meyer, Food Chemistry, CBS Publishers, ISBN : 9788123911496.

SEMESTER III
NON MAJOR ELECTIVE
FOOD SCIENCE

L	T	P	C
2	0	0	2

Course Objectives

- ✓ Learn the importance of food for energy.
- ✓ Know the needs of food additives & Spices.
- ✓ Know food preservatives.
- ✓ Study food adulterations and Quality of food standards.

UNIT I INTRODUCTION

Food : Sources and classification – Food as a source of energy - Functions and biological importance of Carbohydrates, Protein, Fat, Vitamins and Minerals - Calorific value of food – Energy requirements of individuals - Balanced diet-Glycemic index, Glycemic load.

UNIT II FOOD ADDITIVES AND SPICES

Definition, Food colourants : Natural and Artificial - Antioxidants, Sweetening agents, Stabilizers, Flavours, Bleaching and Maturing agents – Leavening agents. Chemistry of Spices.

UNIT III FOOD PRESERVATIVES

Definition – Principles of food Preservation - Classification - Methods of food preservation and Processing by heat, Cold, radiation, drying and deep freezing.

UNIT IV FOOD ADULTERATION

Definition – Types – Detection and Analysis of adulterants in foods: Milk, Chilli powder, Coffee powder, Turmeric powder, Ghee, Oil and Pulses.

UNIT V QUALITY STANDARDS

Quality control - Specification and Standards - FA, WHO standards – Packing and Labelling of foods, Essential Commodities Act - Consumer Protection Act - AGMARK.

Text books

1. B. Sivasankar Food Processing and Preservation, Prentice Hall of India Pvt. Ltd, New Delhi, 2002.

2. M. Swaminathan Textbook on Food Chemistry, Printing and Publishing Co, Ltd, Bangalore 1993.

Reference Books:

1. L.M. Mayer, Food chemistry , CBS, ISBN-9788123911496.

2. Food Science , 3rd Edition, B. Sri Lakshmi New Age International Publisher, 2005.

3. Fundamentals of Foods and Nutrition – R. Mudambi. Sumathi, and M.V. Rajagopal, Willey Eastern Ltd, Madras.

SEMESTER III
NON MAJOR ELECTIVE
WATER MANAGEMENT

L	T	P	C
2	0	0	2

Course Objectives

The main objectives of this course are to

1. Know the various sources of Water pollution.
2. Study Water Quality Parameters.
3. Learn Water Purification Process.
4. Gain Knowledge on Waste water.
5. Develop the methods for Water Storage.

UNIT I WATER POLLUTION

Definition-Sources of water pollutionTypes of water pollutants: Sewage and Domestic wastes, Industrial effluents, Agricultural discharges, Detergents, Pathogens, Pharmaceutical pollutants and Radioactive materials. Eutrophication and its effects.

UNIT II WATER QUALITY PARAMETERS

Physical, Chemical and Biological water quality parameters-Turbidity, Salinity-water quality standards for drinking water –BIS and WHO. Determination of pH, Total hardness, DO, BOD and COD.

UNIT III WATER PURIFICATION

Chemical coagulation, Flocculation, Sedimentation, Filtration and Disinfection - Desalination: reverse osmosis.

Purification of water for industrial purposes: Water softening- Permutit process and Ion-exchange process.

UNIT IV WASTE WATER TREATMENT

Elementary ideas of waste water treatment: Biological and Chemical processes- Pre-treatment-

Primary treatment-**Secondary treatment:** Aerobic and Anaerobic processes –**Tertiary treatment:** Evaporation Adsorption – Chemical precipitation.

UNIT V RESTORATION AND MANAGEMENT

Importance of lakes and rivers-Stresses on the Indian rivers and their effects –A restoration case

study: Ganga Action Plan: Objectives implementation and drawbacks. Rain water harvesting –Drip irrigation-Water recycling- The water Prevention and control of Pollution Act 1974.

Text books

1. A. K. De, Environmental Chemistry, Wiley Eastern Ltd., 3rd Edition, New Delhi, 1994.
2. B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut, 2019.

Reference books

1. R. K. Trivedy and P. K. Goel, Chemical and biological methods for water pollution studies, Environmental Publications, Karad, India, 2019
2. BIS 1991, Specification for drinking water, Bureau of Indian Standards, New Delhi
3. WHO 1992, International standards for drinking water, World Health Organisation, Geneva.
4. Industrial Chemistry, B.K. Sharma 2011.

SEMESTER III
MAJOR PRACTICAL III
ORGANIC PREPARATION & INORGANIC QUALITATIVE ANALYSIS I

L	T	P	C
0	0	2	2

Course Objectives

- ❖ To make the students thorough in the preparation of organic compounds
- ❖ To enable the students to understand various procedures in salt analysis.
- ❖ To create an awareness on ecofriendly approach in salt analysis

II Organic preparation

- ✓ Preparation of salicylic acid from methyl salicylate (or) benzoic acid from ethylbenzoate
- ✓ Preparation of benzoic acid from benzamide
- ✓ Preparation of benzoquinone oxime from benzoquinone
- ✓ Preparation of benzoic acid from benzaldehyde
- ✓ Preparation of p-bromoacetanilide from acetanilide
- ✓ Preparation of 2-naphthyl benzoate from 2-naphthol
- ✓ Preparation of picric acid from phenol
- ✓ Preparation of methyl orange from sulphanilic acid
- ✓ Preparation of glucosazone from glucose

II Qualitative analysis of inorganic single salt containing acidic and one basic radicals.

1. Acidic radicals

Non-Interfering acidic radicals

Carbonate, Nitrate, Sulphate and Chloride

Interfering acidic radicals

Borate, Fluoride, Oxalate and Phosphate.

2. Basic radicals

Group I : Lead

Group II : Copper, Cadmium, Bismuth.

Group IV : Cobalt, Nickel, Manganese,

Group V : Barium, Strontium,

Group VI : Magnesium, Ammonium.

Internal – 50 marks

20 marks - Regularity

30 marks – Average of best Eight experiments (Four preparations & Four single salts) in regular class work

External -50 marks

10 marks – Record (atleast Four preparations & Four single salts)*

20 marks – Procedure-5 and Preparation-15

20 marks – Single salt (One Acidic & one Basic Radicals)

*Experiments done in the class alone should be recorded

(Students having a bonafide record only should be permitted to appear for the practical examination)

Text Books

1. N.S. Gnanapragasam and G. Ramamurthy, Organic Chemistry – Lab manual, S.Viswanathan Co. Pvt., 1998.
2. V.V. Ramanujam, Inorganic Semi Micro Qualitative Analysis, 3rd edition, The National Publishing Company, Chennai, 1974.
3. Vogel's Text Book of Quantitative Chemical Analysis. 5th Edition., ELBS/Longman England, 1989.

Reference Books

1. P.R.Singh, D.C.Gupta, K.S.Bajpal, Experimental Organic Chemistry Vol.I and II, 1980
2. V.K.Ahluwalia, Sunitha Dhingra, Adarsh Gulate College Practical Chemistry, Universities Press (India) Pvt Ltd Reprint 2008.
3. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part III), S. Viswanathan Co. Pvt., 1996.
4. O.P. Pandey, D.N Bajpai, S. Gini, Practical Chemistry, for I, II & III BSc. Students. S.Chand & Company Ltd, Reprint 2009.
5. J.N. Gurthu and R. Kapoor, Advanced Experimental Chemistry (Organic), S. Chand and Co., 1987.

SEMESTER IV
CORE VI INORGANIC CHEMISTRY II

L	T	P	C
4	0	0	4

Course Objectives

The primary objective of this course are to

- ❖ Gain Knowledge on acids, bases and non-aqueous solvents.
- ❖ Study about d and f-block elements.
- ❖ Know the principle and extraction of metals and compounds.
- ❖ Acquire knowledge on halogens and noble gases.
- ❖ Study on errors and analysis of data related to it.

UNIT I MODERN CONCEPT ACIDS AND BASES AND NON-AQUEOUS SOLVENTS

Modern Concepts of Acids and Bases

Arrhenius Concept – Brownsted - Lowery theory – Lewis Concept – Soft and Hard Acids – Soft and Hard Bases – SHAB Principle – Solvent System – Lux – Flood definition – Usanovic Concept.

Non – Aqueous Solvents

Classification of Solvents – General properties of solvents – Self ionization and leveling effect – Reactions in liquid ammonia, Liquid sulfur dioxide, Liquid hydrogen fluoride.

UNIT II CHEMISTRY OF d AND f BLOCK ELEMENTS

d-Block Elements General Characteristic of Transition metals , Metallic character, oxidation states, size, density, melting and boiling points, ionization energy, colour, magnetic properties, reducing properties, catalytic properties, complex formation and alloy formation. Difference between first and other two rows.

f-Block Elements: General Characteristics of f- block elements – Comparative study of lanthanides and actinides – Electronic configuration, oxidation states, colour, spectral and magnetic properties – Lanthanide contraction and its consequences.

UNIT III METALLURGY

Mineral resources of India – Principles of metallurgy – Methods of metal extraction : Concentration – Froth flotation, Gravity separation, Magnetic separation, Calcination, Roasting and Smelting – Refining

of metals : Zone refining, Van-Arkel DeBoer refining and Electrolytic refining.

Preparation properties and uses: Extraction of metals and its important compounds : Cr, Mn, Zr, Th and U. $\text{K}_2\text{Cr}_2\text{O}_7$, KMnO_4 , ZrOCl_2 , ThO_2 , $\text{UO}(\text{CH}_3\text{COO})_2$.

UNIT IV HALOGEN FAMILY AND NOBLE GASES

Basic properties of Halogen – Oxidation states and oxidizing power – Electropositive Character of iodine

Interhalogen compounds: Preparation, properties and Structures of ClF , ICl_3 , BrF_5 , IF_7 –

Pseudohalogens – Cyanogen $(\text{CN})_2$. Thiocyanogen $(\text{SCN})_2$ and Azidocarbon disulphide $(\text{SCSN}_3)_2$.

Noble Gases: Inert gases – position in the periodic table – General Characteristics - Uses – Structure and shape of xenon compounds : XeF_2 , XeF_4 , XeF_6 , XeOF_2 , XeOF_4 .

Clathrates: Preparation, Properties and Uses.

UNIT V ERRORS AND STATISTICAL ANALYSES

Errors : Definition – Types of errors – Random and Systematic errors – Methods of detection and elimination of systematic errors – Error distribution curves - Accuracy and Precision.

Statistical treatment of error analysis : Definition and explanation with examples of important terms : Mean, Median, Mode, Range, Deviation, Mean deviation, Relative mean deviation, Standard deviation, Coefficient of variation and Variance – Student's t-test - F-test Confidence levels - Rejection criteria - Q test – Curve fitting – Method of least squares - Correlation Coefficient – Significant figures and computational rules.

Text Books

1. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic chemistry, 28th edition, Vallbha Publication, New Delhi, 2004.
2. R.D. Madan, Modern, Inorganic chemistry, Chand S & Company, 2nd edition, New Delhi, 2002.
3. D. A. Skoog, D. M. West and Holler, Analytical Chemistry: An Introduction, 6th edition, Saunders College Publishing .

Reference Books

1. F.A. Cotton, Advanced Inorganic Chemistry, Geoffrey Wilkinson, Carlos, Murillo, Manfred, Bochman John- Wiley & Sons, New York, 1998.
2. J.E. Huheey, and A. Ellen Keiter, L. Richard Keiter, Inorganic Chemistry, 4th edition, Pearson Education Pvt Ltd. Harper Collens College publishers, Singapore, 2004.
3. Gary D. Christian, Analytical Chemistry, 6th edition, John Wiley & Sons.

SEMESTER II
ALLIED COURSE II ALLIED CHEMISTRY II

L	T	P	C
4	0	0	3

Course Objectives

The main objectives of this course are to

- Know the importance of coordination compounds and Understand the electronic effects and stereoisomerism in organic compounds
- Gain the knowledge in conductance of the solution and EMF of the cells & its applications.
- Outline the importance of the Bio-molecules and various diseases & its treatment.

UNIT I INORGANIC CHEMISTRY

Coordination Chemistry: Definition of ligand and Complexes- Coordination number and valency of metal ions - IUPAC Nomenclature – Werner's, sidgwick and Pauling's theories. Effective Atomic Number rule- Metal carbonyls. **Chelation** – Chelate Effect- Applications of EDTA in Qualitative and Quantitative Analysis . Biological role of haemoglobin, Vitamine B12 and Chlorophyll.

UNIT II ORGANIC CHEMISTRY

Covalent Bond-Orbital Overlap-Hybridisation – sp, sp², & sp³ hybridisations – Geometry of Organic molecules- Methane, Ethylene and Acetylene. **Electron displacement Effects:** Inductive, Resonance, Hyper conjugative & steric effects. Their effect on the properties of compounds.

Stereoisomerism: Symmetry-elements of symmetry- cause of optical activity, Tartaric acid. Racemisation. Resolution. Geometrical isomerism of Maleic and Fumaric acids.

UNIT III PHYSICAL CHEMISTRY

Electro Chemistry: Molar and equivalent conductance – Effect of dilution on conductivity- Ostwald dilution law - Kohlrausch law -Measurement of conductance - pH determination-Conductometric titrations. Galvanic cells-EMF-standard electrode potentials- Nernst equation(derivation not required) – EMF of electrode and cell - reference electrodes – pH determination using glass electrode – Potentiometric titrations. **Corrosion:** Definition- Methods of prevention of corrosion.

UNIT IV BIO-ORGANIC CHEMISTRY

Carbohydrates: Classification and examples – Reducing and non reducing sugars - glucose and fructose – preparation and properties – structure of glucose – Fischer and Haworth cyclic structures.

Amino acids and proteins: Amino acids – Classification based on structure. Essential and non – essentials amino acids – preparation, properties and uses – peptides (elementary treatment only) – proteins – Classification based on physical properties and biological functions. Structure of proteins – primary and secondary (elementary treatment).

UNIT V PHARMACEUTICAL CHEMISTRY

Common diseases – Infective diseases – Insect borne – Air borne – Water borne – Hereditary diseases. Definition and examples of analgesics, antipyretics, sulpha drugs, antimalarials and, antibiotics. Diabetes – causes – hyper and hypoglycaemic drugs. Indian medicinal plants – Tulsi, neem, keezhanelli – their importance.

Reference Books

1. B.R. Puri, L.R. Sharma, K. C. Kalia , Principles of Inorganic chemistry, 21st edition, Vallabh Publications, 2005.
2. P. L. Soni, “Text Book of Organic Chemistry” 26th Edition, S. Chand & Co, New Delhi, 1994.
3. R.T. Morrison, R.N. Boyd, S.K Bhattacharjee, Organic Chemistry, 7th Edition, Pearson, India, 2011.
4. B.R. Puri, L .R. Sharma, Pathania, Principles of Physical chemistry, 35th edition, Shoban Lal Nagin Chand and Co., 2013.
5. Principles of Biochemistry, 6th Edition, D.L. Nelson and M.M. Cox , W. H. Freeman and company (New York).
6. G.R. Chatwal, Pharmaceutical Chemistry, Himalaya, Publishing House, New Delhi, 2002.
7. Text Book of Pharmaceutical Chemistry, Jeyashree Gosh S. Chand and Company, New Delhi, 2003.
8. S.Lakshmi, Pharmaceutical Chemistry, Sultan Chand and sons, 3rd Edition , 2004

ALLIED CHEMISTRY PRACTICALS II
INORGANIC QUALITATIVE ANALYSIS

L	T	P	C
0	0	2	2

Course Objectives

The main objectives of this course are to

1. Develop the analytical skill in identifying ions in the given salt.
2. Gain the knowledge about specific and confirmatory tests for acidic & basic radicals.

I. Acidic radical

Interfering acidic radicals:

Borate, Fluoride, Oxalate and Phosphate.

II. Basic radicals

- Group I : Lead
- Group II : Copper, Cadmium
- Group IV : Cobalt, Nickel
- Group V : Strontium
- Group VI : Magnesium, Ammonium.

Internal –50 marks

25 marks - Regularity

25 marks – Average of four experiments in regular class work

External -50 marks

10 marks – Record (atleast four experiments)*

10 marks – Procedure

30 marks – Result

*Experiments done in the class alone should be recorded

(Students having a bonafide record only should be permitted to appear for the practical examination)

Reference books

1. G.H.Jeffery, J.Bassett, J.Mendham and R.C.Denny „Vogel’s Text book of Quantitative Chemical Analysis” 5th Edition ELBS.
2. I.M.Kolthoff and E.A.Sanderson, Quantitative Chemical Analysis, S Chand
3. O.P. Pandey, D.N Bajpai, S. Gini, Practical Chemistry, for I, II & III BSc. Students. S.Chand & Company Ltd reprint 2009.
- 4.V.K.Ahluwalia, Sunitha Dhingra, Adarsh Gulate, College Practical Chemistry, Universities Press (India) Pvt Ltd 2008 (reprint)

SEMESTER IV
SKILL BASED COURSE
PHARMACEUTICAL CHEMISTRY

L	T	P	C
4	0	0	4

Course Objectives

The primary objectives of this course are to

1. Learn drug terminology and common diseases.
2. Know common drugs.
3. Study the mechanism of drugs action and metabolism of drugs.
4. Acquire Knowledge on important diseases and its treatment.
5. Learn the chemicals in medicine and medicinal plants.

UNIT I DRUG TERMINOLOGY AND COMMON DISEASES

Drug, Pharmacy, Pharmacology, Pharmacophore, Pharmacognosy, Therapeutics, Toxicology, Chemotherapy.

Common Diseases

Insect Borne Disease: Malaria and Filariasis

Airborne Disease : Diphtheria, whooping Cough, Influenza, Common cold and Tuberculosis.

Waterborne Disease : Cholera, Typhoid and Dysentery.

Digestive disorder – Jaundice – Respiratory disorder – Asthma- Nervous system disorder – Epilepsy- Peptic Ulcer.

UNIT II COMMON DRUGS

Antibiotics, Antipyretics, Analgesics, Anti-inflammatory agents, Sedatives, Antiseptics & Disinfectants, Antihistamines, Tranquilizers, Hypnotics, and Antidepressant Drugs – Definition, examples, uses and Side effects.

UNIT III MECHANISM OF DRUGS ACTION AND METABOLISM OF DRUGS

Mechanism of drugs Action – Absorption, Drug delivery, Drug excretion – Metabolism of drugs – Chemical pathways of drug metabolism – Phase – I (Oxidative, Reductive and Hydrolytic reaction and Phase – II (Conjugate reactions). Physiological effects of different functional groups in drugs – Biological role of Na, K, Ca, Cu and Zn.

UNIT IV VITAL AILMENTS AND TREATMENTS

Blood pressure – Causes, control and treatment – antihypertension drugs – antianginal agents – Cardiovascular drugs – Cardio glycosides, Vasodilators.

Anemia – Causes and control – Antianemic drugs.

Diabetics – Causes and control – Hypo glycaemic drugs – Insulin

Cancer : Causes and treatment – Antineoplastics drugs – Antimetabolite.

UNIT V MEDICALLY IMPORTANT COMPOUNDS AND MEDICINAL PLANTS

Medically Important compounds : Milk of magnesia, Sodium bicarbonate, Aluminium hydroxide gel, Dried Aluminium hydroxide gel, Ferrous fumarate, Ferrous gluconate, Ferrous sulphate, Ferric ammonium citrate.

Medicinal plants: Vallarai, Kizhanelli, Thumbai, Hibiscus, Adadodai, Tnoothuvallai, Nochi, Thulasi, Aloe vera,- Chemical constituents and Medicinal uses.

Text Books

1. S.Lakshmi, Pharmaceutical chemistry, S.Chand and sons, New Delhi, 2011.
2. Jayashree Gosh, A text book of Pharmaceutical chemistry, 3rd edition, S.Chand and company Ltd., New Delhi 2008.

Reference Books

1. S.C.Rastogi, Biochemistry, Tata McGraw Hill Publishing Co. 1993.
2. Rasheeduz Zafar – Medicinal Plants of India – CBS Publishers and Distributors, 2000.
3. Medicinal Chemistry, G.R.Chatwal, Himalaya Publishing House, New Delhi, 2002.

SEMESTER IV
SKILL BASED COURSE
INDUSTRIAL CHEMISTRY

L	T	P	C
4	0	0	4

Course Objective

The main objectives of this course are to

1. Learn about water treatment methods.
2. Know the uses of petroleum and petrochemical products.
3. Study electrical insulating materials and batteries.
4. Acquire knowledge in corrosion and its control.
5. Know the chemicals in day to day life.

UNIT I WATER TREATMENT

Introduction to sources of water – Hardness of Water – Temporary hardness – Permanent hardness – Disadvantages of hardness – Domestic, Industry, Steam generation in boilers – Effect of iron and manganese in water. Estimation of hardness – EDTA method – Estimation of total hardness – O. Hehener's method (alkali titration method).

Water softening methods – Industrial purpose - Lime soda process, Zeolite process, Ion-Exchange – Demineralization – Deionization process. Mixed-bed deionization. Domestic purpose- Removal of suspended impurities - Removal microorganism – Chlorination. Reverse osmosis- Desalination.

UNIT II PETROLEUM AND PETROCHEMICAL INDUSTRY

Liquified Petroleum, Natural gas, Compressed gas, Liquified Natural gas, Composition of crude petroleum- Refining and different types of petroleum products – Applications – Reforming petroleum and non-petroleum fuels : LPG, CNG, LNG, Biogas, fuel derived from biomass, Fuel from waste and Synthetic fuels - Recent advances in fuel technology – Power alcohols.

Petrochemicals and Applications: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and Xylene.

UNIT III ELECTRICAL INSULATING MATERIALS AND BATTERIES

Electrical Insulating Materials – Dielectric properties – Requirements of electrical insulating materials – Classification of insulating materials – Electrical rigid insulators.

Battery : Primary and Secondary Batteries - Battery compounds and their roles, and characteristics of

battery- Working of following batteries: Lead Acid battery, Lithium battery, Solid state electrolyte battery, Fuel cell, Solar cell, Polymer cell.

UNIT IV CORROSION AND PROTECTIVE COATING

Corrosion :Introduction – Economical aspects of corrosion- Chemical and electro chemical corrosion – Mechanism of corrosion – Control of corrosion - Cathodic and anodic protection.

Protective Coating: Paints and pigments – Formulation, Composition, and Related properties – Oil paints, Vehicle oils, Modifide oils , Pigments, Toners and Lake pigments, Fillers, Thinners, Driers, Plasticizers, Enamels, Emulsifying agents – Anti skinning agents.

MetallicCoating : Removal of surface contaminants – removal of superfacial corrosion products – Polishing – Galvanizing – Tinning – Electroplating.

UNIT V SMALL SCALE PREPARATIONS

Preparation and uses of the following chemical substances-Safety matches, Agarbathis, Naphthalene balls, Wax candle, Shoe polish, Gum paste, Writing / fountain pen ink, Chalk / cryons, Plaster of paris, Slicone carbide crucible.

Text books

1. B. K . Sharma, Industrial Chemistry, Goel Publishing House, sixteenth edition 2011.
2. R.M. Felder, R.W. Rousseau, Elementary Principles of Chemical Process, Wiley Publishers, New Delhi, 2015.
3. J. A. Kent(ed), Riegel's Hand Book of Industrial Chemistry, CBS Publishers, New Delhi.
4. Handbook of Electrical and Electronic Insulating materials, A.J.Dekker
5. The Chemistry of secondary batteries Faure, J.H,Gladstone.

Reference books

1. O.P. Veramani , A. K.Narula, Industrial Chemistry, Galgotia Publication Pvt . Ltd, 2004.
2. P.C. Jain, M. Jain, Engineering Chemistry, 17th EditionDanpat Rai Publishing Company New Delhi, 2015.
3. R. Gopalan, D. Venkappayya, S, Nagarajan, Engineering Chemistry,Vikas Publications, 2004.
4. R.V. Sherve, Industrial Chemicl Process, Tata Mc Graw Hill Publishing Company, 2005.

SEMESTER IV
NON MAJOR ELECTIVE
DAIRY CHEMISTRY

L	T	P	C
2	0	0	2

Course Objective

The main objectives of this course are to

- Learn milk properties and its composition.
- Know the processing of milk.
- Know different products of milk.
- Acquire knowledge on milk products.
- Gain knowledge on condensed milk.

UNIT I PROPERTIES OF MILK

Milk Composition – Physico Chemical properties of milk – Animal, Feed and Environmental factors influencing the composition of milk – Milk lipids, Proteins, Sugar– Minerals and Vitamins in Milk – Thermal stability of Milk- Adulterants, Preservatives, and Neutralizer - examples and their detection.

UNIT II PROCESSING OF MILK

Destruction of microorganisms in milk – Physicochemical changes during processing – Boiling, Pasteurization – Pasteurization types – Bottle pasteurization –Batch pasteurization – HTST (High Temperature Short Time) – Vacuum pasteurization –(UHT) Ultra High Temperature Pasteurisation

UNIT IIMILK PRODUCTS-I

Milk Products: Cream - Definition, Classification – Manufacturing - Chemistry of creaming process - Physico–chemical properties – Separation of cream, Estimation of fat in cream, Butter - Definition, Classification, Composition, Theory of churning, Desi butter, Salted butter. Ghee - major constituents, common adulterants and their detection.

UNIT IV MILK PRODUCTS-II

Fermented milk products - Fermentation of milk - Definition and Conditions. Ice creams - Definition, Composition, Types, Manufacture of Ice - Cream, Stabilizers, Emulsifiers and their role-Milk powder - Definition, Process of making milk Powder and Cheese.

UNIT V CONDENSED MILK

Condensed milk – Definition, Classification and Differences between Condensed milk and Skimmed milk– Sanitation - Pasteurization – Nutritive value of milk – Difference between cow milk and Buffalo milk- Milk enzymes.

Special milk - Definition and Advantages of sterilized milk, Flavoured milk, Standardized milk, Toned milk, Double toned milk.

Text Books

1. Applied Chemistry-K. Bagavathi Sundari, MJP, Publishers Chennai. 2006.
2. Principles of Dairy technology - Robert Jenness, John Wiley & Sons, Inc. New York 1959.

Reference Books :

1. Indian Dairy Products – K.S. Rangappa and K.T Acharya, Asia Publishing House, Bombay, India,1975.
2. Fundamentals of Dairy chemistry – N.P. Wong 3rd Edition,CBS Publishers 2001
3. Outlines of Dairy Technology - Sukumar De. – Oxford University Press Publishers 1996
4. Applied chemistry for home science & allied science - T.Jacob, Mcmillan India Ltd, NewDelhi,1979.

SEMESTER IV
NON MAJOR ELECTIVE
CHEMISTRY IN EVERYDAY LIFE

L	T	P	C
2	0	0	2

Course Objectives

The primary objective of this course are to

- ❖ Study on the chemicals used in cosmetics.
- ❖ Know about soaps and detergents.
- ❖ Gain Knowledge on Nutrients.
- ❖ Understand the materials for agricultural chemistry.
- ❖ Know about the drugs.

UNIT I CHEMISTRY IN COSMETICS

Cosmetics – Definition, classification - Additives and its role in cosmetics–Perfumes

Cleansing cream, all-purpose cream, shampoos, deodorants - Antiperspirants - face powder - Compact powder, sunscreen lotion, skin colorant – lipstick. Cosmetic soaps - moisturizing soap and medicated soap. Dentifrices - toothpaste and mouth washers.

UNIT II CHEMISTRY IN THE LAUNDRY

Soaps - Basic chemical compositions of soaps, Surface active agents, builders, additives, fillers and fragrance, toilet soap, bathing bars, washing soaps. Bio - degradability. Detergents– Introduction, Detergent action, Significance of acidity and alkalinity. Common detergent chemicals.

UNIT III CHEMISTRY IN THE KITCHEN

Butter and cooking oil - saturated and unsaturated fatty acids, hydrogenation of oil. antioxidants and cholesterol. Chemistry of cooking - physical and chemical changes, stability of nutrients during cooking. Microwave cooking.

UNIT IV CHEMISTRY IN THE GARDEN

Food for plants, nutrient deficiencies in plants. Fertilizers, composting, pesticides and their toxicities. Insecticides, fungicides. Biological control of weeds and pests.

UNIT V CHEMISTRY IN TEXTILES

Fibres, yarns, and fabrics. Dyes and dyeing. Flammability. Carpet materials. Leather materials - chemistry of tanning.

Text Books

1. Chemistry of Cosmetics, R.Kumar, Prestige Publishers, 2018.
2. Textbook of Fibres and Science and Technology, S.P. Mishra, NewAge International Pvt Ltd., 2000.
3. B.K. Sharma, Industrial Chemistry, Goel Publishing House, Meerut, 2003.

Reference Book

1. TextBook of Herbal Cosmetics, M.Vimaladevi, CBS Publishers, 2019.
2. Introduction to textile Science – 3rd edition, Maryory L.Joshep
3. James A. Kent, Riegel's Hand book of Industrial Chemistry, Springer Science, 2013

SEMESTER IV
MAJOR PRACTICAL IV

L	T	P	C
0	0	2	2

Course Objectives

- ❖ To enable the students to understand various procedures in salt analysis.
- ❖ To create an awareness on ecofriendly approach in salt analysis

Qualitative analysis of inorganic salt mixture containing two acidic and two basic radicals.

1. Acidic radicals

Non-Interfering acidic radicals

Carbonate, Nitrate, Sulphate and Chloride

Interfering acidic radicals

Borate, Fluoride, Oxalate and Phosphate.

2. Basic radicals

Group I : Lead

Group II : Copper, Cadmium, Bismuth.

Group IV : Cobalt, Nickel, Manganese, Zinc

Group V : Barium, Strontium, Calcium

Group VI : Magnesium, Ammonium.

Internal – 50 marks

25 marks - Regularity

25 marks – Average of best five salt mixtures in regular class work

External -50 marks

10 marks – Record (atleast five salt mixtures)*

40 marks – Analysis (10 marks for each radical)

*Experiments done in the class alone should be recorded

(Students having a bonafide record only should be permitted to appear for the practical examination)

Text Books

1. V.V. Ramanujam, Inorganic Semi Micro Qualitative Analysis, 3rd edition, The National Publishing Company, Chennai, 1974.
2. Vogel's Text Book of Inorganic Qualitative Analysis, 4th edition, ELBS, London, 1974.

Reference Books

- 1.V.K.Ahluwalia, Sunitha Dhingra, Adarsh Gulate College Practical Chemistry, Universities Press (India) Pvt Ltd Reprint 2008.
2. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part III), S. Viswanathan Co. Pvt., 1996.
3. O.P. Pandey, D.N Bajpai, S. Gini, Practical Chemistry, for I, II & III BSc. Students. S.Chand & Company Ltd, Reprint 2009.

SEMESTER V
CORE VII ORGANIC CHEMISTRY II

L	T	P	C
6	0	0	4

Course Objectives

The primary objectives of this course are to

- ✓ Learn about stereochemistry and conformational analysis
- ✓ Study amino acids and carbohydrates
- ✓ Understand aromaticity and study reactions of aromatic compounds
- ✓ Gain Knowledge on Heterocyclic compounds

UNIT I OPTICAL ISOMERISM

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

Symmetry elements - chirality – asymmetric molecules and molecular dissymmetry-pseudo asymmetry.

Optical rotation – specific rotation –optical purity – racemisation (through cationic and anionic and radical intermediates), resolution of acids, bases and alcohols via diastereomeric salt formation.

Optical isomers - enantiomers – diastereomers – epimers - notation of optical isomers - Cahn-Ingold-Prelog rules, R and S notations for optical isomers with one and two asymmetric carbon atoms - erythro and threo representations - D and L representations

Optical activity in compounds without asymmetric carbon atoms namely biphenyls, allenes and spiranes. Stereo selectivity – stereo specificity – partial asymmetric synthesis. point,dipole moment – chemical method – dehydration and cyclisation.

UNIT II GEOMETRICAL ISOMERISM AND CONFORMATIONAL ANALYSIS

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

Stability of geometrical isomers and heats of hydrogenation.

Tautomerism: Keto – enol Tautomerism, Amido – imido Tautomerism, Amino – imino Tautomerism.

Conformational analysis of ethane, propane, n-butane, haloethane, 1,2-dihaloethane, 1,2-glycol and 1,2-halohydrin, cyclopentane. Relative stability of conformers on the basis of steric effect, dipole-dipole interaction, H-bonding.

UNIT III AMINOACIDS AND CARBOHYDRATES

Amino acids - classification, general methods of preparation and reactions of amino acids, zwitter ion - isoelectric point, action of heat.

Classification-Monosaccharides- constitution of glucose and fructose. Reactions of glucose and fructose – Osazone formation, Mutarotation, cyclic structure, pyranose and furanose forms. Epimerisation- Interconversions of aldoses and ketoses.

Disaccharides- sucrose- reactions (elucidation of structure not necessary).

Polysaccharides – starch and cellulose (elucidation of structure not necessary).

UNIT IV AROMATICITY AND AROMATIC SUBSTITUTION

Aromaticity – definition – Huckel's rule– stability, carbon-carbon bond lengths of benzene, resonance energy Benzenoid and Non-benzenoid aromatic compounds

Aromatic electrophilic substitution – Mechanism of nitration, halogenation, sulphonation and Friedel-Crafts reaction. Activating and deactivating substituents, orientation in mono substituted benzenes, ortho/para ratio- Orientation- Korner's absolute method, dipole moment method – direct influence of substituents – rules of orientation - Aromatic Nucleophilic substitutions- unimolecular, bimolecular and benzyne mechanisms

UNIT V HETEROCYCLIC COMPOUNDS

Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Comparison of basicity of pyridine, piperidine and pyrrole.

Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution and nucleophilic substitution reaction in pyridine derivatives.

Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis, mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

Text Books

- 1.K.S. Tewari, N.K. Vishnoi, S.N. Mehrotra. A Text Book of Organic Chemistry, Vikas publishing house (P) Ltd. 2002.
2. Arun Bahl and B. S. Bahl Advanced Organic chemistry, S. Chand and Company Ltd., Reprint 2005

3. P.L. Soni, Text Book of Organic chemistry, Sultans chand, New Delhi, 1991

Reference Books

1. Ernest l. Eliel, Stereochemistry of Organic compounds, Tata McGraw –Hill Publication company Ltd., New Delhi, 1975
2. D. Nasipuri, Stereochemistry of Organic Compounds - Principles and Applications, New Age International Publishers, 1994
3. P. S. Kalsi, Stereochemistry -Conformation and Mechanism, New Age International Publishers, 1994
4. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, PHI Limited, New Delhi, 1992.
5. Bhupinder Mehta, Manju Mehta, Organic chemistry, PHI Learning pvt. Ltd., 2005.

SEMESTER V
CORE VIII PHYSICAL CHEMISTRY II

L	T	P	C
6	0	0	4

Course Objectives

The primary objectives of the course are to

- ✓ Understand the basic concept of thermodynamics
- ✓ Study about I, II, & III laws of thermodynamics and its importance
- ✓ Gain knowledge in Phase and Ionic equilibria
- ✓ Know about conductance and its applications
- ✓ Acquire knowledge in various molecular spectroscopy

UNIT I THERMODYNAMICS I

Extensive and intensive variables, state and path functions, open, closed and isolated systems - Zeroth law of thermodynamics-First law of thermodynamics : Concept of heat, q , work, w , internal energy, U or E , and Statement of first law – Enthalpy, H , relation between heat capacities – Calculation of q , w , U or E , and H for reversible, irreversible and free expansion of ideal gases under isothermal and adiabatic conditions -Joule Thomson effect-Joule-Thomson coefficient and its significance-Derivation of the expression for Joule-Thomson coefficient-Inversion temperature. Heats of reaction: Standard enthalpy – Effect of temperature (Kirchhoff's equation) and pressure on enthalpy of reactions-Hess's Law of constant heat summation and its applications.

UNIT II THERMODYNAMICS II

Second law of thermodynamics: concept of entropy, thermodynamic scale of temperature - Statement of second law of thermodynamics - Entropy changes in reversible and irreversible processes- Calculation of entropy change of an ideal gas with change in P , V and T –Entropy changes of an ideal gas in different processes- Physical significance of entropy. Nernst heat theorem- Statement of Third law of thermodynamics – calculation of residual entropy -Calculation of absolute entropy of molecules. Free energy: Gibb's and Helmholtz free energy- variation of free energy with temperature and pressure- Free energy change and spontaneity -Gibbs-Helmholtz equation. Partial molar properties-Chemical potential- Gibbs-Duhem equation-Variation of chemical potential with temperature and pressure.

UNIT III PHASE AND IONIC EQUILIBRIA

Phase Equilibria

Phase equilibria: concept of phases, components and degrees of freedom – equilibrium conditions – Derivation of Gibbs phase rule - Clapeyron and Clapeyron-Clausius Equation and its applications- Phase diagram for one component system : Water and Sulphur systems- Reduced phase rule-Two component system: Simple eutectic systems-Lead-Silver system, Potassium iodide-Water system- Compound formation: (i) Congruent melting point: Zinc- Magnesium system. (ii) Incongruent melting point: Sodium chloride-water system.

Ionic Equilibria

Acids and Bases - Dissociation of weak acids and weak bases - Dissociation of water. pH scale - Common ion effect - Applications - Buffer solutions - Types of buffer solution- Calculation of pH value of buffer solution - Applications of buffer solution- Solubility product - Applications of solubility product principle.

UNIT IV ELECTRICAL CONDUCTANCE

Arrhenius theory of electrolytic dissociation – Conductivity: equivalent and molar conductivity – and their variation with dilution for weak and strong electrolytes –. Kohlrausch's law and its applications - Ionic mobility-Transport number - Determination of transport number: Hittorf's and Moving boundary methods - Applications of conductance measurements – Determination of degree of dissociation of weak electrolytes - Determination of solubility of sparingly soluble salts - Conductometric titrations - Ostwald's dilution law - Debye-Huckel theory of strong electrolytes – Debye-Huckel Onsager Equation – Debye-Falkenhagen and Wien effects –Debye-Huckel limiting law (elementary idea only).

UNIT - V SPECTROSCOPY- I

Spectroscopy: Definitions – Electromagnetic spectrum-various types of molecular spectra.

Rotational spectroscopy: Microwave active molecules- Moment of inertia- types of molecules- rotational spectra of diatomic molecules - selection rules -intensities of spectral lines- applications- effect of isotopic substitution.

Vibrational spectroscopy : Theory –molecular vibrations-simple harmonic oscillator - selection rule- anharmonicity- fundamental, overtone and combination bands – Fermi resonance – degrees of freedom of polyatomic molecules – modes of vibration – Vibration-Rotation spectroscopy : P,Q & R

branch lines .

Raman spectroscopy: Principle -Rayleigh and Raman scattering - Raman effect – rule of mutual exclusion principle - differences between IR and Raman spectroscopy

Ultraviolet-visible spectroscopy: Theory – Born-Oppenheimer approximation – Franck-Condon Principle– electronic transitions: selection rule.

Text Books

1. Principles of Physical Chemistry – B.R.Puri, L.R. Sharma and M.S.Pathania, 47th Edition, Vishal Publishing Co,2020.
2. Textbook of Physical Chemistry, P.L.Soni- Sultan Chand 23rd edition 2007.
- 3.A textbook of Physical Chemistry - A.S Negi & S.C.Anand, Second Edition, New Age International(P) Limited, Publishers,2022.
4. A Textbook of Physical Chemistry, B.R.Puri, L.R. Sharma and M.S.Pathania, 47th Edition, Vishal Publishing Co,2018.
- 5.Principles and applications of Organic Spectroscopy, W.Kemp 3rd Edition 1993.
- 6.Fundamentals of Molecular Spectroscopy, C.N. Banwell, E.M. McCash, Tata McGraw-Hill Publishing Compoany Limited. NewDelhi, 2003.
- 7.Organic Spectroscopy, Principles and Chemical Applications, Y.R, Sharma,S,Chand & Company Limited, New Delhi,2013.

Reference Books

1. Physical Chemistry, Gordon M Barrow, Fifth Edition, Tata McGraw Hill Education Private Limited,2007.
2. Textbook of Physical Chemistry, M.V.Sangaranarayanan, V Mahadevan, University Press (India Private Limited),2012.
3. Physical Chemistry- Ira.N.Levine, 6th Edition, Tata McGraw Hill Education Private Limited,2011.
4. An Introduction to Electrochemistry, Samuel Glasstone, Read Books Ltd,2011.
5. A Textbook of Physical chemistry Thermodynamics and Chemical Equilibrium, 6th edition, M.C.Graw Hill, K.L.Kapoor, Education, 2019.
6. Thermodynamics for Chemist, S.Glasstone, Reprint 2000.

SEMESTER V
MAJOR ELECTIVE I
POLYMER CHEMISTRY

L	T	P	C
4	0	0	4

Course Objectives

The primary objectives of this course are to

- ✓ Know types of polymer and molecular mass
- ✓ Acquire knowledge about the polymerization techniques.
- ✓ Know the details of organic and inorganic polymers.
- ✓ Understand the processing of polymer and polymer degradation.
- ✓ Familiarize about advances in polymers.

UNIT I INTRODUCTION TO POLYMERS AND MOLECULAR WEIGHT OF POLYMER

Basic concepts – Monomers – Functionality. Classification of polymers and characteristic features of each Natural and Synthetic polymers – Thermoplastic and Thermo-setting Plastic, Elastomers, Fibers and Liquid Resins – Addition and Condensation polymers – Linear, Branched and Cross – linked polymers – Homopolymers and Copolymers – Types of copolymers – Alternate, Graft, Block and Random copolymers. Tacticity in polymers – Isotactic, Syndiotactic and atactic polymers.

Importance of Molecular Weight: Degree of polymerization and molecular weight – Number average, Weight average and Viscosity average molecular weights. Glass transition temperature (T_g) – Definition – Factors affecting T_g – relationship between T_g and molecular weight and melting point. Important of T_g .

UNIT II CHEMISTRY OF POLYMERISATION AND POLYMERISATION TECHNIQUES

Chemistry of Polymerisation: Addition and Condensation polymerisation -Mechanism of polymerization – Free radical and ionic (anionic and cationic) polymerisation- Ring opening polymerization, Coordination polymerization – Zeigler Natta catalysts.

Bulk, solution, suspension, emulsion, melt condensation and interfacial poly-condensation polymerization.

UNIT III ORGANIC AND INORGANIC POLYMERS

Preparation and Applications

Organic Polymers

Plastics : Polyethylene, Polyvinyl chloride, Polymethyl methacrylate, Polyethylene terephthalate, Teflon, Bakelite

Rubbers : Natural and synthetic rubbers – Polybutadiene, Polyisobutylene, Butyl rubber, Nitrile rubber, Buna – S, Buna-N, Neoprene rubber.

Synthetic fibers : Nylon 6,6, Nylon 6, Rayon.

Inorganic Polymers : Poly(sulphur nitride) (SN)_x, Borazine, Poly(boron nitride), Polyphosphazenes, Silicones.

UNIT IV POLYMER PROCESSING AND POLYMER DEGRADATION

Polymer Processing: Basic principles of processing – Shape and Size – Processing parameters – Polymer compounding – Additives – Fillers – Plasticizers – Antioxidants – Flame retardants – Stabilizers – Colourants .

Processing techniques : Injection moulding – Compression moulding – Blow moulding – Extrusion moulding – Calendaring – Casting – Roaming – Laminating – Coating.

Polymer Degradation – Types of degradation – Thermal degradation – Mechanical degradation. Ultrasonic degradation. Photo degradation – Oxidation degradation – Hydrolytic degradation.

UNIT V SPECIAL TOPICS IN POLYMER SCIENCE

Conducting Polymers: Definition, Types of conducting polymer- Mechanism of electrical conduction – Soliton- Polaron and Bipolaron- Polyacetylene – Polyaniline- Polyaniline nanowire.

Biopolymers: Biomedical polymers – Contact lens – Dental polymers – Polymers used in Artificial Heart, Kidney, Skin, and Blood cells.

Plastic Waste Management – Chemical recycling – Incineration – Pyrolysis – Mixed waste recycling – Types of recycling (1⁰, 2⁰, 3⁰ and quaternary) development for recycled material

Text books

1. V.R. Gowarikar, N.V. Viswanathan and J. Sreedhar. Polymer science, Wiley Eastern, 1995.
2. F.N. Billmeyer, Text book of polymer science, Wiley Interscience, 1971.
3. Mcurie Morten, Rubber technology, Van Nostrand, Reinold, Newyork
4. B.K. Sharma, Polymer Chemistry, Goel Publishing Home, Meerut, 2011.
5. Nabil Mustafa – “Plastic waste management” Marcel Dekker Inc – 1993.
6. Material Science 2nd edition , P.K. Palanisamy SCITECH Publications India Pvt. Limited Chennai 1st reprint , March 2005

Reference Books

1. M. Jenkins, Biomedical polymers, University Birningham, U.K, Woodhead Publishing 2007
2. M.G. Arora, M.Singh and M.S Yadew, Polymer chemistry, 2nd Revised edition, Anmol Publications Ltd 2003.
3. Principles of Polymer Science, P.Bahadur, N.V.Sastry, Narosa Publications 2002.
4. Physical chemistry polymers – A. Tager, Miv Publishers 1972.
5. Polymer chemistry – Properties and applications, Andrew Peacock, Allidon Calhoun, Hanser Publishers, Munich 2006
6. Mordern Chemistry , David,W.Oxtoy, H.P.Gills,Allan Campion Brooks Cenage .Learning India Private Limited, 1st reprint ,March 2008

SEMESTER V
MAJOR ELECTIVE I
BIO CHEMISTRY

L	T	P	C
4	0	0	4

Course Objectives

The primary objectives of this course are to

1. Get knowledge about amino acids and protein
2. Study about carbohydrates
3. Know the lipids and its significance
4. Understand basics of enzymes and its catalytic activity
5. Acquire knowledge on nucleic acids and significance of blood.

UNIT I AMINO ACIDS AND PROTEINS

Living Cell: Plant and Animal Cells: Cell Membrane- Organells- Functions of major Cellular components- Anabolism and Catabolism and their relation to Metabolism

Amino acids :Classification- Abbreviated names (one letter- three letter)- Physical properties- Optical properties- Chemical Properties.

Peptides: Nomenclature- Properties of Peptide bond - Solid phase peptide Synthesis.

Proteins: Synthesis – Classification – properties - Structure of protein - Primary, Secondary, Tertiary and Quarternary structure- N-terminal and C-terminal aminoacid Structure analysis . Sequencing techniques- Edman degradation.

Catabolism of aminoacids: Transamination- Oxidative deamination- Urea cycle .

UNIT II CARBOHYDRATES AND METABOLISM

Monosacharides - Structure of aldoses and ketoses: Ring structure of sugars - Conformation of sugars- Mutarotation- Anomers- Epimers and Enantiomers; Structure of biologically important sugar derivatives - Oxidation and Reduction of sugars;

Disacharides and Polysaccharides: Formation of disaccharides- Reducing and Non-reducing

disaccharides - Polysaccharides: Homo polysaccharides (Starch- Cellulose- Glycogen)- Hetero polysaccharides (Mucopolysaccharides- Hyaluronic acid- chondroitin sulphate- Heparin)

Carbohydrate metabolism: Embden Meyerhof pathway- Citric acid cycle.

UNIT III LIPIDS

Definition and classification of lipids- Classification of Fatty acids – Glycerids - Physical and Chemical properties - Analysis of Oils and Fats (Saponification number, Iodine number, Polenske number, Richert –Meissel number, Acetyl value).

Phospholipids- Glycerophospholipids: Lecithin- Cephalin- Phosphatidylserine- Phosphatidylinositol- Plasmalogens.

Sphingophospholipid: Sphingomyelin- Glycolipid-Cholesterol and Bile acids (structural elucidation not required).

UNIT IV ENZYMES

Classification and Nomenclature of enzymes - General Characteristics of enzymes - Nature of enzymes – Protein and Non-protein- Cofactor and Prosthetic group, Apoenzyme, Holoenzyme - TPP, NAD, NADP, FAD, FADH₂, ATP and their importance in enzyme actions.

Enzyme activity and specific activity- Features of enzyme catalysis, Factors affecting the rate of chemical reaction- Catalytic power and specificity of enzymes (concept of active sites) , Fischer lock and key model , Koshland's induced fit model.

UNIT V NUCLEIC ACIDS AND CLINICAL CHEMISTRY

Nucleic Acid: RNA-DNA- Nucleosides & Nucleotides – Structure of DNA and RNA – Ribosomal RNA (r-RNA) - Transfer RNA (t-RNA) – Messenger RNA (m-RNA)

Blood & Analysis of Blood : Components of blood and their functions- Difference between plasma and serum- **Blood groups :** Rh factors – Blood analysis: Fasting blood sugar, Random blood sugar, Post prandial blood sugar – HbA_{1c} – Albumin – Urea - **Cholesterol:** HDL & LDL.

Text Books

1. Fundamentals of Biochemistry by J.L. Jain, Sanju Jain & Nitin Jain Publishers Chand and Co Ltd, ISBN 81-219-2453-7, 2008
2. Lehninger: Principles of Biochemistry 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and company (New York), ISBN: 978-1-4641-0962-1, ISBN : 10: 1-4292-3414-8., 2013.
3. Textbook of Biochemistry with clinical correlations, 7th ed., T.M. Devlin, John Wiley & Sons, Inc (New York), ISBN: 978-0-470-28173-4, 2011.

4. Robert L.Caret, Katherine J.Dennistom Joseph J. Topping, Principles and application of organic and biological chemistry,WBB Publishers, USA, 1993.

Reference Books

1. Principles of protein structure, G.E. Schulz, and R.H. Schirmer. Springer, 1st edition 1996.
2. Medical Laboratory Technology, Volume I, Kanai, L. Mukorjee, CBS Publishers,2002.
3. Medical Laboratory Technology- Ramnik sood, , JPB Publishers,2009
4. J.L.Jain, Biochemistry, Sultan Chand and Co. 1999
5. A.Mazur amd B. Harrow, Textbook of biochemistry, 10th edition W.B. Saunders Co., Philadepia, 1971.
6. Paula Yurkanis Bruice, Organic Chemistry, 3rd edition, Pearson education, Inc.(Singapore), NewDelhi, reprint, 2002.
7. P.W. Kuchel and G.B. Ralston, Shaum series. Theory and Problems of Biochemistry , Mc Graw- hill Nool company, Newyork 1988.

SEMESTER V
MAJOR ELECTIVE II
MORDERN INSTRUMENTAL ANALYTICAL TECHNIQUES

L	T	P	C
4	0	0	4

Course Objectives

The main objectives of this course are

1. Understand the Principles of chromatography and its practical applications.
2. Study various thermo analytical techniques.
3. Acquire knowledge in electro analytical techniques.
4. Gain the knowledge on the basis of spectrophotometry and analytical applications.
5. Study on radio analytical techniques.

UNIT I CHROMATOGRAPHY

Chromatography- Classification-Principles of adsorption- adsorbents.

Thinlayer Chromatography-Choice of adsorbents and solvents- Preparation- R_f values

Paper Chromatography- Principle-Solvent used –Factors affecting R_f values

Applications of Thinlayer and Paper Chromatography.

Ion-Exchange Chromatography-Principle –Type of resins- Requirements of good resin-Action of resins-Experimental techniques and applications.

Gas Chromatography : Principle –Experimental techniques and applications

High Performance Liquid Chromatography: Principle - Instrumentation-Applications.

UNIT II THERMOANALYTICAL METHODS

Thermogravimetric Analysis(TGA): Principle, Instrumentation-Working-Function of each component, Applications of TGA, Study of Oxalates, Sulphates and Nitrates by TGA .

Differential Thermal Analysis(DTA): Principle- Instrumentation- Methodology-Applications, DTA of Calcium Oxalate Monohydrate and Manganese Phosphine Monohydrates.

Differential Scanning Calorimetry (DSC): Principle –Instrumentation - Methodology-Applications- Determination of glass transition temperature(T_g).

Thermometric Titrations: Principle-Experimental Techniques- Types of Thermometric reaction and Applications.

UNIT III ELECTRO ANALYTICAL TECHNIQUES

Introduction to electroanalytical techniques – types of electroanalytical techniques.

Electrogravimetry – Principle of electrogravimetric analysis –Determination of copper – Electrolytic separation of copper and nickel.

Coulometry Analysis : Principle of coulometric analysis-Coulometric Titrations-Applications

Voltametry : Polarography-Principle-Experimental assembly-Importance of polarographic curves-Applications to qualitative and quantitative analysis.

Amperometric titrations: Principles and applications

Cyclic Voltametry : Principles and applications.

UNIT IV SPECTROPHOTOMETRY

UV-Visible spectrophotometry: Beer-Lamberts law, Instrumentation-Applications.

Fluorometry: Principles – Instrumentation –Applications.

Flame Photometry: Theory- Instrumentation and Applications.

Atomic Absorption Spectrometry: Theory – Instrumentation and Applications.

Turbidimetry and Nephelometry: Principle- Instrumentation and Applications.

UNIT V RADIOANALYTICAL METHODS

Radio active nuclides, Instrumentation, measurement of α , β & γ radiations.

Radio tracers and Tracer techniques-Application of tracer techniques

Neutron activation analysis: Neutron sources, Interaction of neutrons with matter. Theory of activation methods, Experimental considerations, Non-destructive and destructive methods, Applications.

Isotopic dilution Analysis-Principle –Theory and Applications

Radiometric Titrations: Principle- Procedure, Advantages and Disadvantages, Applications to various types of titrations. Application of radiochemical methods in Biology, Agriculture and Environment.

Text Books

1. Fundamentals of Analytical Chemistry, Skoog, West and Hollers, Saunders college, publishing, edition, 6th 1991, VII edition, 1996.
2. Vogel's, Text book of Quantitative Chemical Analysis – A.I. Vogel, Pearson Education Ltd, 6th edition, 2001.
3. Hand book of Instrumental Techniques for Analytical Chemistry – F. Settle, Printice Hall Inc., 1997.
4. Radioanalytical Chemistry 2007, B. Khan, Springer, 220-231, New York, 2007

Reference Books

1. Analytical Methods, R. Gopalan and K.S. Visvanathan, University Press, I edition, 2018.
2. Quantitative Chemical Analysis, D.C. Harris, W.H. Freeman Publication, IV edition, 1995.
3. W. D. Ehmann, D. E. Vance, D. Radio Chemistry and Nuclear Methods of Analysis 1st edition, Wiley-Inter Science, US 1991
4. Analytical Chemistry – Gray D. Christian, John Wiley & Sons, INC, 5th edition, 2001.

SEMESTER V
MAJOR ELECTIVE II
APPLIED CHEMISTRY

L	T	P	C
4	0	0	4

Course Objectives

The Primary objectives of this course are to

1. Gain knowledge on fuels.
2. Study about industrially important compounds.
3. Acquire knowledge about basic needs of Agriculture developments.
4. Learn the substances useful for human life.
5. Study on Match and Silicate Industries.

UNIT I FUEL CHEMISTRY

Fuels- Definition-Classification – Combustion and Chemical Principles - Calorific value- Characteristics of a good fuel.

Solid fuel: Coal – Types – Gross and Net calorific values- Proximate and Ultimate analysis of coal – High and low temperature of carbonization – Uses.

Liquid fuels : Petroleum and its Chemical Composition- Cracking of heavy oil residues- Thermal and catalytic cracking, Knocking, Anti-knock and Chemical structure, Octane and Cetane numbers – Significance - Petroleum products and their applications.

Gaseous fuels: Preparation and Specific uses of Producer gas, Water gas. LPG and Gobar gas. Advantages and Disadvantages of Solid, Liquid and Gaseous fuels.

Rocket fuels- Classification of Solid Propellants, Liquid Propellants- Combustion -Spontaneous ignition temperature(SIT) - Combustion calculation.

UNIT II : PAINTS, LUBRICANTS, ADHESIVES AND PIGMENTS

Paints : Classification- Primary constituents, Manufacturing of paints, Emulsion paint- Constituent and advantages-Latex paints and Fire retardant paints, Solvents and Thinners.

Lubricants: Functions of lubricants-Properties and Classifications -Additives for lubricating oil, Lubricants of mineral origin. Lubricating grease and Solid lubricants.

Adhesives: Classification and preparation of adhesives. Synthetic resin adhesives and Rubber based adhesives –Uses of adhesives.

Pigments: Characteristics and uses of TiO_2 , Ultramarine Blue and Red lead.

UNIT III AGRICULTURAL CHEMISTRY

Fertilizers: Raw material, manufacture (flow chart)- Chemical process (with equation) of ammonium nitrate, ammonium sulphate, urea, ammonium phosphate, super phosphate, triple super phosphate, NPK fertilizers.

Pesticides: Classification of pesticides, examples.

Insecticides: Stomach poisons, Contact insecticides, Fumigants, Manufacture and uses of Insecticides: DDT, BHC, Pyrethrin, Aldrin and Pentachlorophenol.

Fungicides: Bordeaux mixture, Lime sulphur, Creosote oil.

UNIT IV OILS, SOAPS AND DETERGENTS

Oils: Definition : Fats and Oils- Constituents- Sources-Difference between oils and fats, Manufacture of Cotton seed oil, Sunflower oil and Soyabean oil.

Soaps : Definition, Manufacture of soaps- Types of soaps -Specific uses.

Detergents: Difference between soaps detergents, Synthetic detergents- Surface active agents and their classification- Anionic, Cationic and Non –ionic detergents – Applications including cleaning action.

UNIT V MATCH AND SILICATE INDUSTRIES

Match Industry

Types of Matches- Composition of match head and strikening surface- Manufacture of safety matches- Coloured matches- Pyrotechniques and explosives, Classification of good explosives TNT, RDX ,Gun powder, Ammonium nitrate.

Silicate industry

Cement :Types of cements, composition , manufacture of Portland cement and Setting of cement.

Ceramics: Introduction, Types, Manufacture, and Applications, Refractory materials.

Glass :Definition, Composition, Types, Manufacturing of glass products, Physical and Chemical properties, Applications.

T

ext Books

1. B.K. Sharma, Industrial Chemistry, Goel Publishing House, Meerut, 2003.
2. James A. Kent, Riegel's Hand book of Industrial Chemistry, Springer Science, 2013.

Reference Books

1. C.E. Dryden, Outlines Chemical Technology, Gopala Rao, East west Press, New Delhi
2. S . Johnson, N .Saikia, Fatty acids Profile of edible oils and fats in India, Centre for Science and Environment, New Delhi, India.

SEMESTER V
MAJOR PRACTICAL V
ORGANIC ANALYSIS & PHYSICAL CONSTANT DETERMINATION

L	T	P	C
0	0	4	2

Course Objectives

- ❖ To enable the students to understand the various procedures in organic analysis
- ❖ To create an awareness on microscale experiments in organic chemistry practicals

To determine physical constants of organic liquid & solid substances

I Organic analysis

Qualitative analysis of the given organic compound

- a. Test for aliphatic and aromatic nature of substances
- b. Test for saturation and unsaturation
- c. Identification of functional groups (carboxylic acids, phenols, aldehydes, ketones, esters, amines, amides, anilides, nitrocompounds and carbohydrates)
- d. Preparation of solid derivative to confirm the presence of functional group

II Physical constant determination

- (i) Determination of boiling point of organic liquid substances.
- (ii) Determination of melting point of organic substances.

Internal – 50 marks

25 marks - Regularity

25 marks – Average of best five experiments of organic analysis & three physical constants determination in regular class work

External -50 marks

10 marks – Record (atleast five experiments in organic analysis & three physical constants determination)*

10 marks – procedure for any two functional groups asked by the examiner

25 marks – Analysis

5 marks – Physical constant determination

*Experiments done in the class alone should be recorded

(Students having a bonafide record only should be permitted to appear for the practical examination)

Text Books

- 1.N.S. Gnanapragasam and G. Ramamurthy, Organic Chemistry – Lab manual, S. Viswanathan Co. Pvt., 1998.
2. J.N. Gurthu and R. Kapoor, Advanced Experimental Chemistry (Organic), S. Chand and Co., 1987.
3. B.S. Furniss, A.J. Hannaford, P.W. G. Smith and A.R. Tatchell, Vogel's Text Book of Practical Organic Chemistry. 5th Edn., Pearson Education, 2005.

Reference Books

- 1.Sundaram, Krishnan, Raghavan, Practical Chemistry (Part III), S. Viswanathan Co. Pvt., 1996.
3. P.R.Singh, D.C.Gupta, K.S.Bajpal Experimental Organic Chemistry Vol.I and II, 1980.

SEMESTER V

MAJOR PRACTICAL VI

GRAVIMETRIC ESTIMATION & INORGANIC PREPARATION

L	T	P	C
0	0	4	2

Course Objectives

- ✓ To enable the students to understand the various techniques in gravimetric estimations
- ✓ To make the students thorough in preparations of inorganic compounds

I. Gravimetric Estimation

1. Estimation of lead as lead chromate
2. Estimation of barium as barium chromate
3. Estimation of nickel as nickel dimethylglyoximate
4. Estimation of zinc as zinc oxinate
5. Estimation of copper as copper thiocyanate

II, Inorganic preparation

1. Preparation of potash alum
2. Preparation of chrome alum
3. Preparation of Prussian blue
4. Preparation of sodium ferrioxalate
5. Preparation of tetramminecopper(II) sulphate
6. Preparation of trithioureacopper(I)chloridedihydrate
7. Preparation of potassiumtrioxalatoferrate(III)
8. Preparation of hexathiourea lead(II) nitrate

Internal – 50 marks

25 marks - Regularity

25 marks – Average of best (estimation-3 and preparation-3) six experiments in regular class work

External -50 marks

10 marks – Record (atleast 3 estimations and 4 preparations)*

10 marks – Procedure

30 marks – Result (Estimation -20 and preparation-10)

*Experiments done in the class alone should be recorded

(Students having a bonafide record only should be permitted to appear for the practical examination)

Text Books

1. Vogel's Text Book of Quantitative Chemical Analysis. 5th Edition., ELBS/Longman England, 1989
2. V.K.Ahluwalia, Sunitha Dhingra, Adarsh Gulate College Practical Chemistry, Universities Press (India) Pvt Ltd Reprint 2008.
3. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part III), S. Viswanathan Co. Pvt., 1996.

Reference Books

1. P.R.Singh, D.C.Gupta, K.S.Bajpal Experimental Organic Chemistry Vol.I and II, 1980.
2. O.P. Pandey, D.N Bajpai, S. Gini, Practical Chemistry, for I, II & III BSc. Students. S. Chand &Company Ltd, Reprint 2009

SEMESTER VI
CORE IX INORGANIC CHEMISTRY III

L	T	P	C
5	0	0	4

Course Objectives

The main objectives of this course are due to

- ❖ Study on nomenclature and theories of coordination compounds.
- ❖ Gain knowledge on stability and mechanisms of substitution reactions of complexes.
- ❖ Know various organometallic compounds and its uses.
- ❖ Study the application of spectra to metal complexes.
- ❖ Understand the metal ions and its compounds to biological system.

UNIT I NOMENCLATURE AND THEORIES OF COORDINATION COMPOUNDS

IUPAC Nomenclature-Bonding theories- Valence bond theory- geometry of coordination number 4 and 6 and its limitation, Crystal field theory-Splitting of d-orbitals in octahedral, tetrahedral and square planar complexes-low spin and high spin complexes-Factors affecting crystal field splitting energy-merits and demerits of CFT –Applications of CFT- - Colour and spectra of complexes- Magnetic properties of metal complexes. Isomerism in Coordination compounds-Structural isomerism and stereo isomerism, stereochemistry of complexes with 4 and 6 coordination numbers.

UNIT II STABILITY AND REACTION MECHANISM OF COMPLEXES

Stability of metal complexes-Stability constants- Labile and inert complexes-Thermo and kinetic stability - Factors affecting the stability of complexes -Substitution reactions and Mechanism of Octahedral complexes: aquation, base hydrolysis and anation reactions - Substitution in square planar complexes -Trans effect –Theories of Trans effect - Redox reaction: Inner and outer Sphere electron transfer reactions. Preparation and uses of Prussian blue, Turnbull's blue, Sodium nitroprusside and Nickel DMG complex.

UNIT III ORGANOMETALLIC COMPOUNDS

Definition-Classification based on the nature of metal-carbon bond and the basics of hapticity-Nomenclature of organometallic compounds. The 18e⁻ rule and stability - Ferrocene: Preparation and properties – Metal - alkene complexes : Zeise's Salt – Catalytic properties of organometallic compound :

Wilkinson's Catalyst in hydrogenation of alkene – Insertion reaction: Hydroformylation - Zeigler Natta catalyst in the polymerization of alkene

Metal carbonyls: Definition- Classification - EAN rule- Preparation and properties of Mononuclear carbonyls-Structure of Mo(CO)_6 , Fe(CO)_5 , Ni(CO)_4 –Polynuclear carbonyls, bridged carbonyls and bonding in Carbonyls- $\text{Mn}_2(\text{CO})_{10}$, $\text{Co}_2(\text{CO})_8$, $\text{Fe}_2(\text{CO})_9$, $\text{Fe}_3(\text{CO})_{12}$.

UNIT IV APPLICATION OF SPECTROSCOPY TO TRANSITION METAL COMPLEXES

Electronic spectroscopy: Term symbols- Selection rules –Orbital Selection rule-Spin Selection rule- Metal centered transitions – Charge transfer transitions – MLCT and LMCT - Jahn Teller Distortion- Effect of Jahn-Teller Distortion on electronic spectra of $[\text{Cr(H}_2\text{O)}_6]^{2+}$ and $[\text{Fe(H}_2\text{O)}_6]^{2+}$

Electron spin resonance spectroscopy: Basic principle - g-value - Hyperfine splitting– Kramer's degeneracy & Zero-field splitting .

Mossbauer spectroscopy: Principles - Isomer shift - Quadrupole splitting- Selection rule – MB spectrum of $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$, FeCl_3 , $[\text{K}_4\text{Fe(CN)}_6]$, $[\text{K}_4\text{Fe(CN)}_6]$.

UNIT V BIO INORGANIC CHEMISTRY

Metal ions present in biological system- Essential and trace elements in biological system- Structure and functions of Haemoglobin, Myoglobin and Vitamin B_{12} . Electron carriers : Iron sulphur proteins, Chlorophyll and photosynthesis. Role of alkali and alkaline earth metals in biological system: Na/K pump, Importance of Ca & Mg. Biological functions and toxicity of metals-Fe, Cu, Zn, Cr, Mn, Ni, Co, Cd, Hg and Pb. Applications of Therapeutic chelating drugs: Cis-Platin, carboplatin, platinum anticancer drugs.

Text Books

1. J.D. Lee Concise Inorganic Chemistry 5th Edition Blackwell Science Ltd, 2008.
2. J.E. Huheey, and A. Ellen Keiter, L. Richard Keiter, Inorganic Chemistry, 4th edition, Pearson Education Pvt Ltd. Harper Collens College publishers, Singapore, 2004.
3. W.U. Malik, G.D. Tuli, R.D. Madan, Selected Topics in Inorganic Chemistry 7th Edition, S. Chand and Company Ltd, New Delhi, Reprint 2006.
4. Physical Methods for Chemists, Russel S. Drago, 2nd Edition, Saunders College Publishing, 1992.

Reference Books

1. F.A. Albert Cotton, Advanced Inorganic Chemistry, Geoffrey Wilkinson, Carlos, Murillo, Manfred Bochman, John- Wiley & Sons, New York, 1998.

2. Fred Basalo and Ralph G. Pearson, Mechanism of Inorganic Reactions: A study of metal complexes in solution, 2nd Edition, John Wiley and Sons, Inc.
3. I. Bertini, H.B. Gray, S.J. Lippard, Joan Selverstone Valentine, Bioinorganic chemistry I edition, Viva Books, Pvt. Ltd, 1998.

SEMESTER VI
CORE X ORGANIC CHEMISTRY III

L	T	P	C
5	0	0	4

Course Objectives

The primary objectives of this course are to

1. Study about the aromatic alcohols, aldehydes, Ketones and Acids.
2. Gain Knowledge on rearrangements.
3. Know the aromatic hydrocarbons and dyes.
4. Acquire knowledge on natural Products.
5. Study on UV, IR &NMR spectra of organic compounds.

UNIT I PHENOLS, AROMATIC ALDEHYDE, KETONE AND ACIDS

Phenols

Acidic character of phenols- effect of substituents on acidity of phenols - Mechanisms of Kolbe's reaction and Rieme-Tiemen reaction. Preparation of cresols, catechol, resorcinol, quinol and euginol.

Aldehydes and Ketones

Preparation and uses of cinnamaldehyde. Coumarin, vanillin, Michler's ketone, p-benzoquinone-Quinone mono oxime tautomerism. Mechanism of Cannizaro reaction, benzoin condensation, Perkin reaction, Claisen reaction, Knoevenagel reaction, Gattermann aldehyde synthesis and Houben-Hoesch synthesis.

Aromatic acids

Ortho effect on acidity - preparation of mandelic acid, cinnamic acid and anthranilic acid. Preparation and uses of benzene-1,2- dicarboxylic acid, benzene-1,3- dicarboxylic acid and 1,4-dicarboxylic acid.

UNIT II REARRANGEMENT

Rearrangement to electron-deficient carbon – 1,2 shift (Wagner-Meerwein rearrangement, pinacol-pinacolone rearrangement,

Aromatic rearrangements from oxygen to ring carbon (Fries rearrangement, Claisen rearrangement and benzidine rearrangement).

Rearrangement to electron-deficient nitrogen (Beckmann rearrangement, Schmidt

rearrangement, Hofmann rearrangement, Curtius rearrangement).

Rearrangement to electron-deficient oxygen (Baeyer-Villiger oxidation, rearrangement, Dakin reaction).

UNIT III POLYNUCLEAR HYDROCARBONS AND DYES

Synthesis, reactions & Structure of Naphthalene & Anthracene

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

UNIT IV ALKALOIDS AND TERPENOIDS

Alkaloids: Introduction, classification and general methods for the determination of structure.

Structural elucidation and synthesis of conine, piperine and nicotine Terpenes and terpenoids - classification - isoprene rule. Elucidation of structure and synthesis of citral, limonene, menthol, α -terpineol and camphor.

UNIT V ORGANIC SPECTROSCOPY

UV spectroscopy - chromophore – auxochrome – blue shift, red shift –hypochromic shift, hyperchromic shift – applications for studying functional groups, cis-trans isomerism and nature of double bonds- Woodward-Fischer rules as applied to conjugated dienes and α , β unsaturated ketones.

IR spectroscopy – characteristics of IR absorption frequencies – intermolecular and intramolecular hydrogen bonding – functional group detection.

NMR Spectroscopy - interpretation of NMR spectra of simple organic compounds such as acetone, anisole, benzaldehyde, isobutene, mesitylene, 1-chloropropane, ethyl methyl ketone, benzyl alcohol, and propionic acid.

Text Books

1. K.S. Tewari, N.K. Vishnoi, S.N. Mehrotra. A Text Book of Organic Chemistry, Vikas publishing house (P) Ltd. 2002.
2. Arun Bahl and B. S. Bahl Advanced Organic chemistry, S. Chand and Company Ltd., Reprint 2005.
3. P.L. Soni, Text Book of Organic chemistry, Sultans chand, New Delhi, 1991.

4. M.K.Jain and S.C.Sharma , Modern Organic chemistry, Vishal Publishing Company, 2008.
5. N.Tewari, Advance Organic Reaction mechanism ,Books and allied (P) Ltd,India
2nd
revised edition,Kolkata 2005.
6. Organic Reaction Mechanisms, V. K. Ahluwalia and Rakesh Kumar Parashar,
Narosa Publishing House, NewDelhi 2011.
7. Gurdeep Chatwal, Chemistry of Organic Natural Products, Vol 1 and 2, Goel Pub. House,2002.
- 8, Y.R. Sharma, O.P.Vig, Elementary organic absorption spectroscopy – 1st edition, Goel Pulishers,
Meerut
1997.

Reference Books

1. I. L Finar Organic Chemistry Volume II, Stereochemistry and the Chemistry of
Natural
Products, 5th Edition, Reprint,1986.
2. Jerry March, Advanced Organic Chemistry, Reactions Mechanisms and Structure, 4th Edition,2013.
- 3 . P.S. Kalsi, Spectroscopy of Organic compounds, IV Edition, New AgeInternational(P) Ltd., New
Delhi,
1999.
4. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, PHI Limited, New Delhi, 1992.
5. C.N.Banwell, Fundamentals of Molecular Spectroscopy, McGraw Hill, Fourth
Edition,
2003.
6. Robert. M. Silverstein, G.Clayton Bassler, Terrence .C. Morrill, . Spectroscopic
Identification of Organic Compounds John Wiley and Sons, Inc., Newyork,1974.
7. Jag Mohan, Organic Spectroscopy- Principles and Applications, 2nd Edition, Alpha
Science International Limited, Harrow, U.K.,2000.

SEMESTER VI
CORE XI PHYSICAL CHEMISTRY III

L	T	P	C
5	0	0	4

Course Objectives

The main objective of this course are due to

1. Study on EMF and its applications.
2. Understand the Chemical equilibrium and Interface chemistry.
3. Gain Knowledge on rate of the reaction.
4. Understand the basics of Group theory
5. Acquire knowledge in NMR, ESR and NQR Spectroscopy

UNIT I ELECTROMOTIVE FORCE OF CHEMICAL CELLS

Galvanic cells - Reversible and Irreversible cells - EMF of cells and its measurement - Types of reversible single electrodes - Standard Hydrogen electrode - Calomel electrode - Nernst equation - Standard reduction potentials - Electro chemical series - Significance. - Concentration cells-Electrode concentration cells-Electrolyte concentration cells-Concentration cells with and without transference, liquid junction potential -Application of EMF measurements : Determination of (i) free energy, entropy, enthalpy of a cell reaction, (ii) equilibrium constants and (iii) pH using hydrogen and glass electrodes - Potentiometric titrations – Amperometric titrations-Fuel cells - Hydrogen-oxygen fuel cell.

UNIT II CHEMICAL EQUILIBRIUM AND INTERFACE CHEMISTRY

Chemical equilibrium

Standard free energy change - Law of Mass Action – Various equilibrium constants-Relationship between K_p , K_c and K_x – Van't Hoff reaction Isotherm and Isochore -Le Chatelier's Principle - Applications – Linear free energy Relationships: Hammett equation – Substituent constant(σ) – Reaction constant(ρ) – Applications.

Interface chemistry

Adsorption- Types of adsorption- adsorption of gases by solids- adsorption isotherms- Freundlich adsorption isotherm- Langmuir isotherm- BET adsorption isotherm equation- applications of adsorption- determination of surface area- adsorption indicators.

UNIT III CHEMICAL KINETICS

Rate of reaction-Expressing reaction rates-Factors influencing rates of reactions - order and molecularity

of reactions - Setting up and solving simple differential equation for first order, second order, third order and zero order reactions. Characteristics of I, II, III and zero order reactions. Determination of order of reactions - Effect of temperature on rate constant - Arrhenius equation - determination of Arrhenius frequency factor and energy of activation. Theory of Reaction rates - Lindemann theory of unimolecular reactions - The collision theory of reaction rates and its limitation - The theory of Absolute Reactions Rates - Kinetics of fast reactions - Rate constants of fast reactions.

UNIT IV GROUP THEORY

Concept of symmetry in chemistry - symmetry operations and symmetry elements - rotational axis of symmetry and types of rotational axes - improper rotational axis of symmetry - planes of symmetry and types of planes - identity element - groups and their basic properties –Abelian and cyclic groups - classification of molecules into point groups - Symmetry operations of a molecule to form a group – matrix representations of symmetry operations-derivation of point groups of H₂O, NH₃ and BF₃ molecules - group multiplication tables.

UNIT V SPECTROSCOPY II

Nuclear Magnetic Resonance (NMR) spectroscopy: Theory of NMR- spin-relaxation process - chemical shift - δ and τ scale-internal standards-factors influencing chemical shift - spin-spin coupling- coupling constants - applications of NMR . ¹³C NMR : Principle of ¹³C NMR and its applications

Electron Spin Resonance (ESR) spectroscopy: Principle – g value – Hyperfine splitting- ESR spectrum for Hydrogen, Deuterium, methyl, 1,4-semibenzoquinone and benzene anion radicals.

Nuclear Quadrupole Resonance (NQR) spectroscopy: Principle- Electric field gradient- Quadrupole splitting- Applications of NQR spectroscopy.

Text books

1. B.R. Puri, L.R. Sharma & M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., Jalandhar, 2004
2. P.L. Soni, O.P. Dharmarha & U.N. Dash, Text book of Physical Chemistry, 23rd Edition., Sultan Chand & Sons, New Delhi, 2007.
3. Essentials of Physical Chemistry, B.S. Bahl, Arun Bahl, G.D. Tuli, S. Chand & Company Ltd., New Delhi- Reprint, 2006.
4. Physical Chemistry volumes I & II- S. Pahari, New Central Book Agency, Kolkata, 2004.

Reference Books

1. Physical Chemistry-G.M.Barrow, Tata McGraw Hill Publishing Company, New Delhi-2005.
2. Physical Chemistry-G.K.Vemulapalli, Prentice Hall of India, 2004.
3. Group theory and its Chemical Applications - P.K.Bhattacharya - Himalaya publishing House
4. Principles and applications of Organic Spectroscopy, W.Kemp 3rd Edition 1993.
5. Principles and applications of Organic Spectroscopy, Jag Mohan 2nd edition, Alpha Science and International Limited Harrow UK 2000
6. Fundamentals of Molecular Spectroscopy, C.N. Banwell, E.M. McCash, Tata McGraw-Hill Publishing Company Limited. New Delhi, 2003.
7. Organic Spectroscopy, Principles and Chemical Applications, Y.R, Sharma, S, Chand & Company Limited, New Delhi, 2013.

SEMESTER VI
MAJOR ELECTIVE III
TEXTILE CHEMISTRY

L	T	P	C
4	0	0	4

Course Objectives:

The primary objective of the courses are to

1. Learn types of fibres and removal of impurities in fibres
2. Know briefly about natural and manmade fibres
3. Study on Dyeing and printing fibres

UNIT I TEXTILE FIBERS

Introduction to textiles and essential requirements of textile fibres – Classification of textile fibres – Natural and Man-made fibres – Characteristics of textile fibres. Advantages and Disadvantages of natural and man-made fibres.

Impurities in fibres – General principle of removal of impurities in fibres – singeing – Scouring – Bleaching – Desizing – Kierboiling – Chemicking – Degumming.

Flow charts showing the process involved in textile industry.

UNIT II NATURAL FIBRES

Natural fibres – Types of natural fibres – Natural Cellulosic fibres : Cotton and Jute – Natural protein fibres : Wool and Silk.

Cellulosic fibres : Cotton fibres – Geographical distribution, Structure, Physical and Chemical properties, Grading of cotton fibres -Uses of cotton.

Protein fibres: Silk fibre –Study of life cycle of silkworm – Extraction of silk fibre – Properties of silk fibre – Special features of silk fibre - Uses of silk– Wool- origin , different types of wool properties wool – Process involved in the removal of impurities from raw wool- Uses of wool.

Bast and leaf fibres – Types of bast fibres : Sisal and Ramie – Geographical distribution – Extraction – Properties of major bast fibres – Uses- Introduction to Coir , Hemp and Banana fibres.

UNIT III MAN-MADE FIBRES

Man-made fibres : General principle of manufacturing of Man-made fibres – Types of Man-made fibres –

comparison of Man-made fibres with natural fibres.

Regenerated fibres – Cellulosic fibres (Rayon and Acetate fibres) – Protein fibres (Azlons) – Production – Properties and Uses

Synthetic fibres – Poly amide fibres (nylons) – Polyester fibres –Polynosic fibres, Polyacrylic fibres – PolyUrethane – Polypropylene- polyolefins -Important Physical and Chemical properties and applications.

UNIT IV DYES AND DYEING OF FIBRES

Introduction of dyes – Classification, Properties and Uses of dyes – Dyeing of textile materials (Cotton, Wool and Silk) by direct, acid, basic, vat, disperse and reactive dyes – Fastness of properties of Dyed materials.

Finishes given to fabrics – Methods used to process of mercerizing antcrease and Anti shrink finishes water proofing.

UNIT V TEXTILE PRINTING

Textile printing – Difference between dyeing and printing – Different steps involved in printing : Preparation of materials , Preparation of printing paste, Different thickeners, Drying of printing – Washing and drying of printed material – Printing procedure of fibres

Printing with direct and azoic colours.

Text Books

1. Chemical Technology of Fibrous Materials, F.Sadov, M.Kovchagin and A. Mateshy Mir Publishers, Moscow,1978.
2. Dyeing and Chemical technology of textile fibres – 5th edition, E.R.Trotman Charles – Griffin and Co Ltd,1975
3. A Textbook of Fibre and Science and Technology, S.P.Mishra, New Age International (P) Ltd-2000.
4. James Ronald, Printing and Dying of Fabrics and Plastics, Maharajan Book Distributors, 1996.

Reference Books

- 1.. Chemistry of Dyes and Principles of Dyeing, 2nd Edition V.A.Shenai, Sevak Publications, Mumbai,1983.
2. Berns, R.Bill Meyer and Saltzmans, Principles of Colour Technology, 3rd edition, New York, NY; JohnWiley and Sons, Inc;2000.
3. V.A. Shenai, Introduction to the Chemistry of Dye Stuffs, Sevak, Mumbai 1991.
4. Textile Chemistry – Vol I and II, R.H. Peters Elsevier, Amsterdam, London,1963.
5. Introductory to Textile Science – 3rd edition, Maryory L.Joshep,3rd Edition, Holt, Rinehart and Winson,3 Publishers, 1977.

SEMESTER VI
MAJOR ELECTIVE III
NANOCHEMISTRY

L	T	P	C
4	0	0	4

Course Objectives

The primary objectives of this course are to

1. Know the fundamentals of nano chemistry.
2. Study the methods of preparation of nanomaterial.
3. Acquire the knowledge on characterization of nanoparticles.
4. Know the important applications of nanomaterials in various fields.
5. Gain the Knowledge on the nano materials and its uses.

UNIT I FUNDAMENTALS OF NANOCHEMISTRY

Introduction: Background to Nanoscience – Scientific Revolution – Feynman's Vision.

Definition : Nanochemistry, Nanosized effects, Quantum effects – Surface to Volume ratio - Size dependence properties of Nanoparticles- Optical, Electrical, Magnetic and Chemical properties.

Nanomaterials : Definition and Classification of Nanomaterials -1D Nanomaterials : Quantum well -2D Nanomaterials : Nanowires, Nanotubes, Thinfilim -3D Nanomaterials : Nanopaprticles, Quantum dots, Nanoclustors, Nanocrystals.

Nanocomposites: Definition and classification of Nanocomposites – Structure and specific properties of Nanocomposites.

UNIT IISYNTHESIS OF NANOMATERIALS AND NANOCOMPOSITES

Types of approaches : Topdown (physical) approach and Bottom-up (chemical) approach.

Physical methods: Laser ablation, Arc discharge and Sputtering methods.

Chemical methods: Chemical reduction, Colloidal and Chemical precipitation methods, Solgel, Sonochemical and Chemical vapour deposition methods

Biosynthesis :Synthesis of Nanoparticles by bacteria and fungi.

Greensynthesis : Synthesis of Nanoparticles using plant extracts.

UNIT III CRYSTALLINITY, SURFACE AND OPTICAL CHARACTERIZATION TECHNIQUES

Determination of Particle size, Crystallinity and Surface area: Electron Microscope, Dynamic Light Scattering (DLS), X-ray Diffraction techniques

Morphology:

Surface Topography : Scanning Electron Microscope (SEM) Transmission Electron Microscope (TEM)

Surface compositions: Atomic Force Microscope (AFM), X-ray Photoelectron spectroscopy (XPS).

Elemental Analysis : Energy dispersive X-ray spectra (EDXS)

Band gap Analysis : UV- visible spectroscopy

Unit IV APPLICATIONS OF NANOMATERIALS AND NANOCOMPOSITES

Nanomaterials: Energy Resources : Batteries, Fuel cells, Solar cells.

Medicinal uses : Nanomedicine, Drug delivery, Cancer drugs.

Catalytic uses: Water purification, Energy storage, Biodiesel production, Automobile industries.

Sensor Applications: Environmental (toxic gases, toxic metal ions).

Nanocomposites: Lubricants, Anti-corrosion barrier, Coatings, Aerospace, Food package, Gas barrier, Chemical resistant.

UNIT V PREPARATIONS, PROPERTIES, AND APPLICATIONS OF SPECIAL NANOSCALE MATERIALS

Nanoforms of carbon : Buckminsterfullerene – Graphene – Carbon nanotubes : Single wall carbon nanotube (SWNT) , Multiwall carbon nanotubes (MWNT), Carbon nanofibers.

Nanometal oxides & Chalcogenides : ZnO , TiO₂ , ZrO₂ (Semiconductor oxides) ZnS, CdSe.

Nanocomposites: Clay nanocomposites - Polymer clay nanocomposites, Kaolins clay nanocomposite, Montmorillonite clay nanocomposite.

Text Books

1. Geoffy A. Ozin and Andre C. Arsenault “ Nanochemistry : A Chemical approach to nano materials “, RSC Publishing U.K 2005.
2. Hari singh Nalwa, “ Nano Materials and Nanotechnology” Academic press, New York ,2002.

3. C.N.R. Rao, A. Muller and A.K .Cheetham, “ The Chemistry of Nanomaterials, Volume I and II”, Wiley- VCH Verlag GmbH & Co, KGaA, Weinheim ,2004.
4. Catalysis : Principles and Applications, Edited by B. Visvanathan, S.Sivasankar, A.V. Ramaswamy, Narosa publishing House, 2011.

Reference Books

1. Carbon nanotubes and Nanostructures techniques and applications, James E. Morries, Krzyshof, Iniewski, CRC Press, 2013.
- 2.Nanocomposite : Science and Technology P.M. Ajayan, L.S.Schadler,P.V Braun , Wiley – VCH Verlag 2003.
- 3.Fundamentals of Nanotechnology, Hornyak G,, Louis Tibbals, H-F. Dutta,Toy deep, Press, 2000

SEMESTER VI
MAJOR PRACTICAL PAPER VII
PHYSICAL CHEMISTRY EXPERIMENTS

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0	0	4	2

Course Objectives

To enable the students to understand the principles of physical chemistry experiments.

I Thermometric Experiments

1. Determination of molar mass of the given substance by Rast macro method
2. Determination of molecular weight of the given substance by Transition temperature method.
3. Study of phase equilibrium – Simple eutectic
4. Determination of CST of phenol-water system. Study of the effect of impurity on CST and determination of the strength of unknown.
5. Determination of solubility of a substance at different temperatures and calculation of heat of solution.

II Conduct metric Titration

1. Study of adsorption of oxalic acid on charcoal and verification of Freundlich isotherm.
2. Estimation of HCl by conductometric method using standard oxalic acid (to be prepared) and link NaOH.
3. Determination of equivalent conductance of weak electrolyte and calculation of dissociation constant.

III Potentiometric Titration

1. Estimation of MgSO_4 by conductometric method using standard MgSO_4 (to be prepared) and link BaCl_2
2. Estimation of Fe(II) by potentiometric method using standard ferrous ammonium sulphate (to be prepared) and link KMnO_4
3. Estimation of KMnO_4 by potentiometric method using standard $\text{K}_2\text{Cr}_2\text{O}_7$ (to be prepared)

and link ferrous ammonium sulphate.

IV Kinetics

1. Comparison of the strengths of acids by studying the kinetics of ester hydrolysis.

Internal – 50 marks

25 marks - Regularity

25 marks – Average of best six experiments in regular class work

External -50 marks

10 marks – Record (atleast six experiments)*

10 marks – Procedure (5+5)

30 marks – Experiment

*Experiments done in the class alone should be recorded

(Students having a bonafide record only should be permitted to appear for the practical examination)

Text Books

1. J.N. Gurthu and R. Kapoor, Advanced Experimental Chemistry, S. Chand and Co., 1987.
2. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.
3. David P. Shoemaker, Carl W. Garland, Joseph W. Nibler, Experiments in Physical Chemistry, 5th Edition, McGraw- Hill Book company, 1989.

Reference books

1. Vogel's Text Book of Quantitative Chemical Analysis. 5th Edition., ELBS/Longman England, 1989.
2. O.P. Pandey, D.N Bajpai, S. Gini, Practical Chemistry, for I, II & III BSc. Students. S.Chand & Company Ltd, Reprint, 2009.
3. V.K.Ahluwalia, Sunitha Dhingra, Adarsh Gulate College Practical Chemistry, Universities Press (India) Pvt Ltd ,Reprint 2008.
4. P.R.Singh, D.C.Gupta, K.S.Bajpal, Experimental Organic Chemistry Vol.I and II, 1980.